# Appendix E – Utility Survey Records

## UNDERGROUND SERVICES KEY

- Abandoned
- Acid drain
- British telecom
- Cable TV
- Communication cables
- Sewer combined
- Sewer surface water
- Sewer foul
- Ducting
- Electric cables
- Effluent pipes
- Fuel line
- Fuel gauge line
- Fuel vent line
- Gas pipes
- Heating pipes
- Traffic light cables
- Vapour recovery pipes
- Water pipes
- Unidentified GPR or electro location trace
- Rising main
- Scar trace
- Alarm cables
- CCTV cables
- Chemical pipes
- Compressed air pipes
- Culvert
- Sewer combined overflow
- Electric HV cables
- Electric pilot cables
- Earth cables
- Fibre optic cables
- LPG pipes
- Oil pipes
- Sludge main
- Telemetry cables
- Vehicle detection pad
- Wash water pipes
- End of trace
- Group of services representation
- Taken from records (Not proven on site)
- Assumed route
- Services survey boundary

| | | | |
|---|---|---|---|
| AR | Assumed Route | GPR | Ground Penetrating Radar |
| BD | Backdrop | TFR | Taken From Records |
| CR | Cable Riser | PE | Polyethylene Pipe |
| d | Depth | UTS | Unable To Survey |
| PR | Pipe Riser | UR | Unable To Rod |
| OF | Offset Fill | UT | Unable To Trace |
| T | Tank | NVP | No Visible Pipes |
| VR | Vapour Recovery Point | | |
| UTL | Unable To Lift | | |

## DISCLAIMER

Electromagnetic and ground penetrating radar techniques have been used in the location of underground services shown on this survey plan. These are interpretive procedures and we recommend that trial excavations should be undertaken to to confirm identification, location and depth of services where these are critical.

Please note that not all buried pipes, cable and ducts can be detected and mapped in consideration of their depth, location, material type, geology and proximity to other utilities.

All reasonable effort and care has been made in searching available record drawings. The completeness of the underground service information supplied to and by us cannot be guaranteed.

## NOTES

Where services are non-metallic or not proven on site, positions are taken from records, trench scans & surface detail.

Where stated, depth estimations are typically to the centre or top of the service. Depths to gravity sewers and drains are typically to invert levels, unless otherwise stated.

Where Ground Penetrating Radar (GPR) is quoted the depth is recorded to the assumed external crown of the feature.

The diagram below describes the depth information in more detail.

Where the precise position or depths of these features are critical to the design or ideworks they must be verified by the use of trial excavations.

Pipe sizes which cannot be obtained by visual survey are taken from utilities record drawings or marker plates where available.

Services shown as TFR (Taken From Records) have not been proven on site.

The CAD layering may contain further information.

## TYPICAL FEATURE DEPTH ANNOTATION

| ELECTRO-MAGNETIC DETECTION | GRAVITY DRAIN (VISUAL OBSERVATION) | GROUND PENETRATING RADAR |
|---|---|---|
| APPROX. DEPTH TO CENTRE<br>CABLE/FIBRE OPTIC | APPROX DEPTH TO INVERT | APPROX DEPTH TO EXTERNAL CROWN |

Survey Notes

Grid: Local, plane, metric fixed to National Grid fixed at Stn SC5

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM15

Notes

## Topographical Survey Legend

### BUILDINGS AND WALLS

- Building
- Building Open Sided
- Ruin (RUIN)
- Passage
- Wall with Height (Wall HT1.5m)
- Retaining Wall (R/W)

### FENCE STYLES AND DESCRIPTIONS

- Close Boarded (C/B)
- Corrugated Iron (C/I)
- Chestnut Paling (C/P)
- Chainlink (C/L)
- Handrail (H/R)
- Interwoven (BBI)
- Iron Railings (I/R)
- Lattice (L/T)
- Miscellaneous (Misc)
- Palisade (PAL)
- Post & Chain (P/C)
- Post & Rail (P/R)
- Post & Wire (P/W)
- Post & Barbed Wire (B/W)
- Wire mesh (W/M)
- Stile
- Gate
- Fence Breeblyte

### ROADS

- Kerbs
- Edge of Surfacing
- Pedestrian Crossing (PELICAN, PEGASUS, ZEBRA)
- Track
- Footpath

### STREET FURNITURE

- Bellaire Beacon (BB)
- Bus Stop (BS)
- Bollard (B)
- Cats Eye (CE)
- Coal Chute (CC)
- Closed Circuit TV (CCTV)
- Drain (DR)
- Electricity Pole (EP)
- Flood Light (FL)
- Flag Staff (FS)
- Lamp Post (LP)
- Letter Box (LB)
- Name Plate (street) (NP)
- Mooring Ring (MR)
- Mile Post or Mooring Post (MP)
- Service Marker (MK)
- Mile Stone (MS)
- Post (P)
- Parking Meter (PM)
- Reflector Post (RP)
- Rodding Eye (RE)
- Road Sign (RS)
- Speed Cameras (S/CAM)
- Information Sign (SIGN)
- Stop (SY)
- Traffic Light (TL)
- Telegraph Pole (TP)
- Traffic Light Push Button Post (TLP)
- Traffic Light Control (TLC/P)
- Control Box (C/BOX)
- British Telecom Box (BT BOX)
- Electricity Box (EL BOX)
- Gas Box (GAS BOX)

### INSPECTION CHAMBERS AND PIPES

- Inspection Cover (IC)
- Inspection Cover (Elec) (IC/EL)
- Manhole (MH)
- British Telecom Cover (BT)
- Inspection Cover (Comms) (IC/COM)
- Cable TV (CATV)
- Inspection Cover Traffic Signals (IC/TL)
- Gully (G)
- Kerb Outlet (KO)
- Vent Pipe (VP)
- Down Pipe (DP)
- Rain Water Pipe (RWP)
- Soil Pipe (SWP)
- Gas Pipe (G-PIPE)
- Unable to lift cover (UTL)
- Stop Tap (ST)
- Stop Valve (SV)
- Lamphole (LH)
- Hydrant (HYD)
- Earth Rod (ER)
- Gas Valve (GV)
- Water Meter (WM)
- Washout (WO)
- Rodding Eye (RE)

### GEOTECHNICAL INFORMATION

- Borehole (BH)
- Trial Pit (TP)
- Monitor Pits (MON)
- Probe Hole (PH)
- Window Sample (WS)

### GENERAL INFORMATION

- Petrol Pump (PP)
- Basement Light (BL)
- Footbridge (FB)
- Dish Type Channel
- Slot Type Channel
- Grate Type Channel
- Tactile Paving (TAC)
- Crash Barrier (C/BR)
- Column (COL)
- Stanchion (STAN)
- Car Vacuum (VAC)
- Offset Fill (OF)
- Air Valve (AV)
- Trough (TR)
- Chimney (CHY)
- Telephone Call Box (TCB)

### OVERHEAD FEATURES

- Electricity Pylon (E.PYLON)
- Electricity (EL)
- Telephone (TEL)

### WATER FEATURES

- Canal
- Stream
- Ditch
- Weir
- Culvert
- Drip (Land Drain)
- Spring (SPR)

### RELIEF AND VEGETATION

- Hedge
- Edge of wood/Bushes
- Stump (STUMP)
- Individual Tree
- Slopes with Height Greater than 1m
- Cliff Face
- Marsh
- Reeds

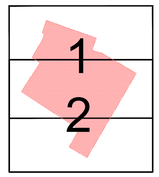
### LEVEL AND HEIGHT INFORMATION

- Standard Spot Height (123.45)
- Precision Spot Height (123.456)
- Bed Level (B:23.92)
- Water Level (W:24.92)
- Soffit Level (S:25.92)
- Threshold Level (THS6.98)
- Cover Level (CL26.45)
- Invert Level (IL25.15)
- Pipe Soffit Level (PS:5.00)
- Floor Level (FL6.00)
- Finished Floor Level (FFL6.00)
- Top of Tank Level (TT7.00)
- Eave Level (EL7.00)
- Ridge Level (RL8.00)
- Roof Hip Level (RHL8.50)
- Flat Roof Level (FRL7.00)
- Top of Canopy Level (TOP/CT7.00)
- Underside of Canopy Level (SOF/CS6.50)
- Window Sill Level (WSL8.00)
- Window Head Level (WHL8.00)
- Springing Level (SPL8.50)
- Arch Level (ALT.00)
- Cable Level (CHTB.55)
- Top of Wall Level (TWL10.00)
- Underside of Beam Level (UBL8.55)
- General Height (HTR.00)

### SURVEY INFORMATION SIGNS

- Permanent Ground Marker
- O.S. Trig Station
- O.S. Bench Mark

Sheet Index




| Rev. | Date | Description |
|---|---|---|
| | | |

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WELWYN GARDEN CITY, AL7 3AX

Project
ONE YMCA, PEARTREE LANE
WELWYN GARDEN CITY
AL7 3UL

Drawing Title
UTILITY SURVEY

| | | | |
|---|---|---|---|
| Drawn By | CPT 09/08/19 | Survey Date | August 2019 |
| Checked by | DJ 09/08/19 | Scale | 1:200 @ A0 |
| Drawing No | 53948/UG1 | Revision | |

## UNDERGROUND SERVICES KEY

| | |
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| Traffic light cables | |
| Vapour recovery pipes | |
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| CCTV cables | |
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| Electric pilot cables | |
| Earth cables | |
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| Vehicle detection pad | |
| Wash water pipes | |
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Building Open Sided
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Wall with Height — Wall HT:1.2m
Retaining Wall — R/W

### FENCE STYLES AND DESCRIPTIONS

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Palisade — PAL
Post & Chain — P/C
Post & Rail — P/R
Post & Wire — P/W
Post & Barbed Wire — B/W
Wire mesh — W/M
Stile
Gate
Fence Breakpte

### ROADS

Kerbs
Edge of Surfacing
Pedestrian Crossing — PEDESTRIAN CROSSING
Track
Footpath

### STREET FURNITURE

Bollard Beacon — BB
Bus Stop — BS
Bollard — B
Cats Eye — CE
Coal Chute — CC
Closed Circuit TV — CCTV
Drain — DR
Electricity Pole — EP
Flood Light — FL
Flag Staff — FS
Lamp Post — LP
Letter Box — LB
Name Plate (street) — NP
Mooring Ring — MR
Mile Post or Mooring Post — MP
Service Marker — MK
Mile Stone — MS
Post — P
Parking Meter — PM
Reflector Post — RP
Rodding Eye — RE
Road Sign — RS
Speed Camera — S/CAM
Information Sign — SIGN
Stop — SY
Traffic Light — TL
Telegraph Pole — TP
Traffic Light Push Button Post — TLP
Traffic Light Control — TLC/P
Control Box — C/BOX
British Telecom Box — BT BOX
Electricity Box — EL BOX
Gas Box — GAS BOX

### INSPECTION CHAMBERS AND PIPES

Inspection Cover — IC
Inspection Cover (Elec) — IC/EL
Manhole — MH
British Telecom Cover — BT
Inspection Cover (Control) — IC/CNM
Cable TV — CATV
Inspection Cover Traffic Signals — IC/TL
Gully — G
Kerb Outlet — KO
Vent Pipe — VP
Down Pipe — DP
Rain Water Pipe — RWP
Soil Pipe — SWP
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Unable to lift cover — UTL
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Stop Valve — SV
Lamphole — LH
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Earth Rod — ER
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Water Meter — WM
Washout — WO
Rodding Eye — RE

### GEOTECHNICAL INFORMATION

Borehole — BH
Trial Pit — TP
Monitor Pin — MON
Probe Hole — PH
Window Sample — WS

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Petrol Pump — PP
Basement Light — BL
Footbridge — FB
Dish Type Channel — DT CHANNEL
Slot Type Channel — ST CHANNEL
Grate Type Channel — GT CHANNEL
Tactile Paving — TAC
Crash Barrier — C/BR
Column — COL
Stanchion — STAN
Car Vacuum — VAC
Offset Fill — OF
Air Valve — A/V
Trough — TR
Chimney — CHY
Telephone Call Box — TCB

### OVERHEAD FEATURES

Electricity Pylon — E.PYLON
Electricity — EL
Telephone — TEL

### WATER FEATURES

Canal
Stream
Ditch
Weir
Culvert
Drip (Land Drain)
Spring — SPR

### RELIEF AND VEGETATION

Hedge
Edge of wood/Bushes
Stump — STUMP
Individual Tree
Slopes with Height Greater than 1m
Cliff Face
Marsh
Reeds

### LEVEL AND HEIGHT INFORMATION

Standard Spot Height — +123.45
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Water Level — WL24.92
Soffit Level — SL25.92
Threshold Level — THSL98
Cover Level — CL26.45
Invert Level — IL25.15
Pipe Soffit Level — PSL5.00
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Eave Level — EL7.00
Ridge Level — RL8.00
Roof Hip Level — RHL8.50
Flat Roof Level — FRL7.00
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Underside of Canopy Level — SOF/CSL50
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Window Head Level — WHL8.00
Springing Level — SPL8.50
Arch Level — ALT.00
Cable Level — CHTBL55
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Underside of Beam Level — UBL8.55
General Height — HTR.00

### SURVEY INFORMATION SIGNS

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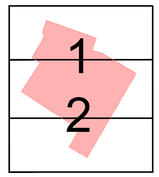
O.S. Trig Station
O.S. Bench Mark

Sheet Index




| Rev. | Date | Description |
|---|---|---|
| | | |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Project
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WELWYN GARDEN CITY
AL7 3UL

Drawing Title
UTILITY SURVEY

| | | | |
|---|---|---|---|
| Drawn By | CPT 09/08/19 | Survey Date | August 2019 |
| Checked by | DJ 09/08/19 | Scale | 1:200 @ A0 |
| Drawing No | 53948/UG2 | Revison | |

# Appendix F – Proposed Drainage Calculations

PINNACLE
CONSULTING ENGINEERS

| | | | | |
|---|---|---|---|---|
| **Alchemy** | 3 Meridian Way | Woolverstone House | Grosvenor Court | Business Suite 5.01 D-1 |
| **Bessemer Road** | Norwich | 61 Berners Street | 67a Patrick Street | WTC The Hague |
| **Welwyn Garden City** | Norfolk | London | Dun Laoghaire | Prinses Margrietplantsoen 33 |
| **AL7 1HE** | NR7 0TA | W1T 3NJ | Co Dublin | Netherlands |
| **T: 01707 527 630** | T: 01603 327 170 | T: 0207 299 8299 | T: +353 1231 1041 | T: +31 70 240 0412 |


| **CLIENT / PROJECT** | SHEET NO. | REVISION | PROJECT REF. |
|---|---|---|---|
| WGC-YMCA PEARTREE LANE | 1 | 1 | C190906 |
| **TITLE** | PREPARED | CHECKED | DATE |
| FOUL WATER DESIGN FLOW RATES | SS | JJ | 25.09.19 |

The reccomended basis for foul sewer design is 6DWF+10%. The multiplier "6" if used to estimate the conditions at peak flow. An additional 10% is factored into the DWF as a provision for infiltration; this is increased to an allowance of 20% in areas with a high water table.

| Development | Flow Rates (l/day) | | | Number of Units | Provision for Infiltration | High Water Table | Peak Factor | Flow Rates (l/s) |
|---|---|---|---|---|---|---|---|---|
| **Development 1** | | | | | | | | |
| General Housing | 600 | per | property | 100 | no | no | 6 | 4.167 |
| **Development 2** | | | | | | | | |
| General Housing | 600 | per | property | 43 | no | no | 6 | 1.792 |
| **Total:** | | | | | | | | **5.958** |

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

| | |
|---|---|
| FEH Rainfall Model | |
| Return Period (years) | 1 |
| FEH Rainfall Version | 1999 |
| Site Location | GB 524500 212550 TL 24500 12550 |
| C (1km) | -0.028 |
| D1 (1km) | 0.293 |
| D2 (1km) | 0.320 |
| D3 (1km) | 0.277 |
| E (1km) | 0.321 |
| F (1km) | 2.481 |
| Maximum Rainfall (mm/hr) | 50 |
| Maximum Time of Concentration (mins) | 30 |
| Foul Sewage (l/s/ha) | 0.000 |
| Volumetric Runoff Coeff. | 0.750 |
| PIMP (%) | 100 |
| Add Flow / Climate Change (%) | 0 |
| Minimum Backdrop Height (m) | 0.200 |
| Maximum Backdrop Height (m) | 1.500 |
| Min Design Depth for Optimisation (m) | 1.200 |
| Min Vel for Auto Design only (m/s) | 1.00 |
| Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Time Area Diagram for Storm

| Time (mins) | Area (ha) | Time (mins) | Area (ha) |
|---|---|---|---|
| 0-4 | 0.067 | 4-8 | 0.164 |

Total Area Contributing (ha) = 0.230

Total Pipe Volume (m³) = 9.864

### Network Design Table for Storm

« - Indicates pipe capacity < flow

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 33.136 | 0.200 | 165.7 | 0.034 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.001 | 9.358 | 0.060 | 156.0 | 0.022 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.002 | 22.536 | 0.140 | 161.0 | 0.014 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |

### Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 50.00 | 4.55 | 82.000 | 0.034 | 0.0 | 0.0 | 0.0 | 1.01 | 40.3 | 4.6 |
| 1.001 | 50.00 | 4.69 | 81.800 | 0.055 | 0.0 | 0.0 | 0.0 | 1.04 | 41.5 | 7.5 |
| 1.002 | 50.00 | 5.00 | 81.665 | 0.069 | 0.0 | 0.0 | 0.0 | 1.24 | 87.4 | 9.4 |

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## Network Design Table for Storm

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.003 | 30.131 | 0.285 | 105.7 | 0.095 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 2.000 | 29.902 | 0.180 | 166.1 | 0.025 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 2.001 | 18.285 | 0.108 | 170.0 | 0.014 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 2.002 | 12.258 | 0.075 | 163.4 | 0.012 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 2.003 | 7.472 | 0.412 | 18.1 | 0.006 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.004 | 2.305 | 0.288 | 8.0 | 0.003 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.005 | 2.305 | 0.298 | 7.7 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.006 | 10.083 | 0.000 | 0.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.007 | 10.083 | 0.000 | 0.0 | 0.006 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |

## Network Results Table

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|---|---|---|---|---|---|---|---|---|---|---|
| 1.003 | 50.00 | 5.33 | 81.525 | 0.164 | 0.0 | 0.0 | 0.0 | 1.53 | 108.1 | 22.2 |
| 2.000 | 50.00 | 4.49 | 82.090 | 0.025 | 0.0 | 0.0 | 0.0 | 1.01 | 40.2 | 3.4 |
| 2.001 | 50.00 | 4.80 | 81.910 | 0.039 | 0.0 | 0.0 | 0.0 | 1.00 | 39.8 | 5.3 |
| 2.002 | 50.00 | 5.00 | 81.802 | 0.051 | 0.0 | 0.0 | 0.0 | 1.02 | 40.6 | 7.0 |
| 2.003 | 50.00 | 5.04 | 81.727 | 0.057 | 0.0 | 0.0 | 0.0 | 3.09 | 122.8 | 7.8 |
| 1.004 | 50.00 | 5.33 | 81.240 | 0.224 | 0.0 | 0.0 | 0.0 | 5.59 | 395.2 | 30.4 |
| 1.005 | 50.00 | 5.34 | 80.902 | 0.224 | 0.0 | 0.0 | 0.0 | 5.69 | 402.0 | 30.4 |
| 1.006 | 50.00 | 6.47 | 80.600 | 0.224 | 0.0 | 0.0 | 0.0 | 0.15 | 10.5« | 30.4 |
| 1.007 | 50.00 | 7.60 | 80.600 | 0.230 | 0.0 | 0.0 | 0.0 | 0.15 | 10.5« | 31.2 |

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## Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | Pipe Out PN | Pipe Out Invert Level (m) | Pipe Out Diameter (mm) | Pipes In PN | Pipes In Invert Level (m) | Pipes In Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1.0 | 83.300 | 1.300 | Open Manhole | 1200 | 1.000 | 82.000 | 225 | | | | |
| S1.1 | 83.300 | 1.500 | Open Manhole | 1200 | 1.001 | 81.800 | 225 | 1.000 | 81.800 | 225 | |
| S1.2 | 83.300 | 1.635 | Open Manhole | 1200 | 1.002 | 81.665 | 300 | 1.001 | 81.740 | 225 | |
| S1.3 | 83.300 | 1.775 | Open Manhole | 1200 | 1.003 | 81.525 | 300 | 1.002 | 81.525 | 300 | |
| S1.4 | 83.300 | 1.210 | Open Manhole | 1200 | 2.000 | 82.090 | 225 | | | | |
| S1.5 | 83.300 | 1.390 | Open Manhole | 1200 | 2.001 | 81.910 | 225 | 2.000 | 81.910 | 225 | |
| S1.6 | 83.300 | 1.498 | Open Manhole | 1200 | 2.002 | 81.802 | 225 | 2.001 | 81.802 | 225 | |
| S1.7 | 83.300 | 1.573 | Open Manhole | 1200 | 2.003 | 81.727 | 225 | 2.002 | 81.727 | 225 | |
| S1.8 | 83.300 | 2.060 | Open Manhole | 1200 | 1.004 | 81.240 | 300 | 1.003 | 81.240 | 300 | |
| | | | | | | | | 2.003 | 81.315 | 225 | |
| PI | 83.300 | 2.398 | Open Manhole | 1200 | 1.005 | 80.902 | 300 | 1.004 | 80.952 | 300 | 50 |
| S1.9 | 83.300 | 2.700 | Open Manhole | 1200 | 1.006 | 80.600 | 300 | 1.005 | 80.604 | 300 | 4 |
| Dummy | 83.300 | 2.700 | Open Manhole | 1200 | 1.007 | 80.600 | 300 | 1.006 | 80.600 | 300 | |
| | 83.300 | 2.700 | Open Manhole | 1200 | | OUTFALL | | 1.007 | 80.600 | 300 | |

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## PIPELINE SCHEDULES for Storm

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| 1.000 | o | 225 | S1.0 | 83.300 | 82.000 | 1.075 | Open Manhole | 1200 |
| 1.001 | o | 225 | S1.1 | 83.300 | 81.800 | 1.275 | Open Manhole | 1200 |
| 1.002 | o | 300 | S1.2 | 83.300 | 81.665 | 1.335 | Open Manhole | 1200 |
| 1.003 | o | 300 | S1.3 | 83.300 | 81.525 | 1.475 | Open Manhole | 1200 |
| 2.000 | o | 225 | S1.4 | 83.300 | 82.090 | 0.985 | Open Manhole | 1200 |
| 2.001 | o | 225 | S1.5 | 83.300 | 81.910 | 1.165 | Open Manhole | 1200 |
| 2.002 | o | 225 | S1.6 | 83.300 | 81.802 | 1.273 | Open Manhole | 1200 |
| 2.003 | o | 225 | S1.7 | 83.300 | 81.727 | 1.348 | Open Manhole | 1200 |
| 1.004 | o | 300 | S1.8 | 83.300 | 81.240 | 1.760 | Open Manhole | 1200 |
| 1.005 | o | 300 | PI | 83.300 | 80.902 | 2.098 | Open Manhole | 1200 |
| 1.006 | o | 300 | S1.9 | 83.300 | 80.600 | 2.400 | Open Manhole | 1200 |
| 1.007 | o | 300 | Dummy | 83.300 | 80.600 | 2.400 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 33.136 | 165.7 | S1.1 | 83.300 | 81.800 | 1.275 | Open Manhole | 1200 |
| 1.001 | 9.358 | 156.0 | S1.2 | 83.300 | 81.740 | 1.335 | Open Manhole | 1200 |
| 1.002 | 22.536 | 161.0 | S1.3 | 83.300 | 81.525 | 1.475 | Open Manhole | 1200 |
| 1.003 | 30.131 | 105.7 | S1.8 | 83.300 | 81.240 | 1.760 | Open Manhole | 1200 |
| 2.000 | 29.902 | 166.1 | S1.5 | 83.300 | 81.910 | 1.165 | Open Manhole | 1200 |
| 2.001 | 18.285 | 170.0 | S1.6 | 83.300 | 81.802 | 1.273 | Open Manhole | 1200 |
| 2.002 | 12.258 | 163.4 | S1.7 | 83.300 | 81.727 | 1.348 | Open Manhole | 1200 |
| 2.003 | 7.472 | 18.1 | S1.8 | 83.300 | 81.315 | 1.760 | Open Manhole | 1200 |
| 1.004 | 2.305 | 8.0 | PI | 83.300 | 80.952 | 2.048 | Open Manhole | 1200 |
| 1.005 | 2.305 | 7.7 | S1.9 | 83.300 | 80.604 | 2.396 | Open Manhole | 1200 |
| 1.006 | 10.083 | 0.0 | Dummy | 83.300 | 80.600 | 2.400 | Open Manhole | 1200 |
| 1.007 | 10.083 | 0.0 | | 83.300 | 80.600 | 2.400 | Open Manhole | 1200 |

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## Area Summary for Storm

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.000 | User | - | 100 | 0.032 | 0.032 | 0.032 |
| | User | - | 100 | 0.002 | 0.002 | 0.034 |
| 1.001 | User | - | 100 | 0.018 | 0.018 | 0.018 |
| | User | - | 100 | 0.003 | 0.003 | 0.022 |
| 1.002 | - | - | 100 | 0.014 | 0.014 | 0.014 |
| 1.003 | - | - | 100 | 0.095 | 0.095 | 0.095 |
| 2.000 | User | - | 100 | 0.023 | 0.023 | 0.023 |
| | User | - | 100 | 0.002 | 0.002 | 0.025 |
| 2.001 | User | - | 100 | 0.011 | 0.011 | 0.011 |
| | User | - | 100 | 0.003 | 0.003 | 0.014 |
| 2.002 | - | - | 100 | 0.012 | 0.012 | 0.012 |
| 2.003 | User | - | 100 | 0.006 | 0.006 | 0.006 |
| 1.004 | User | - | 100 | 0.003 | 0.003 | 0.003 |
| 1.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.006 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.007 | - | - | 100 | 0.006 | 0.006 | 0.006 |
| | | | | Total | Total | Total |
| | | | | 0.230 | 0.230 | 0.230 |

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## Network Classifications for Storm

| PN | USMH Name | Pipe Dia (mm) | Min Cover Depth (m) | Max Cover Depth (m) | Pipe Type | MH Dia (mm) | MH Width (mm) | MH Ring Depth (m) | MH Type |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1.0 | 225 | 1.075 | 1.275 | Unclassified | 1200 | 0 | 1.075 | Unclassified |
| 1.001 | S1.1 | 225 | 1.275 | 1.335 | Unclassified | 1200 | 0 | 1.275 | Unclassified |
| 1.002 | S1.2 | 300 | 1.335 | 1.475 | Unclassified | 1200 | 0 | 1.335 | Unclassified |
| 1.003 | S1.3 | 300 | 1.475 | 1.760 | Unclassified | 1200 | 0 | 1.475 | Unclassified |
| 2.000 | S1.4 | 225 | 0.985 | 1.165 | Unclassified | 1200 | 0 | 0.985 | Unclassified |
| 2.001 | S1.5 | 225 | 1.165 | 1.273 | Unclassified | 1200 | 0 | 1.165 | Unclassified |
| 2.002 | S1.6 | 225 | 1.273 | 1.348 | Unclassified | 1200 | 0 | 1.273 | Unclassified |
| 2.003 | S1.7 | 225 | 1.348 | 1.760 | Unclassified | 1200 | 0 | 1.348 | Unclassified |
| 1.004 | S1.8 | 300 | 1.760 | 2.048 | Unclassified | 1200 | 0 | 1.760 | Unclassified |
| 1.005 | PI | 300 | 2.098 | 2.396 | Unclassified | 1200 | 0 | 2.098 | Unclassified |
| 1.006 | S1.9 | 300 | 2.400 | 2.400 | Unclassified | 1200 | 0 | 2.400 | Unclassified |
| 1.007 | Dummy | 300 | 2.400 | 2.400 | Unclassified | 1200 | 0 | 2.400 | Unclassified |

## 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) |
|---|---|---|---|---|---|---|
| 1.007 | | 83.300 | 80.600 | 80.600 | 1200 | 0 |

## Simulation Criteria for Storm

| | | | |
|---|---|---|---|
| Volumetric Runoff Coeff | 0.750 | Additional Flow - % of Total Flow | 0.000 |
| Areal Reduction Factor | 1.000 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start (mins) | 0 | Inlet Coeffiecient | 0.800 |
| Hot Start Level (mm) | 0 | Flow per Person per Day (l/per/day) | 0.000 |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins) | 60 |
| Foul Sewage per hectare (l/s) | 0.000 | Output Interval (mins) | 1 |

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

## Synthetic Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FEH | E (1km) | 0.321 |
| Return Period (years) | 1 | F (1km) | 2.481 |
| FEH Rainfall Version | 1999 | Summer Storms | Yes |
| Site Location | GB 524500 212550 TL 24500 12550 | Winter Storms | Yes |
| C (1km) | -0.028 | Cv (Summer) | 0.750 |
| D1 (1km) | 0.293 | Cv (Winter) | 0.840 |
| D2 (1km) | 0.320 | Storm Duration (mins) | 30 |
| D3 (1km) | 0.277 | | |

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## Storage Structures for Storm

### Cellular Storage Manhole: Dummy, DS/PN: 1.007

Invert Level (m) 80.600 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.16200 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.16200

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 153.0 | 153.0 | 1.500 | 153.0 | 232.5 | 1.501 | 0.0 | 232.5 |

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## 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 1 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.277
FEH Rainfall Version 1999 E (1km) 0.321
Site Location GB 524500 212550 TL 24500 12550 F (1km) 2.481
C (1km) -0.028 Cv (Summer) 0.750
D1 (1km) 0.293 Cv (Winter) 0.840
D2 (1km) 0.320

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1.0 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 82.055 | -0.170 | 0.000 |
| 1.001 | S1.1 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 81.872 | -0.153 | 0.000 |
| 1.002 | S1.2 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 81.734 | -0.231 | 0.000 |
| 1.003 | S1.3 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 81.618 | -0.207 | 0.000 |
| 2.000 | S1.4 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 82.138 | -0.177 | 0.000 |
| 2.001 | S1.5 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 81.969 | -0.166 | 0.000 |
| 2.002 | S1.6 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 81.871 | -0.157 | 0.000 |
| 2.003 | S1.7 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 81.771 | -0.181 | 0.000 |
| 1.004 | S1.8 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 81.333 | -0.207 | 0.000 |
| 1.005 | PI | 15 Winter | 1 | +0% | 30/15 Summer | | | | 80.995 | -0.207 | 0.000 |
| 1.006 | S1.9 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 80.835 | -0.065 | 0.000 |
| 1.007 | Dummy | 60 Winter | 1 | +0% | 100/15 Summer | | | | 80.689 | -0.211 | 0.000 |

| PN | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|
| 1.000 | S1.0 | 0.13 | | 5.1 | OK | |
| 1.001 | S1.1 | 0.22 | | 7.6 | OK | |
| 1.002 | S1.2 | 0.12 | | 9.4 | OK | |
| 1.003 | S1.3 | 0.21 | | 20.7 | OK | |
| 2.000 | S1.4 | 0.10 | | 3.8 | OK | |
| 2.001 | S1.5 | 0.15 | | 5.5 | OK | |
| 2.002 | S1.6 | 0.20 | | 6.9 | OK | |
| 2.003 | S1.7 | 0.08 | | 7.6 | OK | |
| 1.004 | S1.8 | 0.21 | | 28.6 | OK | |
| 1.005 | PI | 0.21 | | 28.4 | OK | |

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

| PN | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|
| 1.006 | S1.9 | 0.97 | | 28.6 | OK | |
| 1.007 | Dummy | 0.20 | | 5.8 | OK | |

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## 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 1 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.277
FEH Rainfall Version 1999 E (1km) 0.321
Site Location GB 524500 212550 TL 24500 12550 F (1km) 2.481
C (1km) -0.028 Cv (Summer) 0.750
D1 (1km) 0.293 Cv (Winter) 0.840
D2 (1km) 0.320

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1.0 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.107 | -0.118 | 0.000 |
| 1.001 | S1.1 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 81.957 | -0.068 | 0.000 |
| 1.002 | S1.2 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 81.808 | -0.157 | 0.000 |
| 1.003 | S1.3 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 81.738 | -0.087 | 0.000 |
| 2.000 | S1.4 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.181 | -0.134 | 0.000 |
| 2.001 | S1.5 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.031 | -0.104 | 0.000 |
| 2.002 | S1.6 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 81.948 | -0.079 | 0.000 |
| 2.003 | S1.7 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 81.815 | -0.138 | 0.000 |
| 1.004 | S1.8 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 81.460 | -0.080 | 0.000 |
| 1.005 | PI | 15 Winter | 30 | +0% | 30/15 Summer | | | | 81.271 | 0.069 | 0.000 |
| 1.006 | S1.9 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 81.079 | 0.179 | 0.000 |
| 1.007 | Dummy | 15 Winter | 30 | +0% | 100/15 Summer | | | | 80.854 | -0.046 | 0.000 |

| PN | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|
| 1.000 | S1.0 | 0.45 | | 17.1 | OK | |
| 1.001 | S1.1 | 0.81 | | 27.7 | OK | |
| 1.002 | S1.2 | 0.45 | | 34.5 | OK | |
| 1.003 | S1.3 | 0.82 | | 80.2 | OK | |
| 2.000 | S1.4 | 0.34 | | 12.8 | OK | |
| 2.001 | S1.5 | 0.55 | | 19.6 | OK | |
| 2.002 | S1.6 | 0.74 | | 25.6 | OK | |
| 2.003 | S1.7 | 0.31 | | 28.4 | OK | |
| 1.004 | S1.8 | 0.82 | | 109.8 | OK | |
| 1.005 | PI | 0.80 | | 109.4 | SURCHARGED | |

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

| PN | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|
| 1.006 | S1.9 | 3.68 | | 109.1 | SURCHARGED | |
| 1.007 | Dummy | 1.00 | | 29.6 | OK | |

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## 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 1 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.277
FEH Rainfall Version 1999 E (1km) 0.321
Site Location GB 524500 212550 TL 24500 12550 F (1km) 2.481
C (1km) -0.028 Cv (Summer) 0.750
D1 (1km) 0.293 Cv (Winter) 0.840
D2 (1km) 0.320

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1.0 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.294 | 1.069 | 0.000 |
| 1.001 | S1.1 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.188 | 1.163 | 0.000 |
| 1.002 | S1.2 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.087 | 1.122 | 0.000 |
| 1.003 | S1.3 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 82.989 | 1.164 | 0.000 |
| 2.000 | S1.4 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 82.752 | 0.437 | 0.000 |
| 2.001 | S1.5 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 82.694 | 0.559 | 0.000 |
| 2.002 | S1.6 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 82.614 | 0.586 | 0.000 |
| 2.003 | S1.7 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 82.520 | 0.568 | 0.000 |
| 1.004 | S1.8 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 82.413 | 0.873 | 0.000 |
| 1.005 | PI | 15 Winter | 100 | +40% | 30/15 Summer | | | | 81.916 | 0.714 | 0.000 |
| 1.006 | S1.9 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 81.434 | 0.534 | 0.000 |
| 1.007 | Dummy | 15 Winter | 100 | +40% | 100/15 Summer | | | | 81.055 | 0.155 | 0.000 |

| PN | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|
| 1.000 | S1.0 | 0.73 | | 27.7 | FLOOD RISK | |
| 1.001 | S1.1 | 1.34 | | 45.9 | FLOOD RISK | |
| 1.002 | S1.2 | 0.74 | | 57.3 | FLOOD RISK | |
| 1.003 | S1.3 | 1.40 | | 137.9 | SURCHARGED | |
| 2.000 | S1.4 | 0.66 | | 25.0 | SURCHARGED | |
| 2.001 | S1.5 | 0.85 | | 30.4 | SURCHARGED | |
| 2.002 | S1.6 | 1.13 | | 39.4 | SURCHARGED | |
| 2.003 | S1.7 | 0.48 | | 43.0 | SURCHARGED | |
| 1.004 | S1.8 | 1.32 | | 177.6 | SURCHARGED | |
| 1.005 | PI | 1.30 | | 177.4 | SURCHARGED | |

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

| PN | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|
| 1.006 | S1.9 | 5.95 | | 176.4 | SURCHARGED | |
| 1.007 | Dummy | 3.47 | | 102.9 | SURCHARGED | |

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## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

| | |
|---|---|
| Return Period (years) | 2 |
| FEH Rainfall Version | 1999 |
| Site Location | GB 524500 212550 TL 24500 12550 |
| C (1km) | -0.028 |
| D1 (1km) | 0.293 |
| D2 (1km) | 0.320 |
| D3 (1km) | 0.277 |
| E (1km) | 0.321 |
| F (1km) | 2.481 |
| Maximum Rainfall (mm/hr) | 50 |
| Maximum Time of Concentration (mins) | 30 |
| Foul Sewage (l/s/ha) | 0.000 |
| Volumetric Runoff Coeff. | 0.750 |
| PIMP (%) | 100 |
| Add Flow / Climate Change (%) | 0 |
| Minimum Backdrop Height (m) | 0.200 |
| Maximum Backdrop Height (m) | 1.500 |
| Min Design Depth for Optimisation (m) | 0.000 |
| Min Vel for Auto Design only (m/s) | 1.00 |
| Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Time Area Diagram for Storm

| Time (mins) | Area (ha) | Time (mins) | Area (ha) |
|---|---|---|---|
| 0-4 | 0.180 | 4-8 | 0.072 |

Total Area Contributing (ha) = 0.252

Total Pipe Volume (m³) = 15.337

### Network Design Table for Storm

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|

### Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|

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## Network Design Table for Storm

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 40.922 | 0.250 | 163.7 | 0.009 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.001 | 36.156 | 0.220 | 164.3 | 0.014 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.002 | 13.856 | 0.085 | 163.0 | 0.030 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.003 | 18.151 | 0.110 | 165.0 | 0.011 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.004 | 32.014 | 0.195 | 164.2 | 0.007 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.005 | 8.576 | 0.035 | 245.0 | 0.056 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 2.000 | 44.144 | 0.270 | 163.5 | 0.008 | 4.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 2.001 | 18.167 | 0.110 | 165.0 | 0.039 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 2.002 | 22.890 | 0.140 | 163.5 | 0.017 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 2.003 | 8.790 | 0.420 | 20.9 | 0.047 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.006 | 2.522 | 0.020 | 126.1 | 0.013 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.007 | 25.907 | 0.110 | 235.5 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.008 | 6.609 | 0.030 | 220.3 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 50.00 | 4.67 | 82.430 | 0.009 | 0.0 | 0.0 | 0.0 | 1.02 | 40.5 | 1.2 |
| 1.001 | 50.00 | 5.26 | 82.180 | 0.023 | 0.0 | 0.0 | 0.0 | 1.02 | 40.4 | 3.1 |
| 1.002 | 50.00 | 5.49 | 81.960 | 0.052 | 0.0 | 0.0 | 0.0 | 1.02 | 40.6 | 7.1 |
| 1.003 | 50.00 | 5.79 | 81.875 | 0.064 | 0.0 | 0.0 | 0.0 | 1.02 | 40.4 | 8.6 |
| 1.004 | 50.00 | 6.31 | 81.765 | 0.071 | 0.0 | 0.0 | 0.0 | 1.02 | 40.5 | 9.6 |
| 1.005 | 50.00 | 6.45 | 81.495 | 0.128 | 0.0 | 0.0 | 0.0 | 1.00 | 70.7 | 17.3 |
| 2.000 | 50.00 | 4.60 | 82.400 | 0.008 | 0.0 | 0.0 | 0.0 | 1.23 | 86.7 | 1.1 |
| 2.001 | 50.00 | 4.85 | 82.130 | 0.047 | 0.0 | 0.0 | 0.0 | 1.22 | 86.3 | 6.4 |
| 2.002 | 50.00 | 5.16 | 82.020 | 0.064 | 0.0 | 0.0 | 0.0 | 1.23 | 86.7 | 8.6 |
| 2.003 | 50.00 | 5.20 | 81.880 | 0.111 | 0.0 | 0.0 | 0.0 | 3.45 | 244.0 | 15.0 |
| 1.006 | 50.00 | 6.48 | 81.460 | 0.252 | 0.0 | 0.0 | 0.0 | 1.40 | 98.9 | 34.1 |
| 1.007 | 50.00 | 6.91 | 81.390 | 0.252 | 0.0 | 0.0 | 0.0 | 1.02 | 72.1 | 34.1 |
| 1.008 | 50.00 | 7.01 | 81.280 | 0.252 | 0.0 | 0.0 | 0.0 | 1.06 | 74.6 | 34.1 |

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## Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | PN | Pipe Out Invert Level (m) | Diameter (mm) | PN | Pipes In Invert Level (m) | Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S2.0 | 83.600 | 1.170 | Open Manhole | 1200 | 1.000 | 82.430 | 225 | | | | |
| S2.1 | 83.600 | 1.420 | Open Manhole | 1200 | 1.001 | 82.180 | 225 | 1.000 | 82.180 | 225 | |
| S2.2 | 83.600 | 1.640 | Open Manhole | 1200 | 1.002 | 81.960 | 225 | 1.001 | 81.960 | 225 | |
| S2.3 | 83.600 | 1.725 | Open Manhole | 1200 | 1.003 | 81.875 | 225 | 1.002 | 81.875 | 225 | |
| S2.4 | 83.600 | 1.835 | Open Manhole | 1200 | 1.004 | 81.765 | 225 | 1.003 | 81.765 | 225 | |
| S2.5 | 83.600 | 2.105 | Open Manhole | 1200 | 1.005 | 81.495 | 300 | 1.004 | 81.570 | 225 | |
| S2.6 | 83.600 | 1.200 | Open Manhole | 1200 | 2.000 | 82.400 | 300 | | | | |
| S2.7 | 83.600 | 1.470 | Open Manhole | 1200 | 2.001 | 82.130 | 300 | 2.000 | 82.130 | 300 | |
| S2.8 | 83.600 | 1.580 | Open Manhole | 1200 | 2.002 | 82.020 | 300 | 2.001 | 82.020 | 300 | |
| S2.9 | 83.600 | 1.720 | Open Manhole | 1200 | 2.003 | 81.880 | 300 | 2.002 | 81.880 | 300 | |
| S2.10 | 83.600 | 2.140 | Open Manhole | 1200 | 1.006 | 81.460 | 300 | 1.005 | 81.460 | 300 | |
| | | | | | | | | 2.003 | 81.460 | 300 | |
| PI | 83.600 | 2.210 | Open Manhole | 1200 | 1.007 | 81.390 | 300 | 1.006 | 81.440 | 300 | 50 |
| S2.10 | 83.600 | 2.320 | Open Manhole | 1200 | 1.008 | 81.280 | 300 | 1.007 | 81.280 | 300 | |
| TW SW | 83.600 | 2.350 | Open Manhole | 1200 | | OUTFALL | | 1.008 | 81.250 | 300 | |

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## Area Summary for Storm

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.000 | User | - | 100 | 0.009 | 0.009 | 0.009 |
| 1.001 | User | - | 100 | 0.014 | 0.014 | 0.014 |
| 1.002 | User | - | 100 | 0.021 | 0.021 | 0.021 |
| | User | - | 100 | 0.009 | 0.009 | 0.030 |
| 1.003 | User | - | 100 | 0.005 | 0.005 | 0.005 |
| | User | - | 100 | 0.006 | 0.006 | 0.011 |
| 1.004 | User | - | 100 | 0.001 | 0.001 | 0.001 |
| | User | - | 100 | 0.006 | 0.006 | 0.007 |
| 1.005 | User | - | 100 | 0.022 | 0.022 | 0.022 |
| | User | - | 100 | 0.021 | 0.021 | 0.044 |
| | User | - | 100 | 0.010 | 0.010 | 0.054 |
| | User | - | 100 | 0.003 | 0.003 | 0.056 |
| 2.000 | User | - | 100 | 0.008 | 0.008 | 0.008 |
| 2.001 | User | - | 100 | 0.015 | 0.015 | 0.015 |
| | User | - | 100 | 0.001 | 0.001 | 0.016 |
| | User | - | 100 | 0.002 | 0.002 | 0.019 |
| | User | - | 100 | 0.005 | 0.005 | 0.024 |
| | User | - | 100 | 0.002 | 0.002 | 0.026 |
| | User | - | 100 | 0.013 | 0.013 | 0.039 |
| 2.002 | User | - | 100 | 0.003 | 0.003 | 0.003 |
| | User | - | 100 | 0.005 | 0.005 | 0.008 |
| | User | - | 100 | 0.006 | 0.006 | 0.014 |
| | User | - | 100 | 0.002 | 0.002 | 0.017 |
| 2.003 | User | - | 100 | 0.019 | 0.019 | 0.019 |
| | User | - | 100 | 0.023 | 0.023 | 0.041 |
| | User | - | 100 | 0.006 | 0.006 | 0.047 |
| 1.006 | User | - | 100 | 0.012 | 0.012 | 0.012 |
| | User | - | 100 | 0.002 | 0.002 | 0.013 |
| 1.007 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.008 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| | | | | Total | Total | Total |
| | | | | 0.252 | 0.252 | 0.252 |

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## Network Classifications for Storm

| PN | USMH Name | Pipe Dia (mm) | Min Cover Depth (m) | Max Cover Depth (m) | Pipe Type | MH Dia (mm) | MH Width (mm) | MH Ring Depth (m) | MH Type |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S2.0 | 225 | 0.945 | 1.195 | Unclassified | 1200 | 0 | 0.945 | Unclassified |
| 1.001 | S2.1 | 225 | 1.195 | 1.415 | Unclassified | 1200 | 0 | 1.195 | Unclassified |
| 1.002 | S2.2 | 225 | 1.415 | 1.500 | Unclassified | 1200 | 0 | 1.415 | Unclassified |
| 1.003 | S2.3 | 225 | 1.500 | 1.610 | Unclassified | 1200 | 0 | 1.500 | Unclassified |
| 1.004 | S2.4 | 225 | 1.610 | 1.805 | Unclassified | 1200 | 0 | 1.610 | Unclassified |
| 1.005 | S2.5 | 300 | 1.805 | 1.840 | Unclassified | 1200 | 0 | 1.805 | Unclassified |
| 2.000 | S2.6 | 300 | 0.900 | 1.170 | Unclassified | 1200 | 0 | 0.900 | Unclassified |
| 2.001 | S2.7 | 300 | 1.170 | 1.280 | Unclassified | 1200 | 0 | 1.170 | Unclassified |
| 2.002 | S2.8 | 300 | 1.280 | 1.420 | Unclassified | 1200 | 0 | 1.280 | Unclassified |
| 2.003 | S2.9 | 300 | 1.420 | 1.840 | Unclassified | 1200 | 0 | 1.420 | Unclassified |
| 1.006 | S2.10 | 300 | 1.840 | 1.860 | Unclassified | 1200 | 0 | 1.840 | Unclassified |
| 1.007 | PI | 300 | 1.910 | 2.020 | Unclassified | 1200 | 0 | 1.910 | Unclassified |
| 1.008 | S2.10 | 300 | 2.020 | 2.050 | Unclassified | 1200 | 0 | 2.020 | Unclassified |

## 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 | TW SW | 83.600 | 81.250 | 81.250 | 1200 | 0 |

## Simulation Criteria for Storm

| | | | |
|---|---|---|---|
| Volumetric Runoff Coeff | 0.750 | Additional Flow - % of Total Flow | 0.000 |
| Areal Reduction Factor | 1.000 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start (mins) | 0 | Inlet Coeffiecient | 0.800 |
| Hot Start Level (mm) | 0 | Flow per Person per Day (l/per/day) | 0.000 |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins) | 60 |
| Foul Sewage per hectare (l/s) | 0.000 | Output Interval (mins) | 1 |

| | | | |
|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Storage Structures | 1 |
| 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 | FEH |
| Return Period (years) | 2 |
| FEH Rainfall Version | 1999 |
| Site Location | GB 524500 212550 TL 24500 12550 |
| C (1km) | -0.028 |
| D1 (1km) | 0.293 |
| D2 (1km) | 0.320 |
| D3 (1km) | 0.277 |
| E (1km) | 0.321 |
| F (1km) | 2.481 |

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## Synthetic Rainfall Details

| | |
|---|---|
| Summer Storms | Yes |
| Winter Storms | Yes |
| Cv (Summer) | 0.750 |
| Cv (Winter) | 0.840 |
| Storm Duration (mins) | 30 |

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## Online Controls for Storm

### Hydro-Brake® Optimum Manhole: S2.10, DS/PN: 1.008, Volume (m³): 4.4

| | |
|---|---|
| Unit Reference | MD-SHE-0105-5000-1000-5000 |
| Design Head (m) | 1.000 |
| Design Flow (l/s) | 5.0 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 105 |
| Invert Level (m) | 81.280 |
| Minimum Outlet Pipe Diameter (mm) | 150 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) |
|---|---|---|
| Design Point (Calculated) | 1.000 | 5.0 |
| Flush-Flo™ | 0.296 | 5.0 |
| Kick-Flo® | 0.637 | 4.1 |
| Mean Flow over Head Range | - | 4.3 |

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|
| 0.100 | 3.6 | 1.200 | 5.4 | 3.000 | 8.4 | 7.000 | 12.5 |
| 0.200 | 4.8 | 1.400 | 5.8 | 3.500 | 9.0 | 7.500 | 12.9 |
| 0.300 | 5.0 | 1.600 | 6.2 | 4.000 | 9.6 | 8.000 | 13.3 |
| 0.400 | 4.9 | 1.800 | 6.6 | 4.500 | 10.1 | 8.500 | 13.7 |
| 0.500 | 4.7 | 2.000 | 6.9 | 5.000 | 10.6 | 9.000 | 14.1 |
| 0.600 | 4.3 | 2.200 | 7.2 | 5.500 | 11.1 | 9.500 | 14.5 |
| 0.800 | 4.5 | 2.400 | 7.5 | 6.000 | 11.6 | | |
| 1.000 | 5.0 | 2.600 | 7.8 | 6.500 | 12.1 | | |

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## Storage Structures for Storm

### Cellular Storage Manhole: S2.10, DS/PN: 1.008

Invert Level (m) 81.280 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.02520 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.02520

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 195.5 | 195.5 | 1.001 | 0.0 | 258.5 |
| 1.000 | 195.5 | 258.5 | | | |

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## 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 1
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 | FEH |
| FEH Rainfall Version | 1999 |
| Site Location | GB 524500 212550 TL 24500 12550 |
| C (1km) | -0.028 |
| D1 (1km) | 0.293 |
| D2 (1km) | 0.320 |
| D3 (1km) | 0.277 |
| E (1km) | 0.321 |
| F (1km) | 2.481 |
| Cv (Summer) | 0.750 |
| Cv (Winter) | 0.840 |

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

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 |
| Return Period(s) (years) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 40 |

| 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 | S2.0 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 82.457 |
| 1.001 | S2.1 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 82.222 |
| 1.002 | S2.2 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 82.025 |
| 1.003 | S2.3 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 81.945 |
| 1.004 | S2.4 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 81.837 |
| 1.005 | S2.5 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 81.634 |
| 2.000 | S2.6 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 82.423 |
| 2.001 | S2.7 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 82.187 |
| 2.002 | S2.8 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 82.084 |
| 2.003 | S2.9 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 81.938 |
| 1.006 | S2.10 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 81.622 |
| 1.007 | PI | 15 Winter | 1 | +0% | 30/15 Summer | | | | 81.532 |

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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) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| 1.000 | S2.0 | -0.198 | 0.000 | 0.03 | | 1.3 | OK | |
| 1.001 | S2.1 | -0.183 | 0.000 | 0.08 | | 2.9 | OK | |
| 1.002 | S2.2 | -0.160 | 0.000 | 0.18 | | 6.5 | OK | |
| 1.003 | S2.3 | -0.155 | 0.000 | 0.21 | | 7.7 | OK | |
| 1.004 | S2.4 | -0.153 | 0.000 | 0.22 | | 8.5 | OK | |
| 1.005 | S2.5 | -0.161 | 0.000 | 0.27 | | 14.7 | OK | |
| 2.000 | S2.6 | -0.277 | 0.000 | 0.02 | | 1.2 | OK | |
| 2.001 | S2.7 | -0.243 | 0.000 | 0.08 | | 5.9 | OK | |
| 2.002 | S2.8 | -0.236 | 0.000 | 0.10 | | 7.9 | OK | |
| 2.003 | S2.9 | -0.242 | 0.000 | 0.08 | | 13.5 | OK | |
| 1.006 | S2.10 | -0.138 | 0.000 | 0.56 | | 29.5 | OK | |
| 1.007 | PI | -0.158 | 0.000 | 0.46 | | 29.4 | OK | |

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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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.008 | S2.10 | 120 Winter | 1 | +0% | 30/30 Winter | | | | 81.383 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| 1.008 | S2.10 | -0.197 | 0.000 | 0.06 | | 3.3 | OK | |

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## 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 1
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 | FEH |
| FEH Rainfall Version | 1999 |
| Site Location | GB 524500 212550 TL 24500 12550 |
| C (1km) | -0.028 |
| D1 (1km) | 0.293 |
| D2 (1km) | 0.320 |
| D3 (1km) | 0.277 |
| E (1km) | 0.321 |
| F (1km) | 2.481 |
| Cv (Summer) | 0.750 |
| Cv (Winter) | 0.840 |

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

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 |
| Return Period(s) (years) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 40 |

| 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 | S2.0 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.480 |
| 1.001 | S2.1 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.267 |
| 1.002 | S2.2 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 82.235 |
| 1.003 | S2.3 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 82.201 |
| 1.004 | S2.4 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 82.153 |
| 1.005 | S2.5 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 82.061 |
| 2.000 | S2.6 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.445 |
| 2.001 | S2.7 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.248 |
| 2.002 | S2.8 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.156 |
| 2.003 | S2.9 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 82.063 |
| 1.006 | S2.10 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 82.032 |
| 1.007 | PI | 15 Winter | 30 | +0% | 30/15 Summer | | | | 81.855 |

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## 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) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| 1.000 | S2.0 | -0.175 | 0.000 | 0.11 | | 4.3 | OK | |
| 1.001 | S2.1 | -0.138 | 0.000 | 0.29 | | 11.1 | OK | |
| 1.002 | S2.2 | 0.050 | 0.000 | 0.63 | | 22.3 | SURCHARGED | |
| 1.003 | S2.3 | 0.101 | 0.000 | 0.75 | | 27.3 | SURCHARGED | |
| 1.004 | S2.4 | 0.163 | 0.000 | 0.85 | | 32.1 | SURCHARGED | |
| 1.005 | S2.5 | 0.266 | 0.000 | 0.90 | | 48.1 | SURCHARGED | |
| 2.000 | S2.6 | -0.255 | 0.000 | 0.05 | | 4.3 | OK | |
| 2.001 | S2.7 | -0.182 | 0.000 | 0.32 | | 24.0 | OK | |
| 2.002 | S2.8 | -0.163 | 0.000 | 0.41 | | 31.8 | OK | |
| 2.003 | S2.9 | -0.117 | 0.000 | 0.32 | | 51.5 | OK | |
| 1.006 | S2.10 | 0.272 | 0.000 | 1.99 | | 104.5 | SURCHARGED | |
| 1.007 | PI | 0.165 | 0.000 | 1.61 | | 103.9 | SURCHARGED | |

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## 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.008 | S2.10 | 60 Winter | 30 | +0% | 30/30 Winter | | | | 81.602 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| 1.008 | S2.10 | 0.022 | 0.000 | 0.09 | | 5.0 | SURCHARGED | |

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## 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 1
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 | FEH |
| FEH Rainfall Version | 1999 |
| Site Location | GB 524500 212550 TL 24500 12550 |
| C (1km) | -0.028 |
| D1 (1km) | 0.293 |
| D2 (1km) | 0.320 |
| D3 (1km) | 0.277 |
| E (1km) | 0.321 |
| F (1km) | 2.481 |
| Cv (Summer) | 0.750 |
| Cv (Winter) | 0.840 |

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

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 |
| Return Period(s) (years) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 40 |

| 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 | S2.0 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.590 |
| 1.001 | S2.1 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.574 |
| 1.002 | S2.2 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 83.533 |
| 1.003 | S2.3 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 83.455 |
| 1.004 | S2.4 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 83.331 |
| 1.005 | S2.5 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 83.110 |
| 2.000 | S2.6 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.214 |
| 2.001 | S2.7 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.207 |
| 2.002 | S2.8 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.170 |
| 2.003 | S2.9 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 83.114 |
| 1.006 | S2.10 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 82.987 |
| 1.007 | PI | 15 Winter | 100 | +40% | 30/15 Summer | | | | 82.437 |

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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) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| 1.000 | S2.0 | 0.935 | 0.000 | 0.20 | | 7.8 | FLOOD RISK | |
| 1.001 | S2.1 | 1.169 | 0.000 | 0.49 | | 18.7 | FLOOD RISK | |
| 1.002 | S2.2 | 1.348 | 0.000 | 0.93 | | 32.9 | FLOOD RISK | |
| 1.003 | S2.3 | 1.355 | 0.000 | 1.15 | | 41.7 | FLOOD RISK | |
| 1.004 | S2.4 | 1.341 | 0.000 | 1.27 | | 48.3 | FLOOD RISK | |
| 1.005 | S2.5 | 1.315 | 0.000 | 1.57 | | 84.3 | SURCHARGED | |
| 2.000 | S2.6 | 0.514 | 0.000 | 0.10 | | 8.3 | SURCHARGED | |
| 2.001 | S2.7 | 0.777 | 0.000 | 0.49 | | 36.1 | SURCHARGED | |
| 2.002 | S2.8 | 0.850 | 0.000 | 0.64 | | 49.3 | SURCHARGED | |
| 2.003 | S2.9 | 0.934 | 0.000 | 0.53 | | 86.5 | SURCHARGED | |
| 1.006 | S2.10 | 1.227 | 0.000 | 3.45 | | 181.1 | SURCHARGED | |
| 1.007 | PI | 0.747 | 0.000 | 2.79 | | 180.5 | SURCHARGED | |

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## 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.008 | S2.10 | 120 Winter | 100 | +40% | 30/30 Winter | | | | 82.020 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| 1.008 | S2.10 | 0.440 | 0.000 | 0.09 | | 5.0 | SURCHARGED | |

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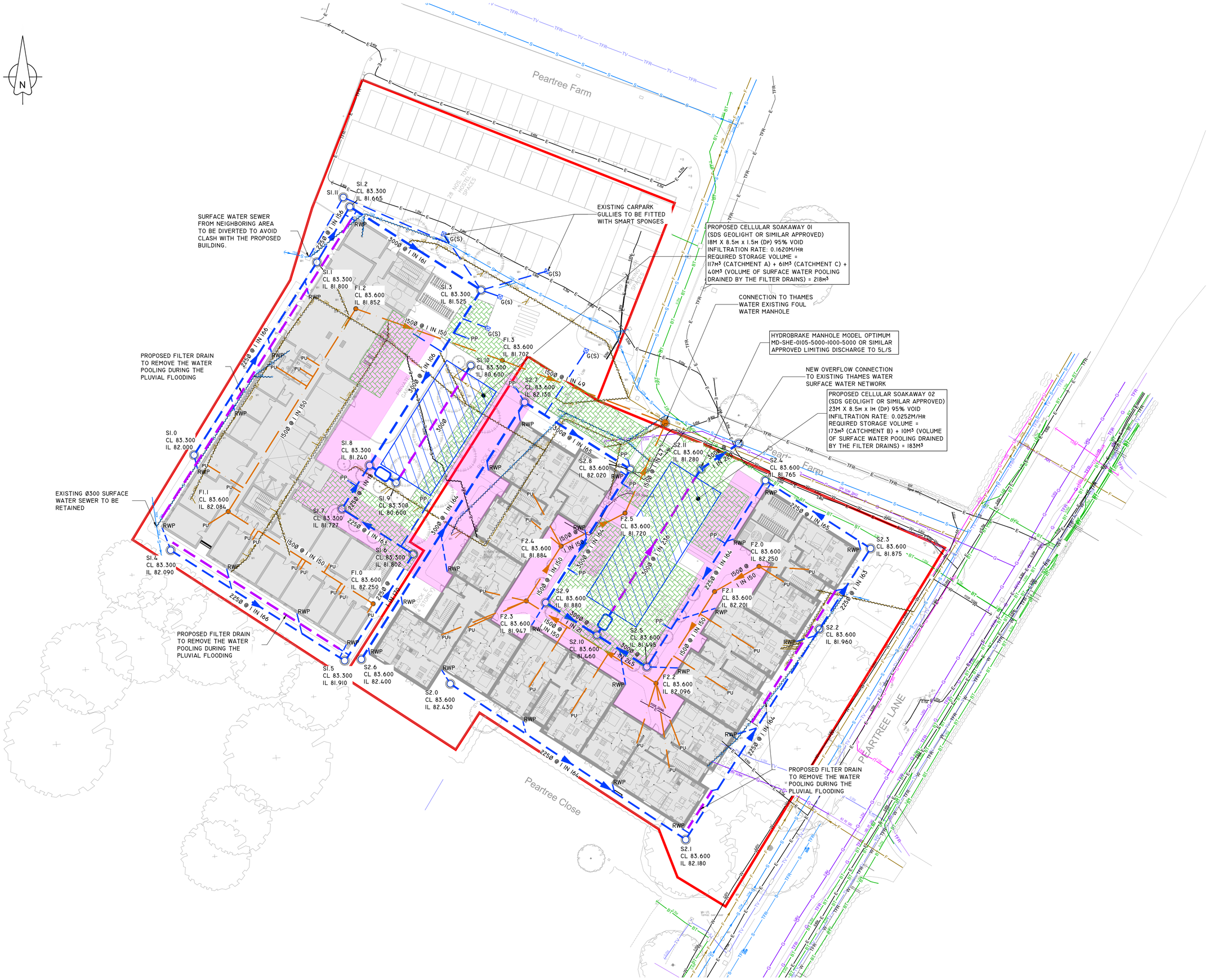
# Appendix G – Proposed Drainage Strategy




## GENERAL NOTES

1. DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
2. FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
3. ANY DISCREPANCIES ARE TO BE REPORTED TO PINNACLE CONSULTING ENGINEERS IMMEDIATELY.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB-CONTRACTORS DRAWINGS AND DETAILS.

## LEGEND

- SITE BOUNDARY
- PROPOSED BUILDING
- PROPOSED SURFACE WATER
- PROPOSED FOUL WATER
- PROPOSED PERFORATED PIPE
- EXISTING SURFACE WATER
- EXISTING FOUL WATER
- EXISTING DRIANAGE SEWER TO BE ABANDONED
- PROPOSED PETROL INTERCEPTOR
- PROPOSED SURFACE WATER SOAKAWAY
- 5M BUFFER ZONE FOR SOAKAWAY
- PROPOSED PERMEABLE PAVING
- G(S) PROPOSED GULLY WITH SMART SPONGE
- PU POP-UP
- RWP RAIN WATER PIPE
- PP PERMEABLE PAVING OUTLET
- E EXISTING ELECTRICAL CABLES
- W EXISTING WATER PIPES
- TV EXISTING CABLE TV
- G EXISTING GAS PIPES
- U UNIDENTIFIED EXISTING GPR OR ELECTRO LOCATION TRACE

0 50MM ON A1 DWG. 50

| REV | DESCRIPTION | BY | CHK | DATE |
|---|---|---|---|---|
| P06 | REVISED DRAINAGE PLAN | IL | JJ | 03.12.2020 |
| P05 | REVISED DRAINAGE PLAN | SC | JJ | 18.11.2020 |
| P04 | REVISED DRAINAGE PLAN | SC | JJ | 05.06.2020 |
| P03 | REVISED DRAINAGE PLAN | SC | JJ | 21.05.2020 |
| P02 | ISSUED FOR PLANNING | SS | JJ | 09.10.2019 |
| P01 | PRELIMINARY | SS | JJ | 03.10.2019 |

CLIENT
SAUNDERS ARCHITECTS ON BEHALF OF YMCA

PROJECT
WGC-ONE YMCA
PEARTREE LANE

DRAWING TITLE
PROPOSED DRAINAGE STRATEGY

PINNACLE CONSULTING ENGINEERS

ALCHEMY,
BESSEMER ROAD,
WELWYN GARDEN CITY,
HERTS,
AL7 1HE. TELEPHONE: 01707 527 630
NORWICH | LONDON | DUBLIN | THE HAGUE

DRAWING STATUS: INFORMATION

| SCALE @ A1 | DATE | DRAWN BY | CHECKED |
|---|---|---|---|
| 1:250 | OCT'19 | SS | JJ |

DRG NO. CI90906-PIN-XX-XX-DR-C-0206 REVISION P06

REF: 190906

COPYRIGHT PINNACLE

# Appendix H – Proposed Catchments Plan

N
Peartree Farm
Peartree Farm
PEARTREE LANE
Peartree Close
28 NO. MOTOR SPACES
108 NO. MOTOR SPACES
PRIVATE GARDEN
CYCLES
SMOKING AREA
DOME GARDEN
PARKING
PARKING
PARKING

# Appendix I – Infiltration Tests

**Delta-Simons Environmental Consultants**
3 Henley Way, Doddington Road, Lincoln LN6 3QR
www.deltasimons.com

# Limited Factual Soakaway Infiltration Report

## WGC-One YMCA, Peartree Lane, Welwyn Garden City

## Presented to **Pinnacle Consulting Engineers**

Issued: April 2020

Delta-Simons Project Number: 20-0093.01

| Issue No. | Status | Issue Date | Comments | Author | Technical Review | Authorised |
|---|---|---|---|---|---|---|
| 1 | Final | 1st April 2020 | | | | |
| | | | | Jessica Rowe<br>Consultant | Redmond Parker-Dunn<br>Principal | Paul Huteson<br>Associate |

## 1.0 Context and Purpose

Delta-Simons Environmental Consultants Limited ("Delta-Simons") was instructed by Pinnacle Consulting Engineers (the "Client") to undertake BRE365 Infiltration testing at the existing YMCA Site, 90 Peartree Lane, Welwyn Garden City, AL7 3UL (the "Site"). A Site Location Map is included as Figure 1.

Delta-Simons has concurrently undertaken environmental investigation at the Site which is reported under a separate cover:

- Environmental Report, WCG-One YMCA, Peartree Lane, Welwyn Garden City, Delta-Simons Project No. 20-0093.01, dated March 2020.

It is understood that the proposed development comprises the demolition of all structures at the Site and the construction of a four-storey 100 bed YMCA Hostel and a 2, 3 and 4 storey building providing up to 43 residential apartments as detailed in Welwyn Hatfield Borough Council Planning Application 6/2019/2714/OUTLINE.

The purpose of this Report is to provide information on the soil infiltration rates beneath the Site to support the Client for drainage design. It is proposed at this stage that surface water drainage will be by two soakaways in the central area of the Site, via interceptors. Correspondence with the Local Planning Authority has been provided by the Client, indicating the requirement of a ground investigation to assess the presence of contamination (reported under a separate cover) and provide infiltration data.

The test locations were indicated by the Client, however following a Site walkover, limited access was available to the area of the proposed soakaways, as such the location of the testing was amended and agreed with the Client.

## 2.0 Limitations

Delta Simons standard limitations are included as Appendix A. In addition, the following specific limitations apply to this assessment:

- Access was limited in the area of the proposed soakaways.

## 3.0 Mapped Ground Conditions

From the British Geological Survey (BGS) Geology of Britain Viewer the Site is indicated as being underlain by superficial Diamicton deposits of the Lowestoft Formation. In addition, superficial sand and gravel deposits of the Kesgrave Catchment Subgroup may encroach onto Site in the northern area. The underlying bedrock is mapped as the Lewes Nodular Chalk Formation and Seaford Chalk Formation (Undifferentiated).

The ground conditions identified during the investigation generally comprised gravelly sandy Made Ground to a maximum depth of 0.68 m bgl underlain by natural firm sandy gravelly clays.

## 4.0 Soakage Testing

Soakage testing was undertaken in general accordance with BRE Digest 365: Soakaway Design [Ref. 1].

The soakage testing comprised excavating two trial pits to depths of approximately 0.95 m bgl and 1.0 m bgl. The locations and depths of the tests were provided by the Clients engineer, however, due to access restrictions and utilities, positions had to be amended and agreed with the Client. The geology at each trial pit location was logged. A gravel pack and monitoring pipes were then installed in the trial pits and the remaining void was backfilled with arisings. The remaining spoil was graded back to original ground level.

The gravel pack in each test location was then filled with water and the depth to water from ground level recorded at intervals over a period of up to 24 hours.

The soakage test data was recorded and used to calculate the soil infiltration rate for each location.

Test results are provided in Appendix B and summarised below. The approximate locations of the soakage tests are shown in Figure 2.

| Location | Test Depth Range (m bgl) | Geology | Infiltration Rate (m/s) |
|---|---|---|---|
| SA101 | 0.50 -1.00 | Sandy gravel clay | $4.5 \times 10^{-5}$ |
| SA102 | 0.50 – 1.00 | Sandy gravel clay | $7.0 \times 10^{-6}$ |

## 5.0 References

**Ref 1:** BRE Digest 365: Soakaway Design, BRE 2016.

## Enclosures:

### Figures

Figure 1 Site Location Map

Figure 2 Intrusive Location Plan

### Appendices

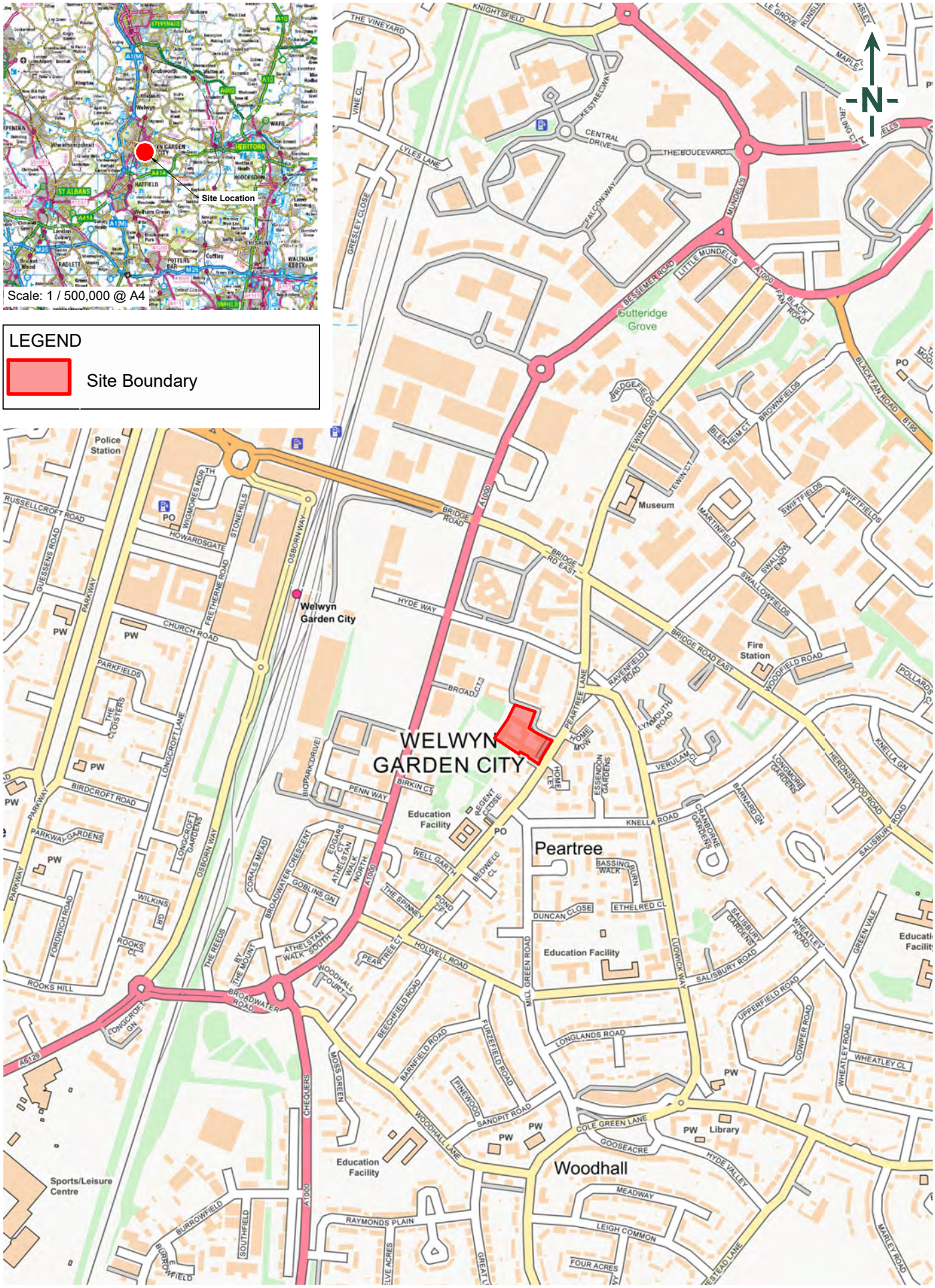
Appendix A Limitations

Appendix B Soakaway Test Results

# Figure 1 – Site Location Map

LEGEND

Site Boundary




Contains OS data © , Crown Copyright and Database Right (2019)

deltasimons
Environment - Health & Safety - Sustainability

| TITLE: | DRAWN BY: JR | SCALE: To Scale@A4 | PROJECT NO: 20-0093 |
|---|---|---|---|
| Site Location Map<br>WCG- One YMCA<br>Peartree Lane, Welwyn Garden City | CHECKED BY: AH | REVISION: 1 | FIGURE NO: 1 |
| | DATE: 13th March 2020 | | |

# Figure 2 – Intrusive Location Plan

LEGEND

Site Boundary

SAx BRE365 Infiltration Test

FOR PLANNING

| REV | DATE | NOTE | IN |
|---|---|---|---|

Project

YMCA
PEARTREE LANE
WELWYN GARDEN CITY

Title

PROPOSED SITE LAYOUT

Scale 1:500 @A3
Date SEPT 2019
Drawn SD
Checked AL
Drawing Number 8057 / P101
Revision -

Saunders
Architecture + Urban Design

saundersarchitects.com | 01707 385300 | London | Manchester | Bristol | Welwyn

Site Plan provided by Client

deltasimons
Environment - Health & Safety - Sustainability

TITLE:
Approximate Intrusive Location Plan
WCG-One YMCA
PeartreeLane, Welwyn Garden City

| DRAWN BY: | SCALE: | PROJECT NO: |
|---|---|---|
| JR | Not to Scale | 20-0093.01 |
| CHECKED BY: RPD | REVISION: 1 | FIGURE NO: 2 |
| DATE: 24th March 2020 | | |

# Appendix A – Limitations

# Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Due to the evolving regulatory climate specific to Per Fluoro Alkyl Substances (PFAS), the scope of works is not intended to be conclusive as it relates to the identification of any PFAS related issues. While Delta-Simons may advise its Client if Delta-Simons becomes aware of the use of PFAS at the subject property, Delta-Simons makes no representation nor accepts any liability that any or all PFAS issues have been identified and/or revealed to its client through its scope of work, as presented herein.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

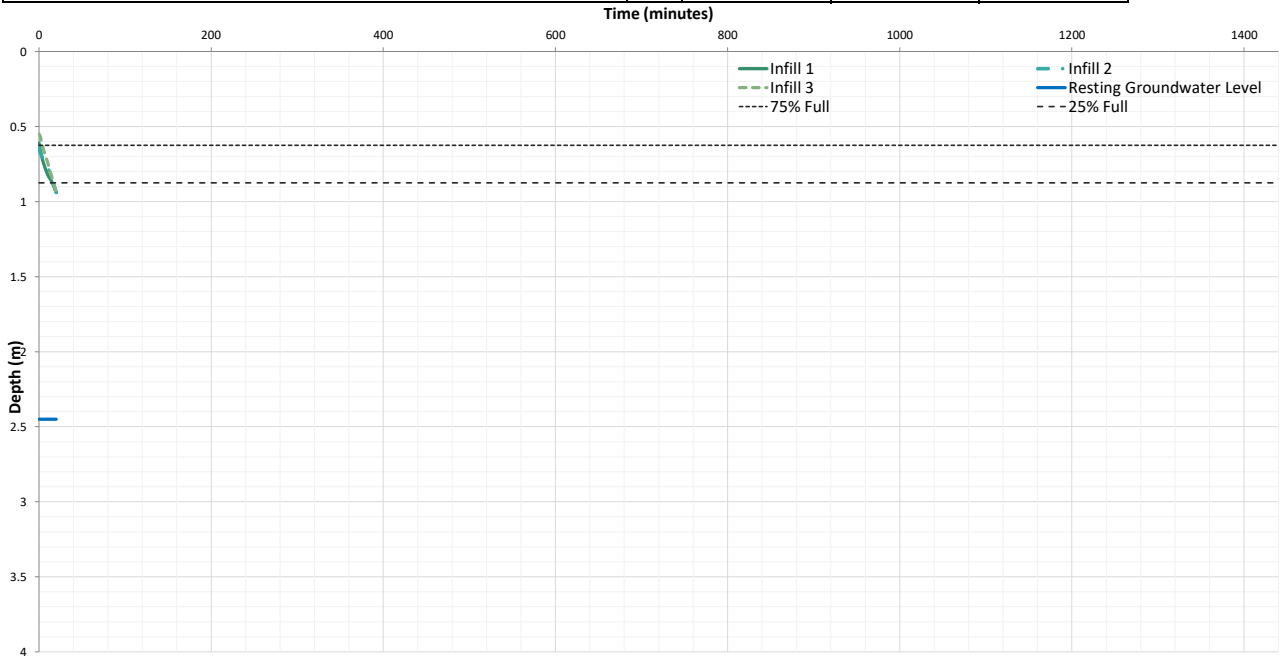
This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

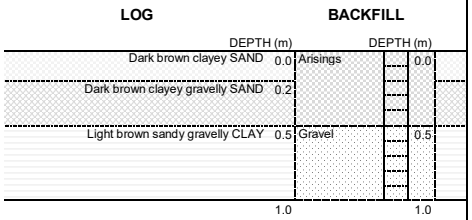
# Appendix B – Soakaway Test Results

| | units | Infill 1 | Infill 2 | Infill 3 |
|---|---|---|---|---|
| Length | m | 1.70 | | |
| Width | m | 0.60 | | |
| Depth | m | 1.00 | | |
| Gravel type | | Standard | | |
| Voids ratio | | 0.35 | | |
| Resting groundwater level at time of testing | m | 2.45 | | |
| Depth of first reading | m | 0.61 | 0.64 | 0.55 |
| Depth of final reading | m | 0.94 | 0.94 | 0.94 |
| Did soakage test reach 25% of maximum fill depth? | | Yes | Yes | Yes |
| Did soakage test reach near empty? | | No | No | No |
| Depth at 75% full/effective depth | m | 0.69 | 0.72 | 0.65 |
| Depth at 25% full/effective depth | m | 0.86 | 0.87 | 0.84 |
| Time at 75% full/effective depth | mins | 3.08 | 4.25 | 4.92 |
| Time at 25% full/effective depth | mins | 13.75 | 15.83 | 15.13 |
| Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth) | $m^3$ | 0.06 | 0.05 | 0.07 |
| Mean surface area for outflow (50% full/effective depth) | $m^2$ | 1.78 | 1.71 | 1.92 |
| tp75 (time for the water level to fall from 75% to 25% full/effective depth) | mins | 10.67 | 11.58 | 10.21 |
| Soil infiltration rate, f = | m/s | 0.00005174 | 0.00004506 | 0.00005929 |
| or | m/s | 5.2E-05 | 4.5E-05 | 5.9E-05 |

| Recommended soil infiltration rate | |
|---|---|
| 4.5E-05 | m/s |

***Note:***
***Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.***




deltasimons

TITLE: Soakaway Test Results
YMCA Peartree Lane, Welwyn Garden City
Pinnacle Consulting Engineers

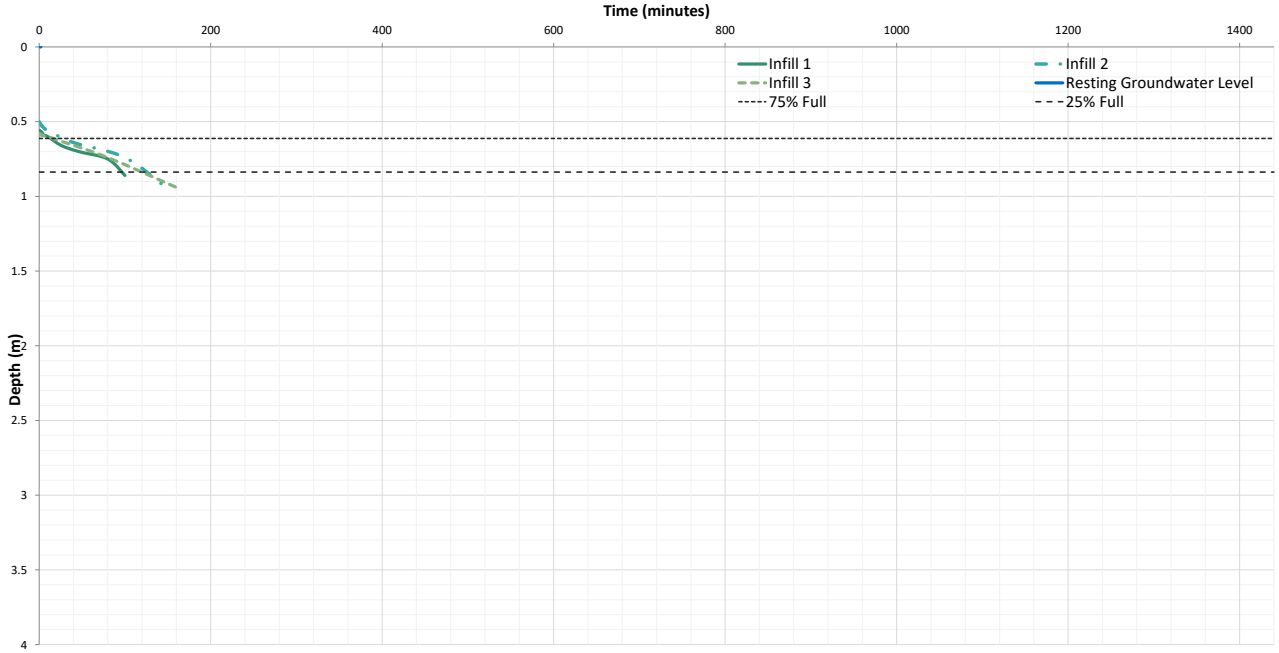
*In accordance with BRE Digest 365 (2016)*

| | | |
|---|---|---|
| DRAWN BY: CB | SCALE: Not to Scale | PROJECT NUMBER: 20-0093.01 |
| CHECKED BY: SS | REVISION: 1 | SOAKAWAY NUMBER: SA101 |
| DATE: 06/03/2020 | | |

| | units | Infill 1 | Infill 2 | Infill 3 |
|---|---|---|---|---|
| Length | m | | 1.70 | |
| Width | m | | 0.60 | |
| Depth | m | | 0.95 | |
| Gravel type | | | Standard | |
| Voids ratio | | | 0.35 | |
| Resting groundwater level at time of testing | m | | 0.00 | |
| Depth of first reading | m | 0.56 | 0.50 | 0.58 |
| Depth of final reading | m | 0.86 | 0.95 | 0.94 |
| Did soakage test reach 25% of maximum fill depth? | | Yes | Yes | Yes |
| Did soakage test reach near empty? | | No | Yes | Yes |
| Depth at 75% full/effective depth | m | 0.64 | 0.61 | 0.67 |
| Depth at 25% full/effective depth | m | 0.79 | 0.84 | 0.86 |
| Time at 75% full/effective depth | mins | 19.33 | 29.69 | 46.25 |
| Time at 25% full/effective depth | mins | 86.36 | 123.21 | 127.00 |
| Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth) | $m^3$ | 0.05 | 0.08 | 0.07 |
| Mean surface area for outflow (50% full/effective depth) | $m^2$ | 1.71 | 2.06 | 1.87 |
| tp75 (time for the water level to fall from 75% to 25% full/effective depth) | mins | 67.03 | 93.53 | 80.75 |
| Soil infiltration rate, f = | m/s | 0.00000779 | 0.00000697 | 0.00000729 |
| or | m/s | 7.8E-06 | 7.0E-06 | 7.3E-06 |

| Recommended soil infiltration rate | |
|---|---|
| 7.0E-06 | m/s |

***Note:***
***Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.***




**LOG**

| | DEPTH (m) |
|---|---|
| Grass over dark brown clayey SAND | 0.0 |
| Light brown gravelly sandy CLAY | 0.2 |
| Light brown sandy gravelly CLAY | 0.6 |
| | 1.0 |

**BACKFILL**

| | DEPTH (m) |
|---|---|
| Arisings | 0.0 |
| Gravel | 0.5 |
| | 1.0 |

deltasimons

TITLE: Soakaway Test Results
YMCA Peartree Lane, Welwyn Garden City
Pinnacle Consulting Engineers

*In accordance with BRE Digest 365 (2016)*

| | | |
|---|---|---|
| DRAWN BY: CB | SCALE: Not to Scale | PROJECT NUMBER: 20-0093.01 |
| CHECKED BY: SS | REVISION: 1 | SOAKAWAY NUMBER: SA102 |
| DATE: 06/03/2020 | | |

# Appendix J – Environmental Report

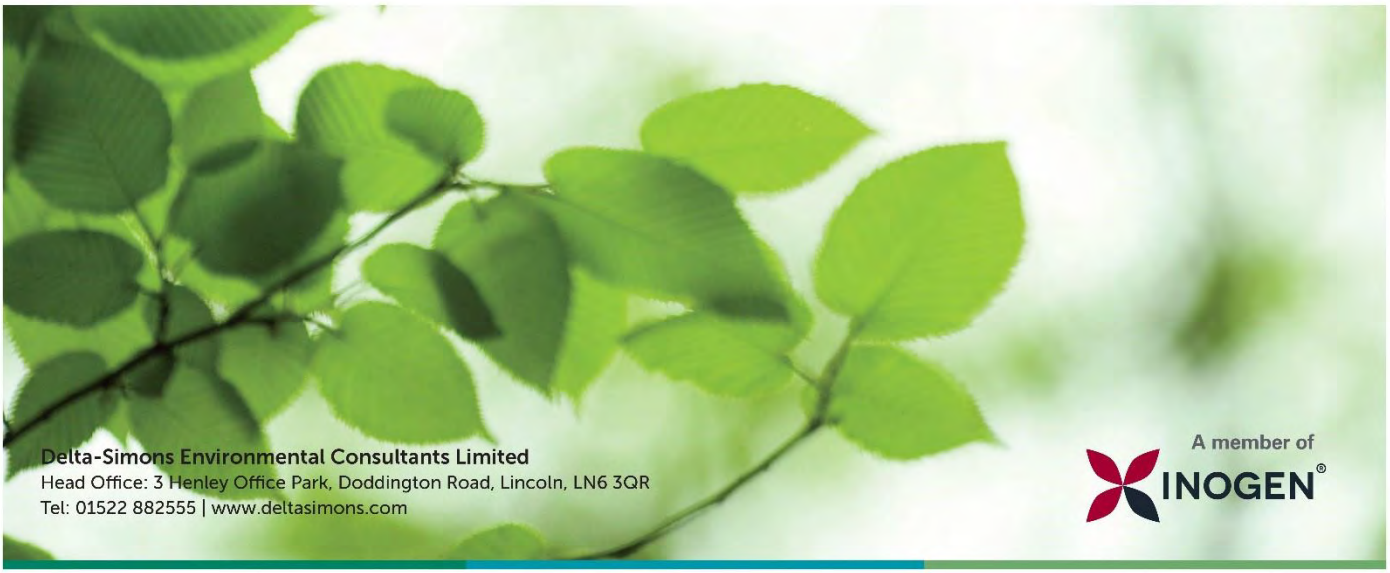
# Environmental Report

## WGC-One YMCA, Peartree Lane, Welwyn Garden City

Presented to **Pinnacle Consulting Engineers**

Issued: April 2020

Delta-Simons Project No. 20-0093.01



**Delta-Simons Environmental Consultants Limited**
Head Office: 3 Henley Office Park, Doddington Road, Lincoln, LN6 3QR
Tel: 01522 882555 | www.deltasimons.com

A member of INOGEN®

# Report Details

| | |
|---|---|
| **Client** | Pinnacle Consulting Engineers |
| **Report Title** | Environmental Report |
| **Site Address** | YMCA, 90 Peartree Lane, Welwyn Garden City, AL7 3UL |
| **Project No.** | 20-0093.01 |
| **Report Date** | 1st April 2020 |
| **Delta-Simons Contact** | Redmond Parker-Dunn (Redmond.parker-dunn@deltasimons.com) |

# Quality Assurance

| Issue No. | Status | Issue Date | Comments | Author | Technical Review | Authorised |
|---|---|---|---|---|---|---|
| **1** | **Final** | **1st April 2020** | | | | |
| | | | | **Jessica Rowe**<br>**Consultant** | **Redmond Parker-Dunn**<br>**Principal** | **Paul Huteson**<br>**Associate** |

# About us

Delta-Simons is a trusted, multidisciplinary environmental consultancy, focused on delivering the best possible project outcomes for customers.

Specialising in Environment, Health & Safety and Sustainability, Delta-Simons provide support and advice within the property development, asset management, corporate and industrial markets. Operating from ten locations - Lincoln, Birmingham, Bristol, Dublin, Leeds, London, Manchester, Newcastle, Norwich and Nottingham - we employ over 100 environmental professionals, bringing experience from across the private consultancy and public sector markets.

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# 1.0 Introduction

## 1.1 Authorisation

Delta-Simons Environmental Consultants Limited ("Delta-Simons") was instructed by Pinnacle Consulting Engineers (the "Client") to prepare anEnvironmental Assessment for YMCA, 90 Peartree Lane, Welwyn Garden City, AL7 3UL (the "Site"). A Site Location Map is included as Figure 1.

## 1.2 Context & Purpose

It is understood that the proposed development comprises the demolition of all structures at the Site and the construction of a four-storey 100 bed YMCA Hostel and a 2, 3 and 4 storey building providing up to 43 residential apartments as detailed in Welwyn Hatfield Borough Council Planning Application 6/2019/2714/OUTLINE. The Proposed Site Layout is included as Drawing 1.

Correspondence with the Local Planning Authority has been provided by the Client, indicating the requirement of a ground investigation to assess the potential presence and associated mobilisation of contamination beneath the Site as part of the proposed surface water drainage strategy for the Site. This investigation does not represent a Geotechnical investigation.

The following Third-Party information has been made available to Delta-Simons for review:

- Argyle Environmental, Site Solutions Combined, Ref. AEL-0046-TSC-959119, dated December 2018.

In addition, Delta-Simons has produced a factual BRE365 infiltration report , dated 1st April 2020, which is reported under a separate cover.

The scope of the investigation and layout of this report has been designed with consideration of guidance on Land Contamination: Risk Management pages of the GOV.UK web pages, the relevant requirements of the National Planning Policy Framework 2019 (NPPF) (paragraphs 170 & 178-180)[1] and the Planning Practice Guidance (Land Affected by Contamination)[2].

The project was carried out to an agreed brief as set out in Delta-Simons' proposal dated January 2020 (Ref. 20-0093.01).

This Report has been based on a review of a previous Third-Party report together with fieldworks comprising soil sampling. Selected soil samples were scheduled for laboratory chemical analysis. Monitoring was carried out on the Site for water levels and concentrations of hazardous ground gas.

The results of the sampling, with the relevant laboratory work, have been presented in the Appendices.

The methods of desk study and fieldworks have been described in Section 2.

The interpretation of the results has been presented as a table in Section 3 with desk study, a conceptual site model (CSM) and initial risk assessment based on the source-pathway-receptor principle and recommendations for aspects of planning design and construction.

## 1.3 Scope

The scope of works performed for this Report comprised the following:

- Review of previous Third-Party report;
- Soil sampling;
- In-situ penetration testing;
- Laboratory testing;
- Ground gas monitoring; and

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779764/NPPF_Feb_2019_web.pdf
[2] https://www.gov.uk/guidance/land-affected-by-contamination

- Contamination assessment.

## 1.4 Limitations

The assessment is limited to the issues agreed within the proposal for the works. Notes on limitations associated with this assessment are provided in Appendix A.

Due to the presence of buildings, associated infrastructure and pedestrian access intrusive locations were limed to accessible areas of the Site to not disrupt the overall operation of the facility.

# 2.0 Investigation Methodology

## 2.1 Desk Study

The following third-party information has been provided to Delta-Simons, which should be read in conjunction with this Report:

- Argyle Environmental, SiteSolutions Combined, Ref. AEL-0046-TSC-959119, dated December 2018.

## 2.2 Conceptual Site Model

A Conceptual Site Model (CSM) represents the relationships between contaminant sources, pathways and receptors. Where all three components may be present on a risk basis an identification and assessment of Possible Pollutant Linkages (PPL) is achieved. Assessing risk in land contamination underpins the "suitable for use" approach adopted for Part 2A of the EPA 1990 regulatory regime and government guidance on land affected by contamination (published 12 June 2014 on gov.uk web site).

Risk is based on the assessor's judgement and a Delta-Simons standard approach. The standard approach is derived from government guidance and uses definitions and a matrix system derived from government guidance and CIRIA document C552 (Contaminated land risk assessment. A Guide to Good Practice).

Sources are listed as part of hazard identification and for this report typically comprise soil and groundwater contaminants on-Site, or off-site where potentially mobile across property boundaries. Ground gas hazards are always considered mobile and subject to ground conditions. Waste items including asbestos are also considered, as are; soil stockpiles, chemical stores and obviously presented invasive weeds.

Relevant potential receptors are considered to include:

- R1 - Construction workers.
- R2 - Third parties during construction (adjacent site users and adjacent residents).
- R3 - Future residents.
- R4 - The underlying Aquifer / Controlled waters.
- R5 - The Built Environment (new buildings and infrastructure).
- R6 – Plants/ vegetable/ livestock in any proposed landscaped areas.

Relevant potential pathways are considered to include:

- P1 - Direct contact, ingestion or inhalation of soil bound contaminants / dust during redevelopment.
- P2 - Inhalation of vapours associated with contamination.
- P3 - Migration of ground gas into on-site buildings causing asphyxiation or risk of explosion.
- P4 - Leaching of contamination into groundwater followed by migration to the wider environment or surface waters.
- P5 - Direct contact between aggressive ground conditions and new infrastructure.
- P6 – Plant and animal uptake.

Where hazards are identified, a Preliminary Risk Assessment (PRA) is undertaken to assess the PPL, and to apply a justified risk ranking (very low - high). Where the PPL is sufficient to result in land being considered as 'contaminated land' under the terms of Part 2A of the Environmental Protection Act (EPA) 1990, a Significant Pollutant Linkage (SPL) may be defined.

A revised CSM is presented which takes into account the relevant findings of the field and laboratory outcomes.

Appendix B also contains the applied risk definitions and matrices.