

## **DRAINAGE STATEMENT**

### **CLYDE COURT LAPWING LANE WEST DIDSBURY**

### **WILMSLOW ROAD DEVELOPMENTS LTD**

| Project No.: 11266 |          |        |           |            |
|--------------------|----------|--------|-----------|------------|
| Issue Date         | Revision | Status | Issued By | Checked By |
| 14.07.2023         | B        |        | KLH       | SJR        |
|                    |          |        |           |            |
|                    |          |        |           |            |

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# DEVELOPMENT DRAINAGE STRATEGY

## 1.0 Introduction

**1.1** This drainage statement has been produced on behalf of Wilmslow Road Developments Ltd to discharge condition 14 of the planning approval for the project which consists of the Conversion and extension of a former nursing home to form a terrace of five 3-storey dwellinghouses and erection of a detached three storey dwellinghouse fronting Clyde Road, with associated landscaping and car parking.

**1.2** The site location is at 22-24 Lapwing Ln, West Didsbury, Manchester M20 2NS. The site covers an area of approximately 52 x 42m and houses a former nursing home, with associated parking and external grassed and paved areas.

**1.3** The National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG) to which condition 14 refers states the following:

*Prior to the commencement of development, details of a sustainable surface water drainage scheme and a foul water drainage scheme shall be submitted to and approved in writing by the Local Planning Authority. The drainage schemes must include:*

- (i) An investigation of the hierarchy of drainage options in the National Planning Practice Guidance (or any subsequent amendment thereof). This investigation shall include evidence of an assessment of ground conditions and the potential for infiltration of surface water in accordance with BRE365;*
- (ii) A restricted rate of discharge of surface water agreed with the local planning authority (if it is agreed that infiltration is discounted by the investigations);*
- (iii) Levels of the proposed drainage systems including proposed ground and finished floor levels in AOD;*
- (iv) Incorporate mitigation measures to manage the risk of sewer surcharge where applicable; and*
- (v) Foul and surface water shall drain on separate systems.*

The approved schemes shall also be in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacement national standards.

Prior to occupation of the proposed development, the drainage schemes shall be completed in accordance with the approved details and maintained thereafter for the lifetime of the development.

**1.4** This drainage statement is produced to demonstrate the scheme has been designed in accordance with the surface water drainage hierarchy outlined above. It describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed scheme for the provision of new drainage to serve the proposed development.

## **2.0 Site Description and Location**

**2.1** The development location is shown on Figure 1 below.

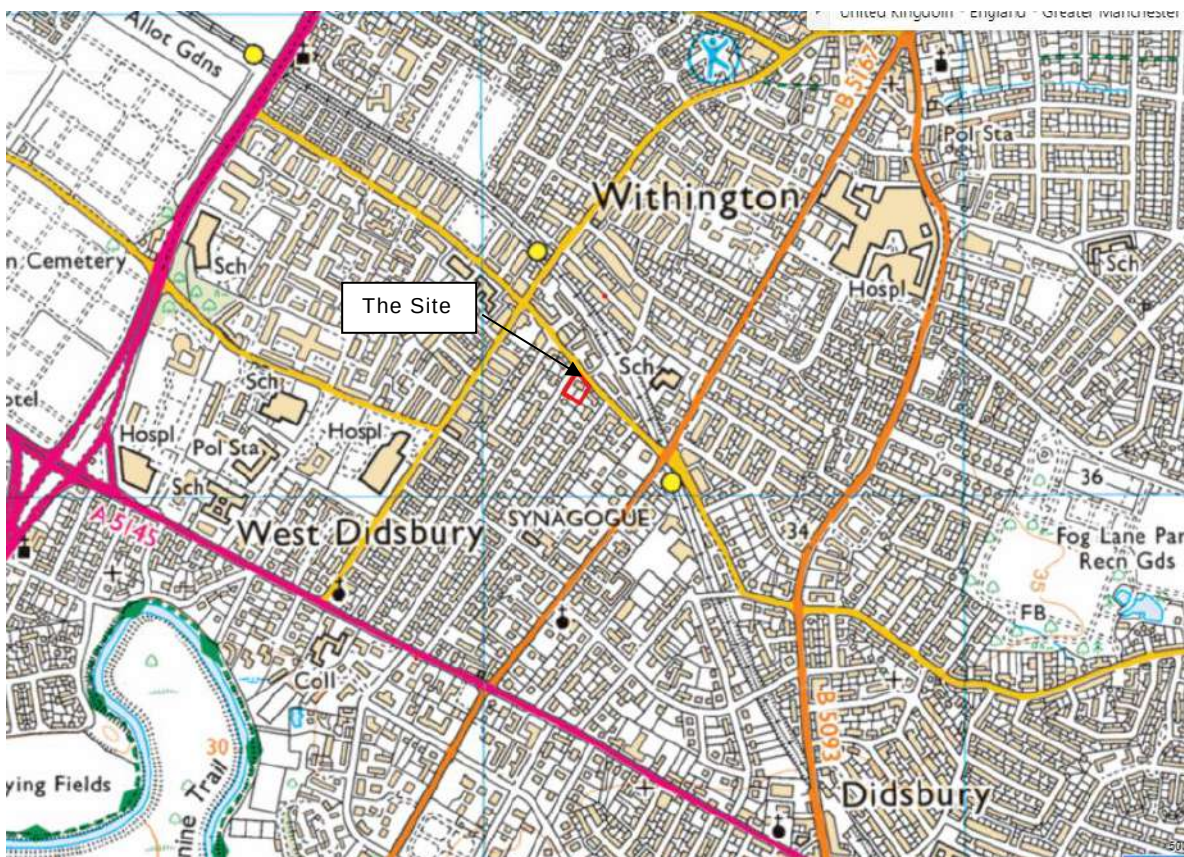


Figure 1 – Site Location Plan

**2.2** The site covers an area of approximately 52 x 42m and houses the Former Clyde Court Nursing Home, with associated parking and external grassed and paved areas.

**2.3** The site is bounded by Clyde Road and Lapwing Lane and residential houses to the East and South, and is centred at Ordnance Survey reference 384215 E, 392216 N.

### **3.0 Investigations and Enquiries**

**3.1** A drainage survey has been carried out to confirm the existing on site drainage and the off site connection to the local sewers.

**3.2** The survey identified combined drains joining in a manhole close to the boundary fence with Clyde Road.

**3.3** The existing sewer records were requested from United Utilities.

### **4.0 Findings and Recommendations**

**4.1** The sewer records received from UU confirmed the on site drainage survey that existing drainage from the site is combined and discharges into the combined sewer in Clyde Road.

**4.2** The planning conditions require that the surface water does not discharge directly into the below ground drainage system.

**4.3** In order to follow the drainage hierarchy outlined in Building Regulations part H3 and National Planning Practice Guidance (NPPG), surface water should be drained via infiltration systems/soakaways wherever possible.

**4.4** Infiltration tests have been carried out to a depth of 1.5m, and the ground is suitable for the use of permeable paving to hard landscaped areas. The demolition of existing building extensions and hard landscaping throughout the site, and the utilisation of permeable paving to new hard landscaped areas will reduce the impermeable surface water area of the site from 1370m<sup>2</sup> to 563m<sup>2</sup>.

**4.5** Keeping soakaways 5m from new and existing buildings, the public highway, site boundaries and the new sunken garden means it is not possible to use soakaways to dispose of surface water from roofs on this site.

**4.6** There are no watercourses in close proximity to the site.

**4.7** It is unclear if infiltration is suitable at basement level of the new detached house and associated sunken garden. Provisionally, a pumped surface water system has been indicated on the proposed drawing layout until this has been clarified.

**4.8** The invert level of the combined existing manhole on site forming the connection to the public sewer is higher than the basement level of the new detached house. Consequently, the foul and surface water drainage from this property will be pumped, and emergency storage capacity will be provided in line with current guidance. A maintenance regime for the pumps will also be implemented.

**4.9** Permeable paving will require a maintenance regime to maintain its functionality. The maintenance regime is in appendix B.

## **5.0 Conclusions**

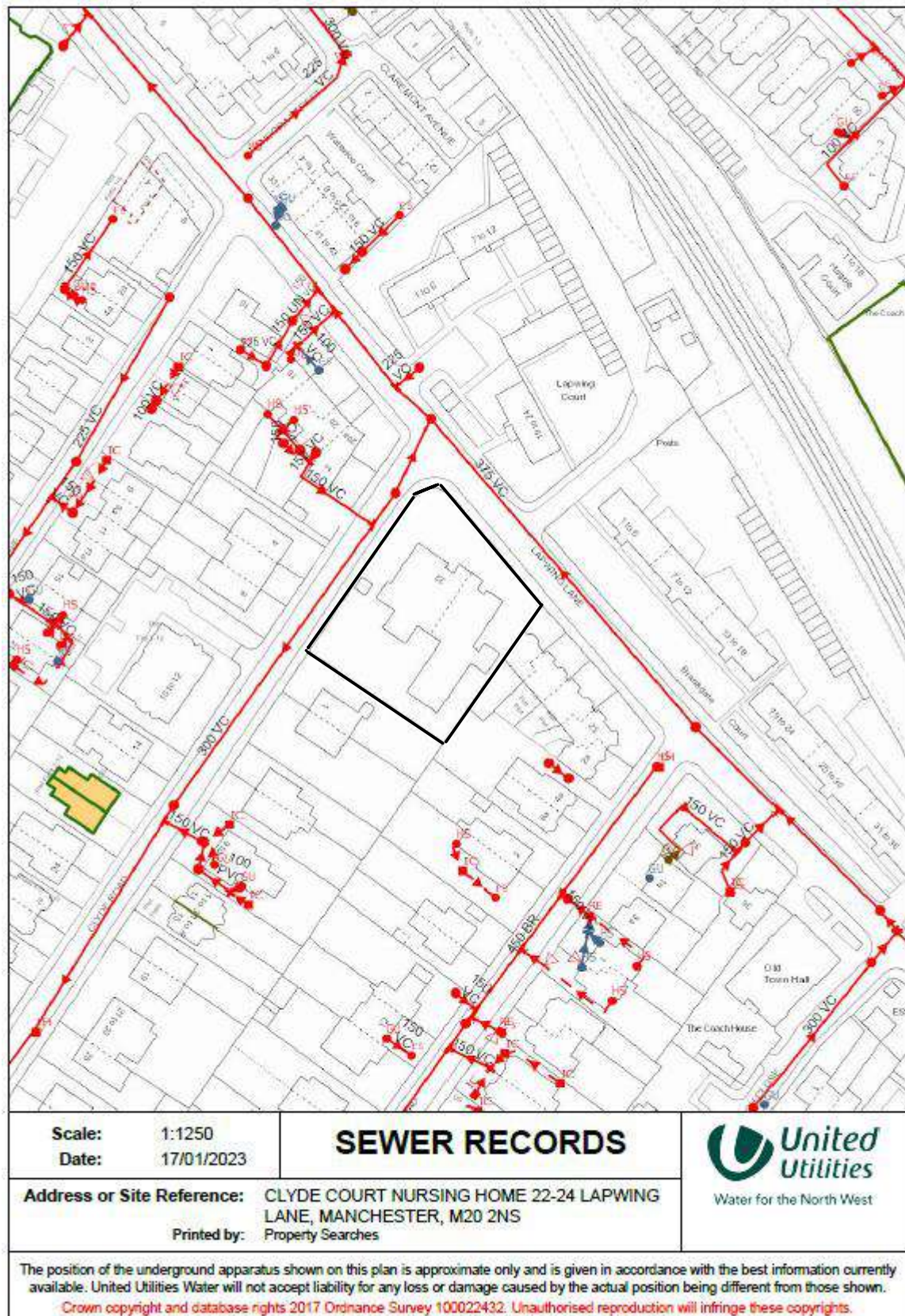
**5.1** Based on the restrictions of the site configuration a hydro-brake will be installed in the surface water system to limit the rate at which water discharges off site, at a rate to be agreed with the Lead Local Flood Authority and United Utilities not exceeding 5l/s, into the combined sewer in Clyde Road.

**5.2** The final design will be issued once the discharge rate for surface water is agreed with the Lead Local Flood Authority and United Utilities.

**5.3** The proposed drainage scheme is as indicated on drawing 11266-101-P3 issued with this statement.

**5.4** The UU sewer records are in appendix A of this statement.

## UU Sewer Records

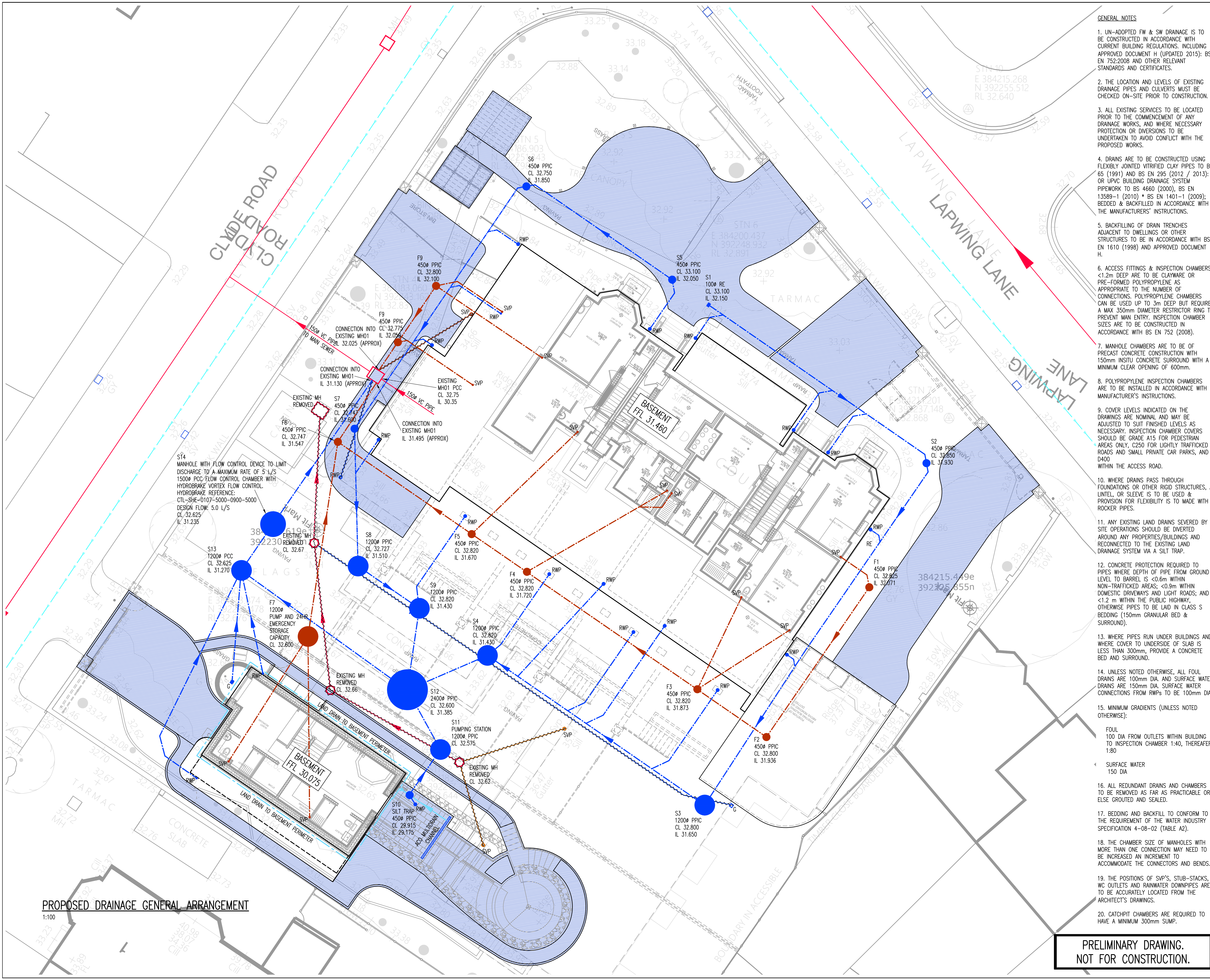


## Appendix B

### Maintenance Regime

| Clyde Court - Drainage Maintenance Plan   |                    |                     |                                                                                                                                                                                                                                 |                    |
|-------------------------------------------|--------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Task                                      | Managed By         | Frequency           | Agreed Action                                                                                                                                                                                                                   | Person Responsible |
| General Visual Inspection                 | Facilities Manager | Weekly              | Visual checks of the gullies, surface channels and manhole covers are to be carried out by a suitably trained and experienced person.                                                                                           | Facilities Manager |
| Cleaning of Drainage Channels and Gullies | Facilities Manager | Quarterly/6 Monthly | Drainage channels and gullies are to be checked monthly to assess the buildup of debris deposited. Depending on the local environment, channels and gully pots are to be cleaned at regular intervals of between 3 to 6 months. | Facilities Manager |
| Permeable Paving                          | Facilities Manager | As required         | Refer to Tobermore Guidelines                                                                                                                                                                                                   | Facilities Manager |
| Foul and Surface Pumps                    | Facilities Manager | As required         | As advised by Pump supplier, (maintenance contract recommended)                                                                                                                                                                 | Facilities Manager |

## **Appendix C**



- GENERAL NOTES
- UN-ADOPTED FW & SW DRAINAGE IS TO BE CONSTRUCTED IN ACCORDANCE WITH CURRENT BUILDING REGULATIONS, INCLUDING APPROVED DOCUMENT H (UPDATED 2015): BS EN 752:2008 AND OTHER RELEVANT STANDARDS AND CERTIFICATES.
  - THE LOCATION AND LEVELS OF EXISTING DRAINAGE PIPES AND CULVERTS MUST BE CHECKED ON-SITE PRIOR TO CONSTRUCTION.
  - ALL EXISTING SERVICES TO BE LOCATED PRIOR TO THE COMMENCEMENT OF ANY DRAINAGE WORKS, AND WHERE NECESSARY PROTECTION OR DIVERSIONS TO BE UNDERTAKEN TO AVOID CONFLICT WITH THE PROPOSED WORKS.
  - DRAINS ARE TO BE CONSTRUCTED USING FLEXIBLY JOINTED VITRIFIED CLAY PIPES TO BS 65 (1991) AND BS EN 295 (2012 / 2013); OR UPVC BUILDING DRAINAGE SYSTEM PIPEWORK TO BS 4660 (2000), BS EN 13589-1 (2010) \* BS EN 1401-1 (2009); BEDDED & BACKFILLED IN ACCORDANCE WITH THE MANUFACTURERS' INSTRUCTIONS.
  - BACKFILLING OF DRAIN TRENCHES ADJACENT TO DWELLINGS OR OTHER STRUCTURES TO BE IN ACCORDANCE WITH BS EN 1610 (1998) AND APPROVED DOCUMENT H.
  - ACCESS FITTINGS & INSPECTION CHAMBERS <1.2m DEEP ARE TO BE CLAYWARE OR PRE-FORMED POLYPROPYLENE AS APPROPRIATE TO THE NUMBER OF CONNECTIONS. POLYPROPYLENE CHAMBERS CAN BE USED UP TO 3m DEEP BUT REQUIRE A MAX 350mm DIAMETER RESTRICTOR RING TO PREVENT MAN ENTRY. INSPECTION CHAMBER SIZES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH BS EN 752 (2008).
  - MANHOLE CHAMBERS ARE TO BE OF PRECAST CONCRETE CONSTRUCTION WITH 150mm INSITU CONCRETE SURROUND WITH A MINIMUM CLEAR OPENING OF 600mm.
  - POLYPROPYLENE INSPECTION CHAMBERS ARE TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
  - COVER LEVELS INDICATED ON THE DRAWINGS ARE NOMINAL AND MAY BE ADJUSTED TO SUIT FINISHED LEVELS AS NECESSARY. INSPECTION CHAMBER COVERS SHOULD BE GRADE A15 FOR PEDESTRIAN AREAS ONLY, C250 FOR LIGHTLY TRAFFICKED ROADS AND SMALL PRIVATE CAR PARKS, AND D400 WITHIN THE ACCESS ROAD.
  - WHERE DRAINS PASS THROUGH FOUNDATIONS OR OTHER RIGID STRUCTURES, A LINTEL, OR SLEEVE IS TO BE USED & PROVISION FOR FLEXIBILITY IS TO BE MADE WITH ROCKER PIPES.
  - ANY EXISTING LAND DRAINS SEVERED BY SITE OPERATIONS SHOULD BE DIVERTED AROUND ANY PROPERTIES/BUILDINGS AND RECONNECTED TO THE EXISTING LAND DRAINAGE SYSTEM VIA A SILT TRAP.
  - CONCRETE PROTECTION REQUIRED TO PIPES WHERE DEPTH OF PIPE FROM GROUND LEVEL TO BARREL IS <0.6m WITHIN NON-TRAFFICKED AREAS; <0.9m WITHIN DOMESTIC DRIVEWAYS AND LIGHT ROADS; AND <1.2 m WITHIN THE PUBLIC HIGHWAY, OTHERWISE PIPES TO BE LAID IN CLASS S BEDDING (150mm GRANULAR BED & SURROUND).
  - WHERE PIPES RUN UNDER BUILDINGS AND WHERE COVER TO UNDERSIDE OF SLAB IS LESS THAN 300mm, PROVIDE A CONCRETE BED AND SURROUND.
  - UNLESS NOTED OTHERWISE, ALL FOUL DRAINS ARE 100mm DIA. AND SURFACE WATER DRAINS ARE 150mm DIA. SURFACE WATER CONNECTIONS FROM RWP'S TO BE 100mm DIA.
  - MINIMUM GRADIENTS (UNLESS NOTED OTHERWISE):  
FOUL  
100 DIA FROM OUTLETS WITHIN BUILDING TO INSPECTION CHAMBER 1:40, THEREAFTER 1:80  
SURFACE WATER  
150 DIA
  - ALL REDUNDANT DRAINS AND CHAMBERS TO BE REMOVED AS FAR AS PRACTICABLE OR ELSE GROUTED AND SEALED.
  - BEDDING AND BACKFILL TO CONFORM TO THE REQUIREMENT OF THE WATER INDUSTRY SPECIFICATION 4-08-02 (TABLE A2).
  - THE CHAMBER SIZE OF MANHOLES WITH MORE THAN ONE CONNECTION MAY NEED TO BE INCREASED AN INCREMENT TO ACCOMMODATE THE CONNECTORS AND BENDS.
  - THE POSITIONS OF SVP'S, STUB-STACKS, WC OUTLETS AND RAINWATER DOWNPIPES ARE TO BE ACCURATELY LOCATED FROM THE ARCHITECT'S DRAWINGS.
  - CATCHPIT CHAMBERS ARE REQUIRED TO HAVE A MINIMUM 300mm SUMP.

- LEGEND
- EXISTING COMBINED DRAIN
  - EXISTING WATER MAIN
  - EXISTING SURFACE WATER DRAIN
  - EXISTING FOUL DRAIN
  - EXISTING SURFACE WATER DRAIN STOPPED OFF AND SEALED
  - EXISTING FOUL DRAIN STOPPED OFF AND SEALED
  - EXISTING COMBINED MANHOLE
  - PROPOSED COMBINED DRAIN
  - PROPOSED FOUL DRAIN
  - PROPOSED SURFACE WATER DRAIN
  - PROPOSED LAND DRAIN
  - PROPOSED POLYPROPYLENE INSPECTION CHAMBER
  - PROPOSED PRE-CAST CONCRETE MANHOLE
  - PROPOSED RAINWATER PIPE
  - PROPOSED SOIL VENT PIPE
  - PROPOSED SOIL PIPE
  - PROPOSED GULLY
  - PROPOSED RODDING EYE
  - PERMEABLE BLOCK PAVING (PRIVATE DRIVEWAY/ GARDEN)

- R.I.P. DRAWING REFERENCE
- SEE STANDARD DETAIL SERIES 11266-SD DRAWINGS FOR DETAIL OF CONSTRUCTION

|     |                                 |          |            |      |          |
|-----|---------------------------------|----------|------------|------|----------|
| P3  | ISSUED FOR APPROVAL             | SHR      | KLH        | LR   | 26.07.23 |
| P2  | UPDATED TO ARCHITECT'S COMMENTS | KLH      | SJR        | LR   | 06.03.23 |
| P1  | ISSUED FOR INFORMATION          | KLH      | SJR        | LR   | 01.03.23 |
| Rev | Details                         | Drawn By | Checked By | Date |          |

Client: WILMSLOW ROAD INVESTMENTS LTD

Project: CLYDE COURT WEST DIDSBURY

Title: PROPOSED DRAINAGE GENERAL ARRANGEMENT

Issued For: APPROVAL

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|                            |                        |                  |
|----------------------------|------------------------|------------------|
| Scale: <b>AS INDICATED</b> | @                      | (A1)             |
| Project No: <b>11266</b>   | Drawing No: <b>101</b> | Issue: <b>P3</b> |

DO NOT SCALE - USE FIGURED DIMENSIONS ONLY.  
This drawing is confidential and is the property of Reid Jones Partnership. It must not be disclosed to any third party, copied or lent without prior written consent. The contractor is to check all dimensions on site prior to commencement of works.

ISO 9001:2015  
REGISTERED  
QUALITY ASSURANCE

PRELIMINARY DRAWING.  
NOT FOR CONSTRUCTION.

## **Appendix D**

### Adoptable Manhole Type

| Max Width (mm) | Diameter (mm) | Max Width (mm) | Diameter (mm) |
|----------------|---------------|----------------|---------------|
| 374            | 1200          | 749            | 1500          |
| 499            | 1350          | 900            | 1800          |

&gt;900 Link+900 mm

| Max Depth (m) | Diameter (mm) | Max Depth (m) | Diameter (mm) |
|---------------|---------------|---------------|---------------|
| 1.500         | 1050          | 99.999        | 1200          |

### Nodes

| Name      | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|-----------|-----------|---------------|-----------------|---------------|-------------|--------------|-----------|
| S1        | 0.008     | 5.00          | 33.100          |               | -337.000    | 290.557      | 0.950     |
| S2        | 0.008     | 5.00          | 32.850          | 450           | -325.110    | 281.924      | 0.920     |
| S3        | 0.016     | 5.00          | 32.800          | 1200          | -338.361    | 262.476      | 1.150     |
| S4        | 0.004     | 5.00          | 32.800          | 1200          | -351.207    | 271.000      | 1.370     |
| S5        | 0.006     | 5.00          | 33.100          | 450           | -340.193    | 292.813      | 1.050     |
| S6        | 0.006     | 5.00          | 32.800          | 450           | -348.898    | 298.370      | 0.950     |
| S7        | 0.002     | 5.00          | 32.747          | 450           | -359.110    | 283.975      | 1.147     |
| S8        |           |               | 32.727          | 1200          | -358.902    | 276.305      | 1.217     |
| S9        | 0.006     | 5.00          | 32.800          | 1200          | -355.275    | 273.805      | 1.370     |
| S12       |           |               | 32.600          | 2400          | -355.578    | 270.038      | 1.215     |
| S10       | 0.004     | 5.00          | 32.620          | 450           | -355.497    | 261.645      | 0.750     |
| S11       |           |               | 32.575          | 1200          | -354.145    | 264.700      | 1.739     |
| S13       | 0.001     | 5.00          | 32.625          | 1200          | -365.834    | 275.525      | 1.356     |
| S14       |           |               | 32.625          | 1500          | -363.953    | 278.300      | 1.390     |
| DISCHARGE |           |               | 32.750          | 1200          | -358.391    | 287.084      | 1.619     |

### Pipeline Schedule

| Link  | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|-------|------------|-------------|----------|-----------|-----------|-----------|--------------|-----------|-----------|--------------|
| 1.000 | 14.694     | 66.8        | 150      | Circular  | 33.100    | 32.150    | 0.800        | 32.850    | 31.930    | 0.770        |
| 1.001 | 23.533     | 84.0        | 150      | Circular  | 32.850    | 31.930    | 0.770        | 32.800    | 31.650    | 1.000        |
| 1.002 | 15.417     | 70.1        | 150      | Circular  | 32.800    | 31.650    | 1.000        | 32.800    | 31.430    | 1.220        |
| 1.003 | 4.476      | 99.5        | 150      | Circular  | 32.800    | 31.430    | 1.220        | 32.600    | 31.385    | 1.065        |
| 2.000 | 10.328     | 51.6        | 150      | Circular  | 33.100    | 32.050    | 0.900        | 32.800    | 31.850    | 0.800        |
| 2.001 | 17.649     | 70.6        | 150      | Circular  | 32.800    | 31.850    | 0.800        | 32.747    | 31.600    | 0.997        |
| 2.002 | 7.673      | 85.3        | 150      | Circular  | 32.747    | 31.600    | 0.997        | 32.727    | 31.510    | 1.067        |
| 2.003 | 4.405      | 55.1        | 150      | Circular  | 32.727    | 31.510    | 1.067        | 32.800    | 31.430    | 1.220        |
| 2.004 | 3.779      | 84.0        | 150      | Circular  | 32.800    | 31.430    | 1.220        | 32.600    | 31.385    | 1.065        |

| Link  | US Node | Dia (mm) | Node Type | MH Type   | DS Node | Dia (mm) | Node Type | MH Type   |
|-------|---------|----------|-----------|-----------|---------|----------|-----------|-----------|
| 1.000 | S1      |          | Manhole   | Adoptable | S2      | 450      | Manhole   | Adoptable |
| 1.001 | S2      | 450      | Manhole   | Adoptable | S3      | 1200     | Manhole   | Adoptable |
| 1.002 | S3      | 1200     | Manhole   | Adoptable | S4      | 1200     | Manhole   | Adoptable |
| 1.003 | S4      | 1200     | Manhole   | Adoptable | S12     | 2400     | Manhole   | Adoptable |
| 2.000 | S5      | 450      | Manhole   | Adoptable | S6      | 450      | Manhole   | Adoptable |
| 2.001 | S6      | 450      | Manhole   | Adoptable | S7      | 450      | Manhole   | Adoptable |
| 2.002 | S7      | 450      | Manhole   | Adoptable | S8      | 1200     | Manhole   | Adoptable |
| 2.003 | S8      | 1200     | Manhole   | Adoptable | S9      | 1200     | Manhole   | Adoptable |
| 2.004 | S9      | 1200     | Manhole   | Adoptable | S12     | 2400     | Manhole   | Adoptable |

### Pipeline Schedule

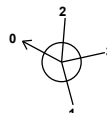
| Link  | Length<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | Link<br>Type | US CL<br>(m) | US IL<br>(m) | US Depth<br>(m) | DS CL<br>(m) | DS IL<br>(m) | DS Depth<br>(m) |
|-------|---------------|----------------|-------------|--------------|--------------|--------------|-----------------|--------------|--------------|-----------------|
| 1.004 | 11.632        | 100.3          | 150         | Circular     | 32.600       | 31.385       | 1.065           | 32.625       | 31.269       | 1.206           |
| 3.000 | 3.341         | 3.2            | 150         | Circular     | 32.620       | 31.870       | 0.600           | 32.575       | 30.836       | 1.589           |
| 3.001 | 5.527         | 12.3           | 150         | Circular     | 32.575       | 31.836       | 0.589           | 32.600       | 31.385       | 1.065           |
| 1.005 | 3.352         | 98.6           | 150         | Circular     | 32.625       | 31.269       | 1.206           | 32.625       | 31.235       | 1.240           |
| 1.006 | 10.397        | 100.0          | 150         | Circular     | 32.625       | 31.235       | 1.240           | 32.750       | 31.131       | 1.469           |

| Link  | US<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type | DS<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type |
|-------|------------|-------------|--------------|------------|------------|-------------|--------------|------------|
| 1.004 | S12        | 2400        | Manhole      | Adoptable  | S13        | 1200        | Manhole      | Adoptable  |
| 3.000 | S10        | 450         | Manhole      | Adoptable  | S11        | 1200        | Manhole      | Adoptable  |
| 3.001 | S11        | 1200        | Manhole      | Adoptable  | S12        | 2400        | Manhole      | Adoptable  |
| 1.005 | S13        | 1200        | Manhole      | Adoptable  | S14        | 1500        | Manhole      | Adoptable  |
| 1.006 | S14        | 1500        | Manhole      | Adoptable  | DISCHARGE  | 1200        | Manhole      | Adoptable  |

### Manhole Schedule

| Node | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                         | Link | IL<br>(m) | Dia<br>(mm) |     |
|------|----------------|-----------------|-----------|--------------|-------------|-------------------------------------------------------------------------------------|------|-----------|-------------|-----|
| S1   | -337.000       | 290.557         | 33.100    | 0.950        |             |   | 0    | 1.000     | 32.150      | 150 |
| S2   | -325.110       | 281.924         | 32.850    | 0.920        | 450         |  | 1    | 1.000     | 31.930      | 150 |
|      |                |                 |           |              |             |  | 0    | 1.001     | 31.930      | 150 |
| S3   | -338.361       | 262.476         | 32.800    | 1.150        | 1200        |  | 1    | 1.001     | 31.650      | 150 |
|      |                |                 |           |              |             |  | 0    | 1.002     | 31.650      | 150 |
| S4   | -351.207       | 271.000         | 32.800    | 1.370        | 1200        |  | 1    | 1.002     | 31.430      | 150 |
|      |                |                 |           |              |             |  | 0    | 1.003     | 31.430      | 150 |
| S5   | -340.193       | 292.813         | 33.100    | 1.050        | 450         |  | 0    | 2.000     | 32.050      | 150 |
| S6   | -348.898       | 298.370         | 32.800    | 0.950        | 450         |  | 1    | 2.000     | 31.850      | 150 |
|      |                |                 |           |              |             |  | 0    | 2.001     | 31.850      | 150 |
| S7   | -359.110       | 283.975         | 32.747    | 1.147        | 450         |  | 1    | 2.001     | 31.600      | 150 |
|      |                |                 |           |              |             |  | 0    | 2.002     | 31.600      | 150 |
| S8   | -358.902       | 276.305         | 32.727    | 1.217        | 1200        |  | 1    | 2.002     | 31.510      | 150 |
|      |                |                 |           |              |             |  | 0    | 2.003     | 31.510      | 150 |

**Manhole Schedule**

| Node      | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                                     | Link | IL<br>(m) | Dia<br>(mm) |     |
|-----------|----------------|-----------------|-----------|--------------|-------------|-------------------------------------------------------------------------------------------------|------|-----------|-------------|-----|
| S9        | -355.275       | 273.805         | 32.800    | 1.370        | 1200        | <div></div>   | 1    | 2.003     | 31.430      | 150 |
|           |                |                 |           |              |             |                                                                                                 | 0    | 2.004     | 31.430      | 150 |
| S12       | -355.578       | 270.038         | 32.600    | 1.215        | 2400        | <div></div>   | 1    | 3.001     | 31.385      | 150 |
|           |                |                 |           |              |             |                                                                                                 | 2    | 2.004     | 31.385      | 150 |
|           |                |                 |           |              |             |                                                                                                 | 3    | 1.003     | 31.385      | 150 |
|           |                |                 |           |              |             |                                                                                                 | 0    | 1.004     | 31.385      | 150 |
| S10       | -355.497       | 261.645         | 32.620    | 0.750        | 450         | <div></div>    |      |           |             |     |
|           |                |                 |           |              |             |                                                                                                 | 0    | 3.000     | 31.870      | 150 |
| S11       | -354.145       | 264.700         | 32.575    | 1.739        | 1200        | <div></div>    | 1    | 3.000     | 30.836      | 150 |
|           |                |                 |           |              |             |                                                                                                 | 0    | 3.001     | 31.836      | 150 |
| S13       | -365.834       | 275.525         | 32.625    | 1.356        | 1200        | <div></div>   | 1    | 1.004     | 31.269      | 150 |
|           |                |                 |           |              |             |                                                                                                 | 0    | 1.005     | 31.269      | 150 |
| S14       | -363.953       | 278.300         | 32.625    | 1.390        | 1500        | <div></div> | 1    | 1.005     | 31.235      | 150 |
|           |                |                 |           |              |             |                                                                                                 | 0    | 1.006     | 31.235      | 150 |
| DISCHARGE | -358.391       | 287.084         | 32.750    | 1.619        | 1200        | <div></div>  | 1    | 1.006     | 31.131      | 150 |

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.15%**

| Node Event        | US Node   | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|-----------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute winter  | S1        | 10          | 32.195    | 0.045     | 4.4          | 0.0000        | 0.0000     | OK         |
| 30 minute winter  | S2        | 28          | 32.128    | 0.198     | 6.8          | 0.0315        | 0.0000     | SURCHARGED |
| 30 minute winter  | S3        | 27          | 32.127    | 0.477     | 13.6         | 0.5390        | 0.0000     | SURCHARGED |
| 30 minute winter  | S4        | 28          | 32.122    | 0.692     | 12.5         | 0.7829        | 0.0000     | SURCHARGED |
| 30 minute winter  | S5        | 28          | 32.122    | 0.072     | 2.5          | 0.0115        | 0.0000     | OK         |
| 30 minute winter  | S6        | 28          | 32.122    | 0.272     | 5.0          | 0.0433        | 0.0000     | SURCHARGED |
| 30 minute winter  | S7        | 28          | 32.122    | 0.522     | 5.8          | 0.0830        | 0.0000     | SURCHARGED |
| 30 minute winter  | S8        | 28          | 32.121    | 0.611     | 4.8          | 0.6914        | 0.0000     | SURCHARGED |
| 30 minute winter  | S9        | 28          | 32.121    | 0.691     | 5.4          | 0.7814        | 0.0000     | SURCHARGED |
| 30 minute winter  | S12       | 28          | 32.120    | 0.735     | 14.0         | 3.3261        | 0.0000     | SURCHARGED |
| 360 minute winter | S10       | 304         | 32.036    | 0.166     | 0.3          | 0.0263        | 0.0000     | SURCHARGED |
| 360 minute winter | S11       | 304         | 32.036    | 1.200     | 1.2          | 1.3567        | 0.0000     | SURCHARGED |
| 30 minute winter  | S13       | 28          | 32.109    | 0.840     | 8.6          | 0.9502        | 0.0000     | SURCHARGED |
| 30 minute winter  | S14       | 28          | 32.104    | 0.869     | 7.2          | 1.5362        | 0.0000     | SURCHARGED |
| 15 minute summer  | DISCHARGE | 1           | 31.131    | 0.000     | 5.0          | 0.0000        | 0.0000     | OK         |

| Link Event (Outflow) | US Node | Link         | DS Node   | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|----------------------|---------|--------------|-----------|---------------|----------------|----------|---------------|--------------------|
| 15 minute winter     | S1      | 1.000        | S2        | 4.3           | 0.699          | 0.200    | 0.1392        |                    |
| 15 minute winter     | S2      | 1.001        | S3        | 8.6           | 0.769          | 0.442    | 0.4054        |                    |
| 15 minute summer     | S3      | 1.002        | S4        | 14.6          | 0.949          | 0.685    | 0.2714        |                    |
| 15 minute winter     | S4      | 1.003        | S12       | 13.5          | 0.826          | 0.760    | 0.0788        |                    |
| 15 minute winter     | S5      | 2.000        | S6        | 3.3           | 0.696          | 0.132    | 0.1004        |                    |
| 15 minute winter     | S6      | 2.001        | S7        | 6.5           | 0.915          | 0.307    | 0.3107        |                    |
| 15 minute winter     | S7      | 2.002        | S8        | 7.1           | 0.922          | 0.367    | 0.1351        |                    |
| 15 minute winter     | S8      | 2.003        | S9        | 5.3           | 0.642          | 0.221    | 0.0775        |                    |
| 15 minute summer     | S9      | 2.004        | S12       | 5.5           | 0.549          | 0.282    | 0.0665        |                    |
| 15 minute winter     | S12     | 1.004        | S13       | 11.1          | 0.823          | 0.625    | 0.2048        |                    |
| 15 minute winter     | S10     | 3.000        | S11       | 2.2           | 1.319          | 0.022    | 0.0310        |                    |
| 120 minute summer    | S11     | Pump         | S12       | 1.7           |                |          |               |                    |
| 15 minute summer     | S13     | 1.005        | S14       | 8.5           | 0.777          | 0.476    | 0.0590        |                    |
| 180 minute summer    | S14     | Hydro-Brake® | DISCHARGE | 5.0           |                |          |               | 29.0               |