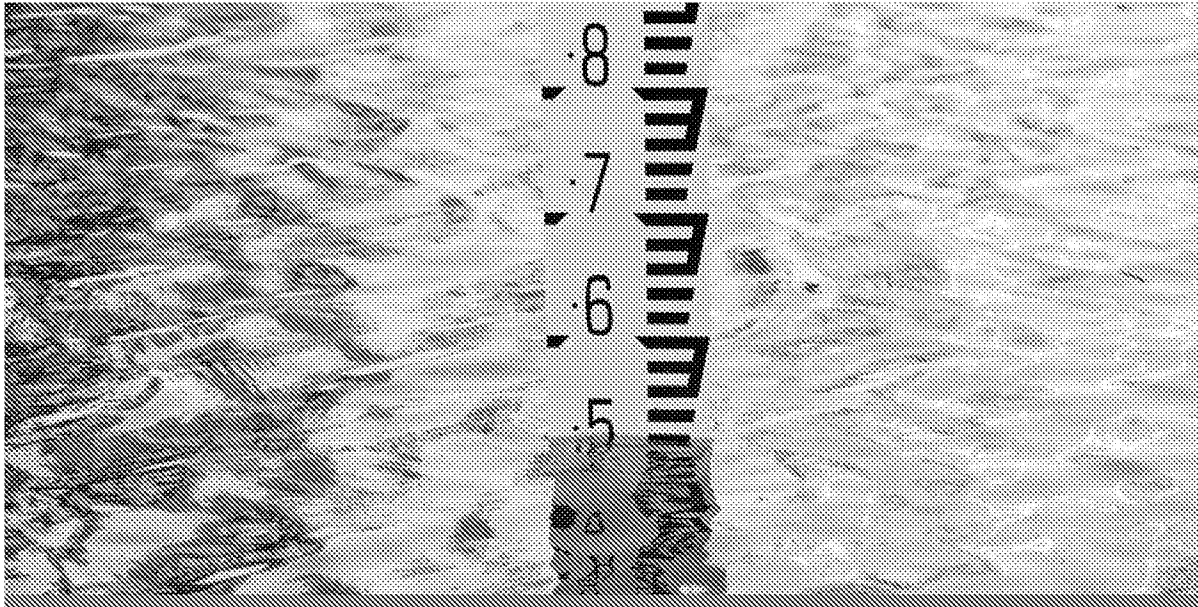




# SuDS Drainage Statement

Comfort Inn, Lyminster Road, Littlehampton

Client

**Mr Mousavizadeh**

Comfort Inn

Arundel Hospitality Ltd

Lyminster Road, Littlehampton

**Ref:** 7321

**Date:** December 2018

Consulting Engineers

**GTA Civils Ltd**

Gloucester House

66a Church Walk

Burgess Hill

West Sussex RH15 9AS

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| Issue                   | Issue date       | Compiled | Checked |
|-------------------------|------------------|----------|---------|
| Preliminary/First Issue | 24 December 2018 | JP       | MR      |
| Second Issue            | 06 July 2020     | JP       | MR      |
|                         |                  |          |         |
|                         |                  |          |         |
|                         |                  |          |         |

## 1 Introduction

- 1.1 This Statement has been prepared for Comfort Inn, Crossbush Service Station, Lyminster. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.
- 1.2 GTA CIVILS Ltd. was appointed by the client to provide a SuDS Drainage Statement (SDS) and proposed strategy design in order to achieve Planning Approval at said property.
- 1.3 The second version of this statement has been prepared following a Winter Groundwater Monitoring Exercise. The drainage strategy has been amended to reflect this result.

## 2 Existing Site

- 2.1 The application site lies within the area administered by Arun District Council (ADC). A site location map and an aerial view are shown in Appendix A.
- 2.2 The developable site area is 4098m<sup>2</sup> comprising a parking area and made ground/spoil heaps.
- 2.3 The topographic survey in Appendix B shows the site to be relatively flat with localised variations in level at an average of 16.00m AOD.
- 2.4 Geology: the BGS records show this area to be underlain by superficial deposits of sand and gravel which are themselves underlain by London clay. This was borne out by the findings of intrusive investigations (refer to the Site Investigation extracts in Appendix D) which also confirmed the presence of varying depths of made ground.
- 2.5 A Winter Groundwater Monitoring Exercise was undertaken between 04/11/19 and 02/04/20 in 2 boreholes within the site. The resultant charts are shown in Appendix D. These show the water table level rising to 0.2m depth at BH01 and 0.4m below ground level at BH02. The layout showing these 2 borehole locations is shown in Appendix D, too.
- 2.6 Included within the site's extents - at the southern end - is the head of a watercourse which conveys water towards the west where it eventually discharges into tributaries of the River Arun.
- 2.7 The local area sewer records show that there are existing public rising mains beyond the southern boundary and that the existing hotel has its own pumped rising main which discharges at a point to the east of the site.

### 3 Proposed Site & Drainage Strategy

- 3.1 The approved layout shows proposals for 3 new accommodation blocks along with an extension to the capacity of the existing building. The proposed layouts, including drainage strategy, are shown in Appendix C.
- 3.2 Proposed surface water drainage: SuDS (Sustainable Urban Drainage Systems) Policy states that surface water runoff for use must be discharged according to the following hierarchy:
- Infiltration to ground;
  - Discharge to a surface water body;
  - Discharge to a surface water sewer, highway drain, or another drainage system;
  - Discharge to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewerage undertaker.
- 3.3 The SuDS Hierarchy (infiltration, watercourses, public sewers, private sewers) was considered. Given the high water table level (see the SI in Appendix D and section 2.5 above) infiltration features will not be viable here.
- 3.4 The development's surface water will be routed to the watercourse at the southern end of the site via an orifice-based control chamber, probably a vortex device such as a hydrobrake. This will restrict flows to a potential maximum of 2.0l/s which is the practical minimum limit of vortex devices. This will allow the control of flows while minimising the likelihood of blockages.
- 3.5 The backed up volume of water will be stored in a 1.2m diameter storage pipe at the low level - initially. The rainwater will be routed via porous pavings' sub-base in the whole car park area. The drainage strategy layout is shown in Appendix C. Calculation sheets in Appendix E show that the network will store all the water and not flood.
- 3.6 The proposed parking area will be of permeable paving with a porous sub-base of clean, coarse granular fill. This will have a 30% void ratio which will provide capacity for the storage of water while it is discharged to ground and to the water course.
- 3.7 The filtration characteristics of coarse granular fill are excellent. The SuDS Manual published by CIRIA demonstrates that this will provide sufficient treatment for the 3 main pollution parameters, namely total suspended solids, metals and hydrocarbons.
- 3.8 Maintenance of the SuDS system will be the overall responsibility of the Applicant. Regular inspections shall be made of the structure and manholes – in line with industry standards. A formal Maintenance Plan will be prepared during the next stage.

- 3.9 Exceedance flows: In the 1 in 1000 years event, initially the storage pipe will overtop, resulting in a shallow overland flow into the watercourse at the southern boundary. This will act as a drain for excess flows – in the event of the control manhole clogging up, thereby limiting the impact of any exceedance.

- End of Statement -

## Appendix A

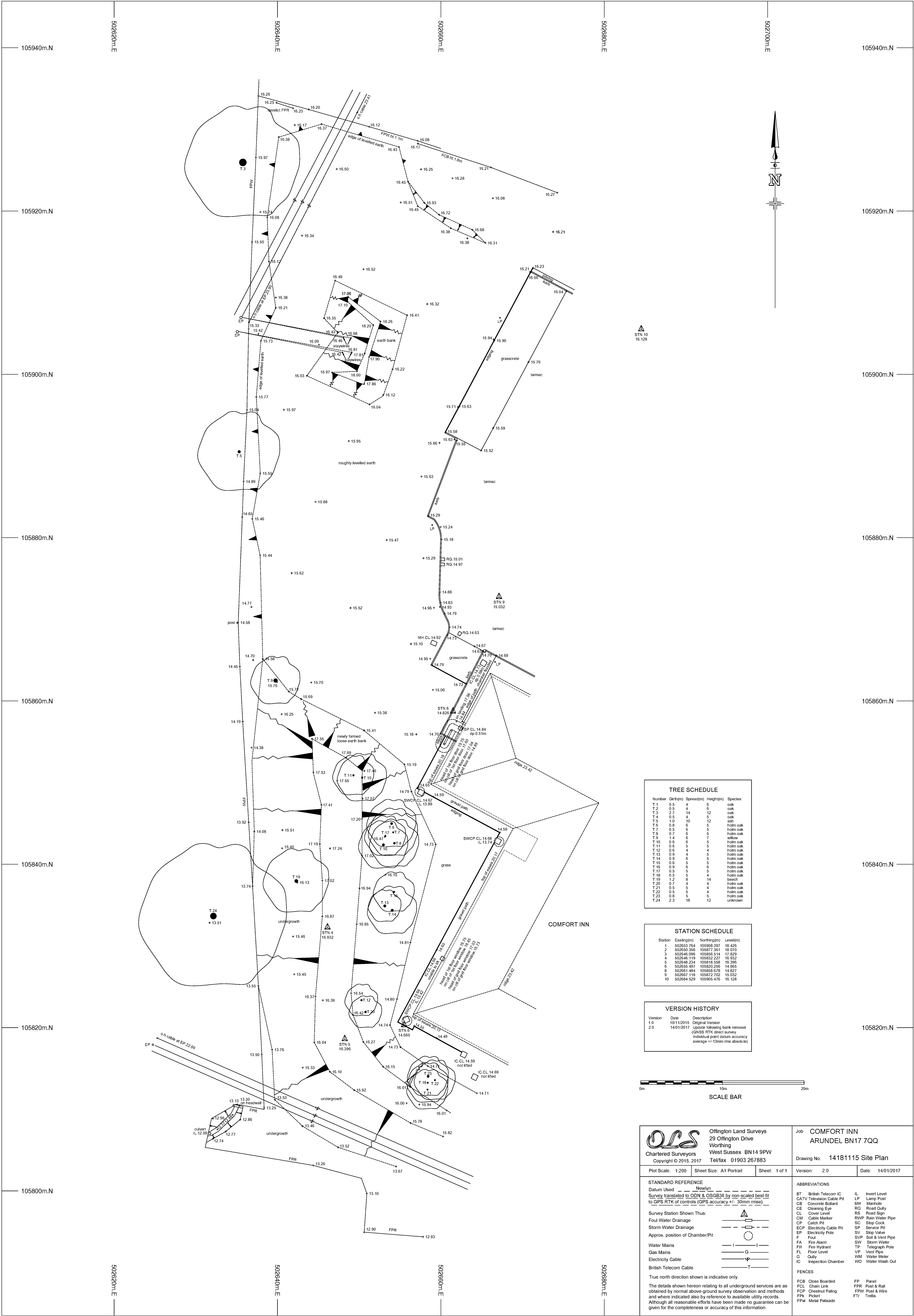
### Site Location Map & Aerial Photo





## Appendix B

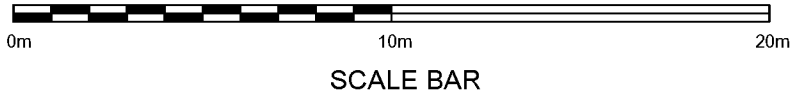
### Topographic Survey Layout & Sewer Records



| TREE SCHEDULE |          |           |           |          |
|---------------|----------|-----------|-----------|----------|
| Number        | Girth(m) | Spread(m) | Height(m) | Species  |
| T.1           | 0.5      | 4         | 6         | oak      |
| T.2           | 0.5      | 4         | 6         | oak      |
| T.3           | 2.7      | 14        | 12        | oak      |
| T.4           | 0.5      | 4         | 5         | oak      |
| T.5           | 1.0      | 10        | 12        | ash      |
| T.6           | 0.8      | 6         | 5         | holm oak |
| T.7           | 0.5      | 6         | 5         | holm oak |
| T.8           | 0.7      | 6         | 5         | holm oak |
| T.9           | 1.4      | 6         | 7         | willow   |
| T.10          | 0.6      | 6         | 5         | holm oak |
| T.11          | 0.6      | 5         | 5         | holm oak |
| T.12          | 0.6      | 4         | 4         | holm oak |
| T.13          | 0.9      | 4         | 5         | holm oak |
| T.14          | 0.8      | 6         | 5         | holm oak |
| T.15          | 0.6      | 5         | 5         | holm oak |
| T.16          | 0.9      | 6         | 6         | holm oak |
| T.17          | 0.5      | 5         | 5         | holm oak |
| T.18          | 0.5      | 5         | 4         | holm oak |
| T.19          | 1.2      | 8         | 14        | beech    |
| T.20          | 0.7      | 4         | 4         | holm oak |
| T.21          | 0.5      | 5         | 4         | holm oak |
| T.22          | 0.5      | 5         | 4         | holm oak |
| T.23          | 0.8      | 5         | 5         | holm oak |
| T.24          | 2.3      | 18        | 12        | unknown  |

| STATION SCHEDULE |            |             |          |
|------------------|------------|-------------|----------|
| Station          | Easting(m) | Northing(m) | Level(m) |
| 1                | 502653.754 | 105908.397  | 18.425   |
| 2                | 502650.356 | 105877.361  | 18.070   |
| 3                | 502646.996 | 105866.514  | 17.829   |
| 4                | 502646.119 | 105832.227  | 16.932   |
| 5                | 502648.234 | 105818.558  | 16.395   |
| 6                | 502655.487 | 105820.256  | 14.663   |
| 8                | 502651.484 | 105858.678  | 14.827   |
| 9                | 502657.118 | 105872.702  | 15.032   |
| 10               | 502684.529 | 105905.476  | 16.128   |

| VERSION HISTORY |            |                                                                                                                      |
|-----------------|------------|----------------------------------------------------------------------------------------------------------------------|
| Version         | Date       | Description                                                                                                          |
| 1.0             | 10/11/2015 | Original Version                                                                                                     |
| 2.0             | 14/01/2017 | Update following bank removal (GNSS RTK direct survey, individual point datum accuracy average +/-15mm rms absolute) |





Offington Land Surveys  
29 Offington Drive  
Worthing  
West Sussex BN14 9PW  
Chartered Surveyors  
Copyright © 2015, 2017  
Tel/fax 01903 267883

Job  
COMFORT INN  
ARUNDEL BN17 7QQ  
Drawing No. 14181115 Site Plan  
Version: 2.0  
Date: 14/01/2017

Plot Scale: 1:200  
Sheet Size: A1 Portrait  
Sheet: 1 of 1

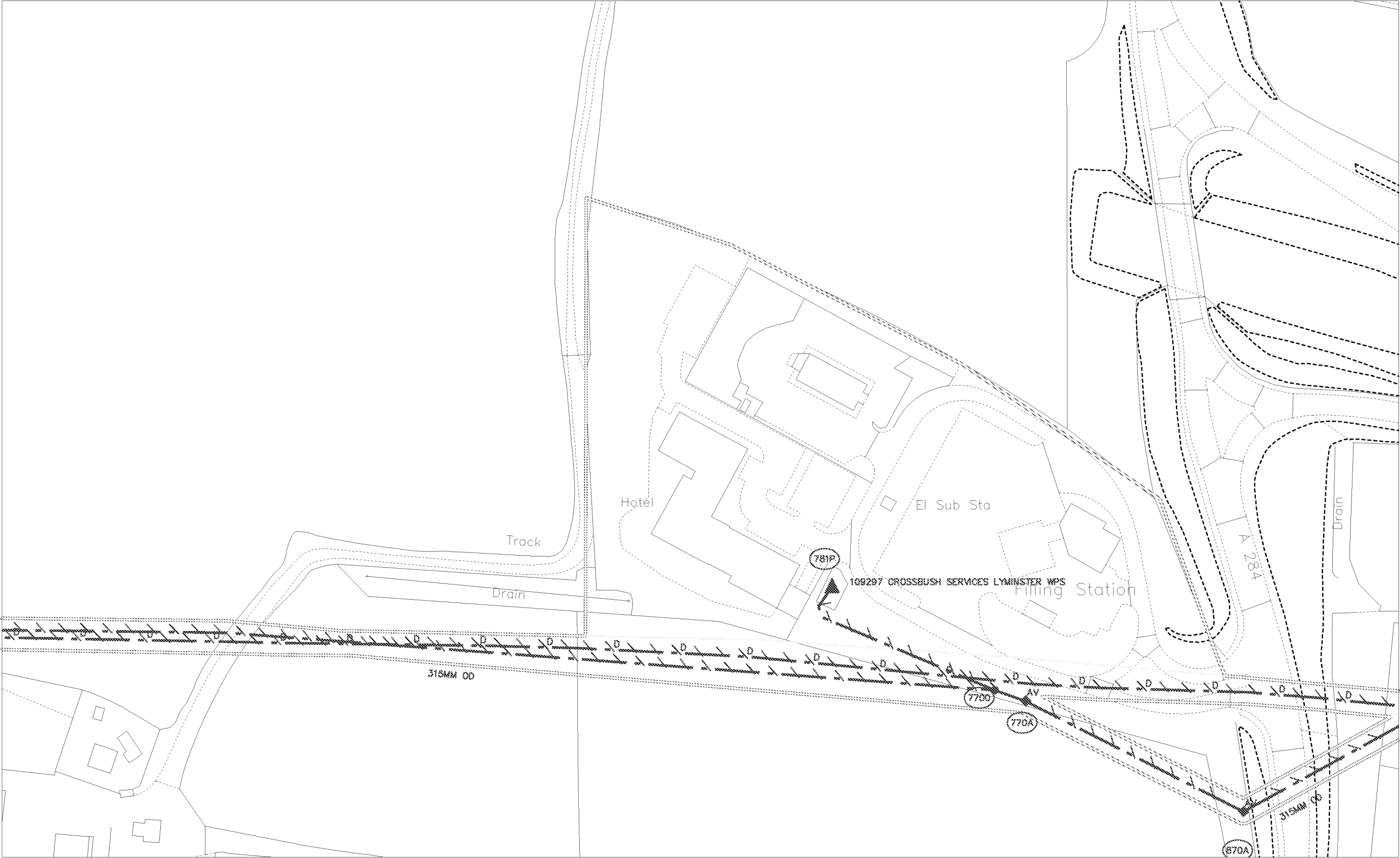
STANDARD REFERENCE  
Datum Used Newlyn  
Survey translated to ODN & OSG836 by non-scaled best-fit to GPS RTK of controls (GPS accuracy +/- 30mm rms).  
Survey Station Shown Thus:  
Foul Water Drainage  
Storm Water Drainage  
Approx. position of Chamber/Pit  
Water Mains  
Gas Mains  
Electricity Cable  
British Telecom Cable  
True north direction shown is indicative only.  
The details shown hereon relating to all underground services are as obtained by normal above-ground survey observation and methods and where indicated also by reference to available utility records. Although all reasonable efforts have been made no guarantee can be given for the completeness or accuracy of this information.

ABBREVIATIONS  
BT British Telecom IC Invert Level  
CATV Television Cable Pit LP Lamp Post  
CB Concrete Bollard MH Manhole  
CE Cleaning Eye RG Road Gully  
CL Cover Level RS Road Sign  
CM Cable Marker RWP Rain Water Pipe  
CP Catch Pit SV Stop Valve  
ECP Electricity Cable Pit SP Service Pit  
EP Electricity Pole SV Stop Valve  
F Foul SVP Soil & Vent Pipe  
FA Fire Alarm SW Storm Water  
FH Fire Hydrant TP Telegraph Pole  
FL Floor Level VP Vent Pipe  
G Gully WM Water Meter  
IC Inspection Chamber WO Water Wash Out

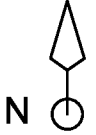
FENCES  
FCB Close Boarded FP Panel  
FCL Chain Link FPR Post & Rail  
FCP Chestnut Paling FFW Post & Wire  
FPK Picket FTR Trellis  
FPal Metal Palisade

SEWER RECORDS PAGE 1 OF 2

106001



105713

|        |                                      |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         |
|--------|--------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 502437 | O.S. REF.<br><b>TQ0205NE</b>         | Drawn by: rohandas | <div>The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy.<br/>The actual positions should be determined on site.<br/><small>WARNING: BAC pipes are constructed of Bonded Asbestos Cement</small><br/><small>WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement</small><br/>Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved<br/>Licence No. WU 298530.</div> | <div><br/>N</div> <div></div> |
|        | Title: 302616_Comfort Inn, Lyminster | Scale: 1:1250      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         |
|        |                                      | Date: 26/07/2018   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         |

502910

SEWER RECORDS PAGE 2 OF 2

| Node  | Cover  | Invert | Size | Material | Shape | Node | Cover | Invert | Size | Material | Shape | Node | Cover | Invert | Size | Material | Shape | Node | Cover | Invert | Size | Material | Shape |
|-------|--------|--------|------|----------|-------|------|-------|--------|------|----------|-------|------|-------|--------|------|----------|-------|------|-------|--------|------|----------|-------|
| 770AX | 14.453 | 12.993 | UNK  | PE       | CIRC  |      |       |        |      |          |       |      |       |        |      |          |       |      |       |        |      |          |       |
| 781PX |        |        | 100  | PVC      | CIRC  |      |       |        |      |          |       |      |       |        |      |          |       |      |       |        |      |          |       |
| 870AX | 13.973 | 12.517 | UNK  | PE       | CIRC  |      |       |        |      |          |       |      |       |        |      |          |       |      |       |        |      |          |       |

LINE STYLES / COLOURS

|            |       |                              |
|------------|-------|------------------------------|
| Brown      | ----- | Foul                         |
|            | ----- | Foul Syphon Sewer            |
|            | ----- | Foul Vacuum Main             |
|            | ----- | Foul Rising Main             |
| Red        | ----- | Combined                     |
|            | ----- | Combined Syphon Sewer        |
|            | ----- | Combined Rising Main         |
|            | ----- | Lateral Drain                |
| Orange     | ----- | Building Over Agreement Area |
| Dark Blue  | ----- | Treated Effluent             |
| Purple     | ----- | Sludge                       |
|            | ----- | Sewer Catchment              |
|            | ----- | Section 104 Area             |
| Light Blue | ----- | Surface Water                |
|            | ----- | Surface Water Rising Main    |
| Yellow     | ----- | Private                      |
| Green      | ----- | Access Shaft                 |
|            | ----- | Decommissioned               |

MATERIALS

|     |                              |
|-----|------------------------------|
| AK  | Alkaline                     |
| BAC | Bonded Asbestos Cement       |
| BRD | Brick (Common)               |
| BRE | Brick (Engineering)          |
| CC  | Concrete Box Culvert         |
| CI  | Cast Iron                    |
| CO  | Concrete (In-Situ)           |
| CP  | Concrete (Pre-Cast)          |
| CSB | Concrete Segments (bolted)   |
| CSU | Concrete Segments (unbolted) |
| DI  | Ductile Iron                 |
| GRG | Glass Reinforced Concrete    |
| GRP | Glass Reinforced Plastic     |
| MAC | Masonry in regular Courses   |
| MAR | Masonry in random Courses    |
| PE  | Polyethylene                 |
| PF  | Pitch Fibre                  |
| PP  | Polypropylene                |
| PVC | Polyvinyl Chloride           |
| RPM | Reinforced Plastic Matrix    |
| SI  | Spun Iron                    |
| ST  | Steel                        |
| VC  | Vertified Clay               |
| XXX | Other                        |
| ZZZ | Unknown                      |

|                          |
|--------------------------|
| Manhole (SW)             |
| Manhole (F&C)            |
| Lamp hole (SW)           |
| Lamp hole (F&C)          |
| Pumping Station (SW)     |
| Pumping Station (F&C)    |
| Side entry manhole (SW)  |
| Side entry manhole (F&C) |
| Blind shaft (SW)         |
| Blind shaft (F&C)        |
| Ejector station (SW)     |
| Ejector station (F&C)    |
| Watertight door (SW)     |
| Watertight door (F&C)    |
| Flushing ch. Min-e (SW)  |
| Flushing ch. Min-e (F&C) |
| Flushing ch. No-e (SW)   |
| Flushing ch. No-e (F&C)  |
| Demonstration Chamber    |

LEGEND - SEWERS

|                         |
|-------------------------|
| Washout (SW)            |
| Washout (F&C)           |
| Rodding Eye (SW)        |
| Rodding Eye (F&C)       |
| Gauging point (SW)      |
| Gauging point (F&C)     |
| Intercept chamber (SW)  |
| Intercept chamber (F&C) |
| Storm Tank (SW)         |
| Storm Tank (F&C)        |
| Vortex chamber (SW)     |
| Vortex chamber (F&C)    |
| Label ellipse           |
| Dummy/S24 manhole       |
| Outfall                 |
| Penstock chamber        |
| Demiboards              |
| Storm Overflow          |
| Backdrop manhole        |
| Other (s)               |
| Other                   |
| Change In sewer (s)     |
| Change In sewer         |
| Rafflux valve           |
| Flap valve              |
| Cascade                 |
| Anode                   |
| Valve                   |
| Closed Valve            |
| Air Valve               |
| Hatch box (SW)          |
| Hatch box (F&C)         |
| Direction arrow         |
| Emptying valve          |
| Catchpit                |
| Soakaway                |
| Inlet                   |
| Balancing Pond          |

|                                              |
|----------------------------------------------|
| Wastewater treatment works                   |
| Marine treatment works                       |
| Outfall headworks                            |
| Vent                                         |
| Vent column                                  |
| Tidal storage tank                           |
| Blank end                                    |
| Head of Public Sewer                         |
| Micro Pumping Station                        |
| SHAPES (S)                                   |
| A Arched                                     |
| B Barrel                                     |
| C Circular                                   |
| E Egg                                        |
| H Horseshoe                                  |
| R Rectangular                                |
| S Square                                     |
| T Trapezoidal                                |
| U U Shape                                    |
| X Other                                      |
| NODE REFERENCING SYSTEM                      |
| 1st digit: hundred metre easting identifier  |
| 2nd digit: hundred metre northing identifier |
| 3rd digit: sewer type identifier             |
| 4th digit: next sequential node              |
| 0-4 = Foul/Combined                          |
| 5-9 = Surface Water                          |

|           |                               |                                                                                       |
|-----------|-------------------------------|---------------------------------------------------------------------------------------|
| Drawn by: | rohandas                      |  |
| Title:    | 302616_Comfort Inn, Lyminster |                                                                                       |
| Date:     | 26/07/2018                    |                                                                                       |

105978



105736

502432

LEGEND - MAINS

|  |                                        |  |                                    |
|--|----------------------------------------|--|------------------------------------|
|  | Distribution Main / Communication pipe |  | Clockwise closing valve            |
|  | Trunk Main                             |  | Fire Hydrant                       |
|  | Raw water main                         |  | Washout                            |
|  | Non potable                            |  | Washout hydrant                    |
|  | Abandoned main                         |  | Meter                              |
|  | Proposed Main                          |  | Capped end                         |
|  | Fire main                              |  | Emptying plug                      |
|  | Non SWS                                |  | Stopcock                           |
|  | Sluice valve                           |  | Leak Noise Correlator Survey Point |
|  | Closed valve                           |  | Anode                              |
|  | Air valve                              |  | Telemetry cable                    |
|  | Butterfly valve                        |  | Access point / hatchbox            |
|  | Pressure reducing valve                |  |                                    |
|  | Reflux valve                           |  |                                    |
|  | Motorised valve                        |  |                                    |

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

MATERIALS

|  |                            |                                    |
|--|----------------------------|------------------------------------|
|  | Dialysis machine           | Alkathene                          |
|  | Break pressure tank        | Cast iron                          |
|  | Change node                | Spun (grey) iron                   |
|  | Pumping station            | Concrete                           |
|  | Booster station            | Ductile iron                       |
|  | Insertion Flow Meter Point | Bonded Asbestos Cement             |
|  | Water tower                | Glass reinforced plastic           |
|  | Service reservoir          | Glass reinforced epoxy             |
|  | Water Supply Works         | (Unplasticised) Polyvinyl chloride |
|  | Bore hole / Well           | Polyethylene                       |
|  | Intake                     | Steel                              |
|  | Customer site              | Concrete segments bolted           |
|  | Swab insertion point       | Concrete segments unbolted         |
|  |                            | Galvanised iron                    |
|  |                            | Ductile sleeve                     |
|  |                            | Concrete pre-stressed              |
|  |                            | High performance polyethylene      |
|  |                            | Unknown                            |

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

|     |                                                                                                                                                                                                                                |            |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| AK  | Drawn by:                                                                                                                                                                                                                      | rohandas   |
| CI  | Scale:                                                                                                                                                                                                                         | 1:1250     |
| SI  | Date:                                                                                                                                                                                                                          | 26/07/2018 |
| CO  | <p>The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd. accept no responsibility in the event of inaccuracy. The actual positions of pipes should be determined on site.</p> |            |
| DI  |                                                                                                                                                                                                                                |            |
| BAC | <p>Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.</p>                                                                               |            |
| GRP |                                                                                                                                                                                                                                |            |
| GRE |                                                                                                                                                                                                                                |            |
| PVC |                                                                                                                                                                                                                                |            |
| PE  |                                                                                                                                                                                                                                |            |
| ST  |                                                                                                                                                                                                                                |            |
| CSB |                                                                                                                                                                                                                                |            |
| CSU |                                                                                                                                                                                                                                |            |
| GI  |                                                                                                                                                                                                                                |            |
| DS  |                                                                                                                                                                                                                                |            |
| CPS |                                                                                                                                                                                                                                |            |
| HPE |                                                                                                                                                                                                                                |            |
| ??  |                                                                                                                                                                                                                                |            |

O.S.Ref: TQ0205NE

TITLE: 302616\_Comfort Inn, Lyminster



502915

## Appendix C

### Proposed Site Layout & Drainage Strategy

**BLOCK C**

**BLOCK B**

**BLOCK A**

43 PARKING SPACES

SECTION A - A

SECTION B - B

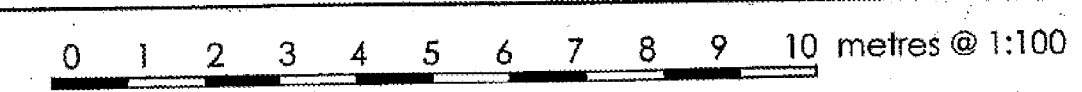
REV.A AUG. 2017 LANDSCAPING AND BOUNDARY DEFINITION

**ATELIER CONSULTANTS**  
phone 07977 070 031

OLD RECTORY COTTAGE, 55C KINGSTON LANE BN42 4SP  
e.mail [peter@atelierconsultants.co.uk](mailto:peter@atelierconsultants.co.uk)

**PROJECT:** ARUNDEL RESIDENCE INN, CROSSBUSH, ARUNDEL  
**CLIENT:**  
**Drawing Title:** PROPOSED SITE PLAN  
**Scale** :1:100 @ A1 **Date:** May 2017 **Drawing**

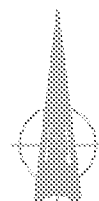
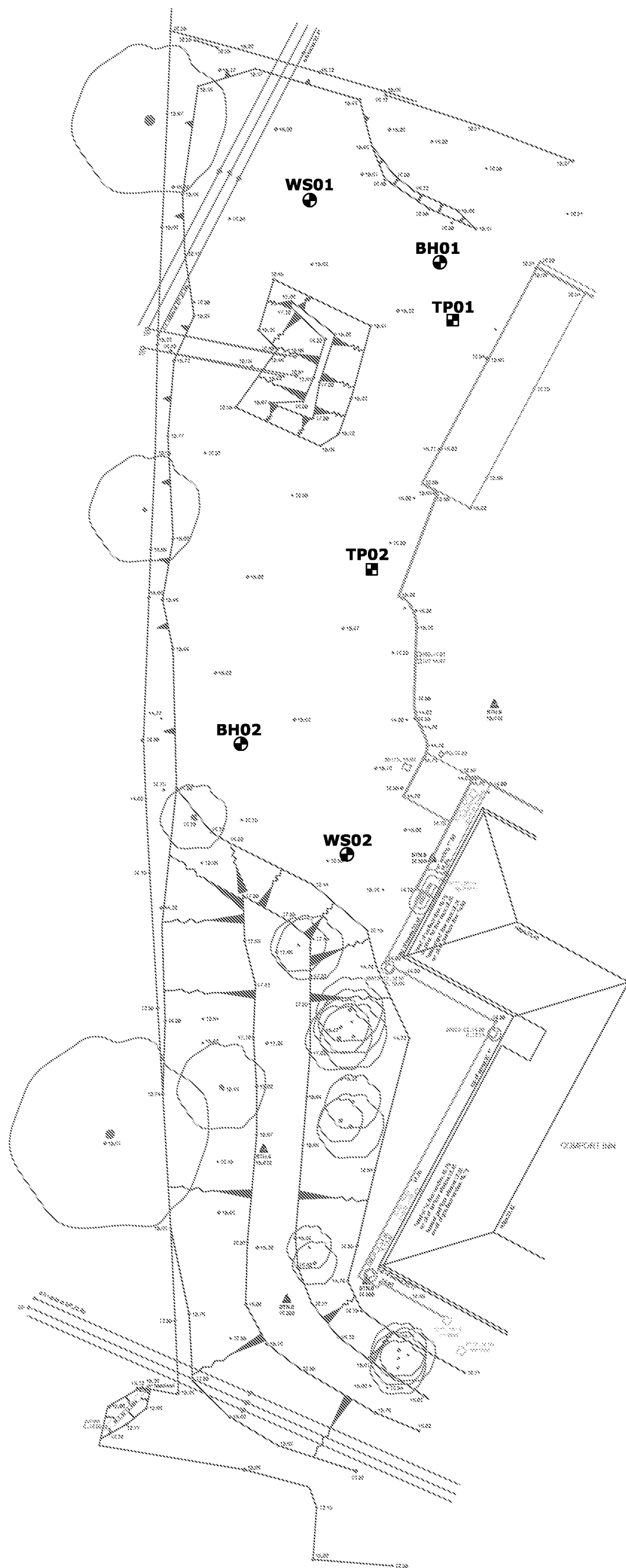
Drawing Number: 095 / P / 10 Rev. **A**





## Appendix D

### Soakage Test Results & Winter Groundwater Monitoring Charts



# ASHDOWN SITE INVESTIGATION

## L · I · M · I · T · E · D

Unit 3,  
The Old Grain Store,  
Ditchling Common Business Park,  
Ditchling,  
West Sussex  
BN6 8SG  
Tel: 01273 483119  
email: contact@ashdownsi.co.uk

| DRAWN BY: | DATE:      | SCALE (at A3): |
|-----------|------------|----------------|
| TSH       | April 2018 | 1:400          |

**SITE:**  
Site Adjacent to Comfort Inn,  
Arundel,  
West Sussex

| REPORT REF.: | FIGURE NO.: |
|--------------|-------------|
| R18-12799    | 1           |

**DRAWING TITLE:**  
Site Plan

monitoring period may have been influenced by percolation of surface water into the standpipe installation.

#### 4. STORMWATER INFILTRATION SYSTEMS

In situ infiltration testing<sup>1</sup> was carried out in both trial pits. During each test performed, the water level within the test pit did not fall below 75% to 25% of the initial test depth and calculation of the soil infiltration rate in accordance with the BRE digest was not possible. For each test, the soil infiltration rate has therefore been calculated by dividing the volume of water lost during the test by the product of the average surface area of the trial pit in contact with water during the test period and the test duration in seconds.

In situ infiltration testing<sup>2</sup> was also undertaken within boreholes WS01 and WS02.

The infiltration rates derived from the tests are summarised in the following table.

*Table 1. Calculated Infiltration Rates*

| Exploratory Hole      | Test Response Zone Depth (m) |        | Stratum               | Infiltration Rate (f) (m/sec)                                                     |
|-----------------------|------------------------------|--------|-----------------------|-----------------------------------------------------------------------------------|
|                       | Top                          | Bottom |                       |                                                                                   |
| <b>WS01 Borehole</b>  | 2.00                         | 3.00   | London Clay Formation | Negligible – the water level fell only 10mm during the test period of 185 minutes |
| <b>WS02 Borehole</b>  | 1.00                         | 2.60   | Raised Beach Deposits | Negligible – the water level fell only 20mm during the test period of 190 minutes |
| <b>TP01 Trial pit</b> | 0.50                         | 0.80   | London Clay Formation | $1.9 \times 10^{-6}$                                                              |
| <b>TP02 Trial pit</b> | 0.35                         | 0.65   | Raised Beach Deposits | $1.0 \times 10^{-6}$                                                              |

The results from the infiltration tests indicate that the underlying natural soils possess poor to negligible infiltration characteristics. The results should be provided to engineers responsible for the design of the drainage system.

**Ashdown Site Investigation Ltd.**  
**April 2018**

<sup>1</sup> Conducted in general accordance with the requirements of BRE 365, Soakaway Design.

<sup>2</sup> Conducted in accordance with The Soakaway Design Guide, published by Kent County Council, July 2000.

**Site Name:** Site Adjacent to Comfort Inn, Arundel, West Sussex

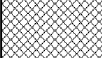
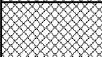
**Job Number:** R18-12799

**Start Date:** 06/03/2018

End Date: 06/03/2018

**Trial Pit Number: TP01**

Sheet 1 of 1

| Samples and In Situ Testing |                |              |             | Stratum Description                                                               |                      |
|-----------------------------|----------------|--------------|-------------|-----------------------------------------------------------------------------------|----------------------|
| Sample/ Test Type           | Depth From (m) | Depth To (m) | Test Result | Legend                                                                            | Depth/ Reduced Level |
|                             |                |              |             |  | 0.00                 |
| D                           | 0.20           |              |             |  | 0.10                 |
| D                           | 0.40           |              |             |  | 0.30                 |
|                             |                |              |             |  | 0.50                 |
| D                           | 0.80           |              |             |                                                                                   | 0.80                 |
| End of trial pit at 0.80m   |                |              |             |                                                                                   |                      |

## Remarks

**Groundwater:** Trial pit dry on completion.

**Stability:** Trial pit stable on completion.

**Notes:** n/a

Excavation Method: HDP

**Pit Length:** 0.30m

**Pit Width:** 0.28m

**Made By:** RJ

Sheet 1 of 1

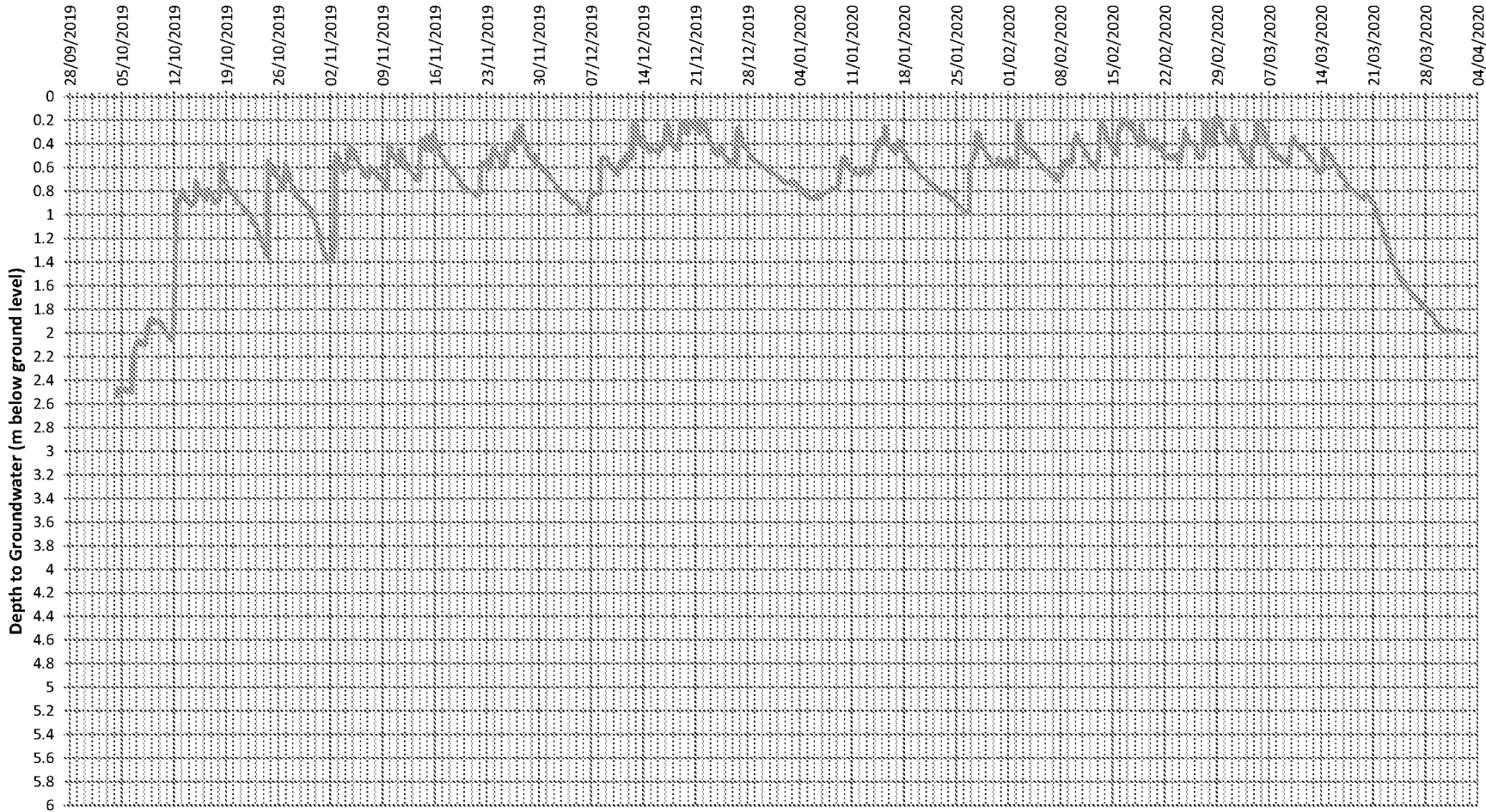
End of borehole at 3.00m

**Made By:** RJ

Ashdown Site Investigation Limited

|                                                          |                    |
|----------------------------------------------------------|--------------------|
| Site: Site Adjacent to Comfort Inn, Arundel, West Sussex | Project No. P14169 |
|----------------------------------------------------------|--------------------|

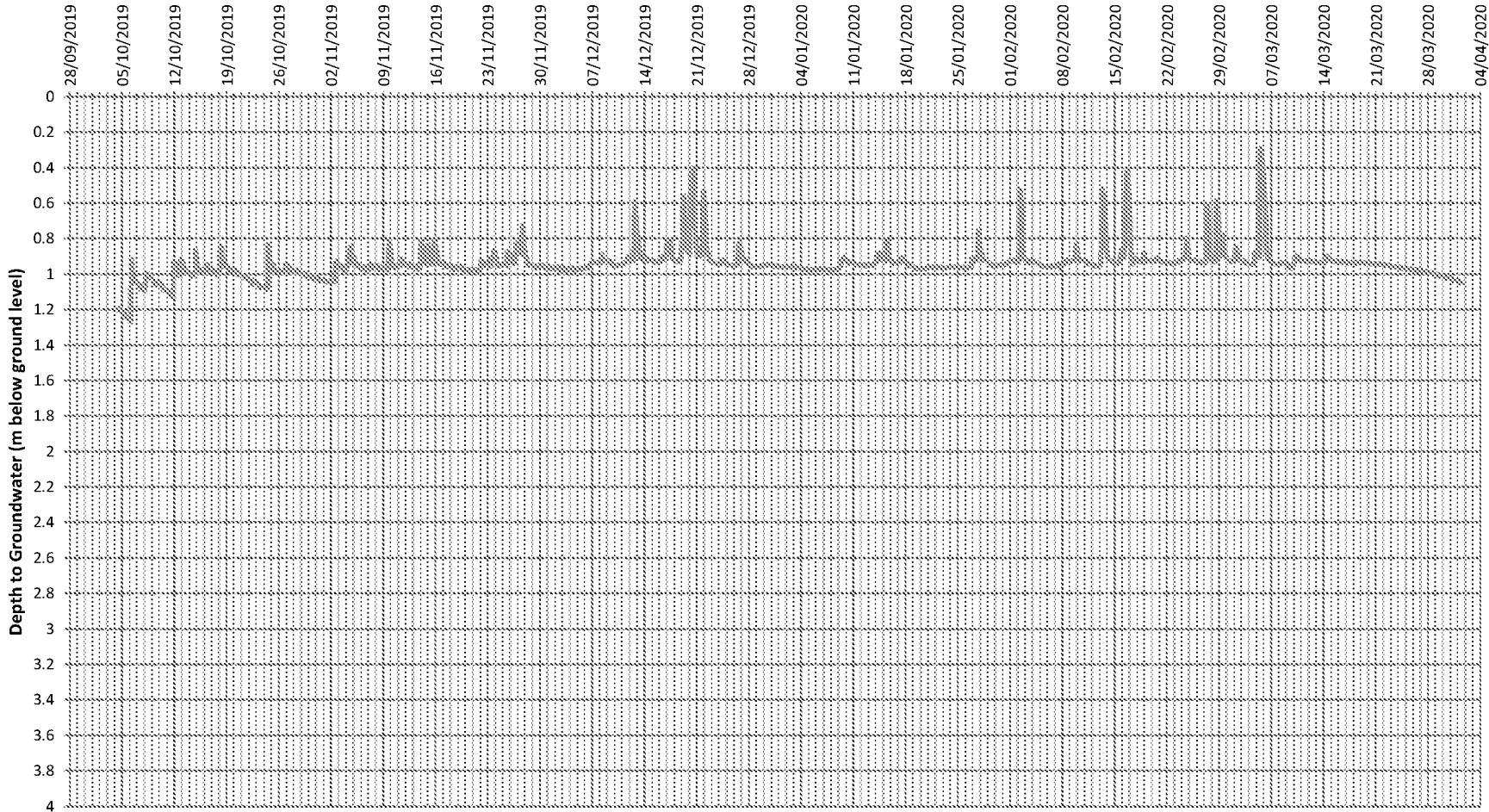
Groundwater Monitoring Results - BH01



Ashdown Site Investigation Limited

|                                                          |                    |
|----------------------------------------------------------|--------------------|
| Site: Site Adjacent to Comfort Inn, Arundel, West Sussex | Project No. P14169 |
|----------------------------------------------------------|--------------------|

Groundwater Monitoring Results - BH02



## Appendix E

### Drainage Calculation Sheets

|                       |                 |                                                                                     |
|-----------------------|-----------------|-------------------------------------------------------------------------------------|
| GTA Civils Ltd        |                 | Page 1                                                                              |
| 66a Church Walk       | COMFORT INN     |  |
| Burgess Hill          | LYMINSTER ROAD  |                                                                                     |
| West Sussex RH15 9AS  | LITTLEHAMPTON   |                                                                                     |
| Date 06/07/2020       | Designed by DMS |                                                                                     |
| File 7321 NETWORK.MDX | Checked by MR   |                                                                                     |
| Micro Drainage        | Network 2018.1  |                                                                                     |

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

|                                        |        |                                       |       |
|----------------------------------------|--------|---------------------------------------|-------|
| FSR Rainfall Model - England and Wales |        |                                       |       |
| Return Period (years)                  | 1      | Foul Sewage (l/s/ha)                  | 0.000 |
| M5-60 (mm)                             | 19.500 | Volumetric Runoff Coeff.              | 0.750 |
| Ratio R                                | 0.350  | PIMP (%)                              | 100   |
| Maximum Rainfall (mm/hr)               | 0      | Add Flow / Climate Change (%)         | 0     |
| Maximum Time of Concentration (mins)   | 30     | 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 Inverts

Time Area Diagram for Storm

| Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) |
|----------------|--------------|----------------|--------------|
| 0-4            | 0.109        | 4-8            | 0.062        |

Total Area Contributing (ha) = 0.171

Total Pipe Volume (m³) = 34.368

Network Design Table for Storm

| PN     | Length<br>(m) | Fall<br>(m) | Slope<br>(1:X) | I.Area<br>(ha) | T.E.<br>(mins) | Base<br>Flow (l/s) | k<br>(mm) | HYD<br>SECT | DIA<br>(mm) | Section Type | Auto<br>Design                                                                        |
|--------|---------------|-------------|----------------|----------------|----------------|--------------------|-----------|-------------|-------------|--------------|---------------------------------------------------------------------------------------|
| S1.000 | 21.750        | 0.275       | 79.1           | 0.149          | 5.00           | 0.0                | 0.600     | o           | 100         | Pipe/Conduit |  |
| S1.001 | 30.140        | 0.077       | 391.4          | 0.022          | 0.00           | 0.0                | 0.600     | o           | 1200        | Pipe/Conduit |  |
| S1.002 | 10.480        | 0.130       | 80.6           | 0.000          | 0.00           | 0.0                | 0.600     | o           | 100         | Pipe/Conduit |  |
| S1.003 | 3.500         | 0.035       | 100.0          | 0.000          | 0.00           | 0.0                | 0.600     | o           | 100         | Pipe/Conduit |  |

Network Results Table

| PN     | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m) | E I.Area<br>(ha) | E Base<br>Flow (l/s) | Foul<br>(l/s) | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) |
|--------|-----------------|----------------|--------------|------------------|----------------------|---------------|-------------------|--------------|--------------|---------------|
| S1.000 | 0.00            | 5.42           | 14.160       | 0.149            | 0.0                  | 0.0           | 0.0               | 0.87         | 6.8          | 0.0           |
| S1.001 | 0.00            | 5.69           | 12.947       | 0.171            | 0.0                  | 0.0           | 0.0               | 1.88         | 2131.7       | 0.0           |
| S1.002 | 0.00            | 5.89           | 12.870       | 0.171            | 0.0                  | 0.0           | 0.0               | 0.86         | 6.7          | 0.0           |
| S1.003 | 0.00            | 5.96           | 12.740       | 0.171            | 0.0                  | 0.0           | 0.0               | 0.77         | 6.0          | 0.0           |

Free Flowing Outfall Details for Storm

| Outfall<br>Pipe Number | Outfall<br>Name | C. Level<br>(m) | I. Level<br>(m) | Min<br>I. Level<br>(m) | D,L<br>(mm) | W<br>(mm) |
|------------------------|-----------------|-----------------|-----------------|------------------------|-------------|-----------|
| S1.003                 | SHWALL          | 13.300          | 12.705          | 0.000                  | 0           | 0         |

|                       |                 |                                                                                     |
|-----------------------|-----------------|-------------------------------------------------------------------------------------|
| GTA Civils Ltd        |                 | Page 2                                                                              |
| 66a Church Walk       | COMFORT INN     |  |
| Burgess Hill          | LYMINSTER ROAD  |                                                                                     |
| West Sussex RH15 9AS  | LITTLEHAMPTON   |                                                                                     |
| Date 06/07/2020       | Designed by DMS |                                                                                     |
| File 7321 NETWORK.MDX | Checked by MR   |                                                                                     |
| Micro Drainage        | Network 2018.1  |                                                                                     |

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.002, Volume (m³): 42.9

|                   |                            |                                   |        |
|-------------------|----------------------------|-----------------------------------|--------|
| Unit Reference    | MD-SHE-0057-2000-2000-2000 | Sump Available                    | Yes    |
| Design Head (m)   | 2.000                      | Diameter (mm)                     | 57     |
| Design Flow (l/s) | 2.0                        | Invert Level (m)                  | 12.870 |
| Flush-Flo™        | Calculated                 | Minimum Outlet Pipe Diameter (mm) | 75     |
| Objective         | Minimise upstream storage  | Suggested Manhole Diameter (mm)   | 1200   |
| Application       | Surface                    |                                   |        |

| Control Points            | Head (m) | Flow (l/s) | Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|---------------------------|----------|------------|
| Design Point (Calculated) | 2.000    | 2.0        | Kick-Flo®                 | 0.506    | 1.1        |
| Flush-Flo™                | 0.247    | 1.3        | Mean Flow over Head Range | -        | 1.5        |

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) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 1.2        | 0.600     | 1.2        | 1.600     | 1.8        | 2.600     | 2.3        | 5.000     | 3.0        | 7.500     | 3.7        |
| 0.200     | 1.3        | 0.800     | 1.3        | 1.800     | 1.9        | 3.000     | 2.4        | 5.500     | 3.2        | 8.000     | 3.8        |
| 0.300     | 1.3        | 1.000     | 1.5        | 2.000     | 2.0        | 3.500     | 2.6        | 6.000     | 3.3        | 8.500     | 3.9        |
| 0.400     | 1.3        | 1.200     | 1.6        | 2.200     | 2.1        | 4.000     | 2.7        | 6.500     | 3.4        | 9.000     | 4.0        |
| 0.500     | 1.1        | 1.400     | 1.7        | 2.400     | 2.2        | 4.500     | 2.9        | 7.000     | 3.6        | 9.500     | 4.1        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                                                                     |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------|--------------------------------------|-------------------------|----------|------|-------------|------|------------------------------|------|------------------|--------|-------------------------|---|-----------------------|--------|-----------|------|----------------------|---|---------------|-----|------------|-------|---------------------|---|
| GTA Civils Ltd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | Page 3                                                                              |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| 66a Church Walk                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | COMFORT INN     |  |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| Burgess Hill                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | LYMINSTER ROAD  |                                                                                     |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| West Sussex RH15 9AS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | LITTLEHAMPTON   |                                                                                     |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| Date 06/07/2020                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Designed by DMS |                                                                                     |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| File 7321 NETWORK.MDX                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Checked by MR   |                                                                                     |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| Micro Drainage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Network 2018.1  |                                                                                     |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| <p><u>Storage Structures for Storm</u></p> <p><u>Porous Car Park Manhole: S1, DS/PN: S1.000</u></p> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Porosity</td><td>0.30</td><td>Slope (1:X)</td><td>40.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Invert Level (m)</td><td>14.180</td><td>Depression Storage (mm)</td><td>0</td></tr><tr><td>Max Percolation (l/s)</td><td>2514.7</td><td>Width (m)</td><td>18.4</td><td>Evaporation (mm/day)</td><td>0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Length (m)</td><td>492.0</td><td>Membrane Depth (mm)</td><td>0</td></tr></table> |                 |                                                                                     | Infiltration Coefficient Base (m/hr) | 0.00000                 | Porosity | 0.30 | Slope (1:X) | 40.0 | Membrane Percolation (mm/hr) | 1000 | Invert Level (m) | 14.180 | Depression Storage (mm) | 0 | Max Percolation (l/s) | 2514.7 | Width (m) | 18.4 | Evaporation (mm/day) | 0 | Safety Factor | 2.0 | Length (m) | 492.0 | Membrane Depth (mm) | 0 |
| Infiltration Coefficient Base (m/hr)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0.00000         | Porosity                                                                            | 0.30                                 | Slope (1:X)             | 40.0     |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| Membrane Percolation (mm/hr)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1000            | Invert Level (m)                                                                    | 14.180                               | Depression Storage (mm) | 0        |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| Max Percolation (l/s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2514.7          | Width (m)                                                                           | 18.4                                 | Evaporation (mm/day)    | 0        |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| Safety Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2.0             | Length (m)                                                                          | 492.0                                | Membrane Depth (mm)     | 0        |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |
| ©1982-2018 Innovyze                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                                                                     |                                      |                         |          |      |             |      |                              |      |                  |        |                         |   |                       |        |           |      |                      |   |               |     |            |       |                     |   |

|                       |                 |                                                                                     |
|-----------------------|-----------------|-------------------------------------------------------------------------------------|
| GTA Civils Ltd        |                 | Page 4                                                                              |
| 66a Church Walk       | COMFORT INN     |  |
| Burgess Hill          | LYMINSTER ROAD  |                                                                                     |
| West Sussex RH15 9AS  | LITTLEHAMPTON   |                                                                                     |
| Date 06/07/2020       | Designed by DMS |                                                                                     |
| File 7321 NETWORK.MDX | Checked by MR   |                                                                                     |
| Micro Drainage        | Network 2018.1  |                                                                                     |

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model    FSR M5-60 (mm) 19.500 Cv (Summer) 0.750  
Region England and Wales    Ratio R 0.350 Cv (Winter) 0.840

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

Profile(s)

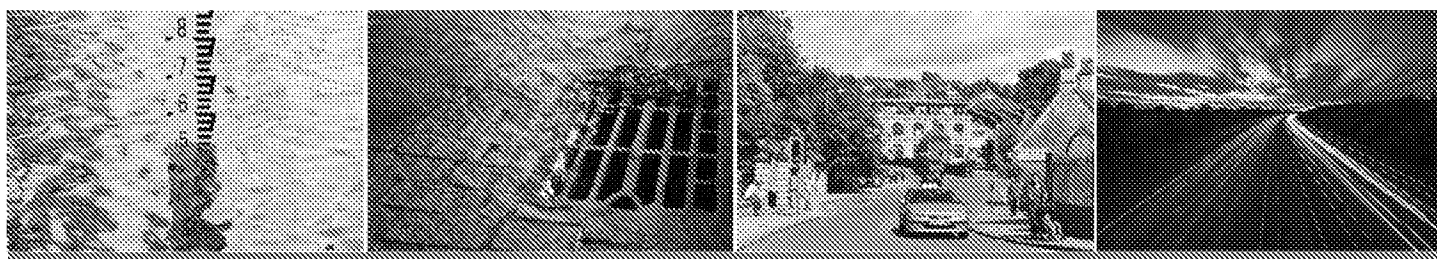
Summer and Winter

Duration(s) (mins)    15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880,  
4320, 5760, 7200, 8640, 10080

Return Period(s) (years)    1, 30, 100  
Climate Change (%)    0, 0, 40

|        |        |        |        |         |               |           |           |          | Water  | Surcharged | Flooded | Pipe   |          |       |            |
|--------|--------|--------|--------|---------|---------------|-----------|-----------|----------|--------|------------|---------|--------|----------|-------|------------|
| PN     | US/MH  |        | Return | Climate | First (X)     | First (Y) | First (Z) | Overflow | Level  | Depth      | Volume  | Flow / | Overflow | Flow  | Status     |
|        | Name   | Storm  | Period | Change  | Surcharge     | Flood     | Overflow  | Act.     | (m)    | (m)        | (m³)    | Cap.   | (l/s)    | (l/s) |            |
| S1.000 | S1 360 | Winter | 100    | +40%    | 1/15 Summer   |           |           |          | 14.838 | 0.578      | 0.000   | 1.24   |          | 8.1   | FLOOD RISK |
| S1.001 | S2 360 | Winter | 100    | +40%    | 30/120 Winter |           |           |          | 14.818 | 0.671      | 0.000   | 0.01   |          | 8.9   | SURCHARGED |
| S1.002 | S3 360 | Winter | 100    | +40%    | 1/15 Summer   |           |           |          | 14.818 | 1.848      | 0.000   | 0.31   |          | 2.0   | SURCHARGED |
| S1.003 | S4 180 | Winter | 100    | +40%    |               |           |           |          | 12.783 | -0.057     | 0.000   | 0.39   |          | 2.0   | OK         |

|        |      | US/MH    | Level |
|--------|------|----------|-------|
| PN     | Name | Exceeded |       |
| S1.000 | S1   |          |       |
| S1.001 | S2   |          |       |
| S1.002 | S3   |          |       |
| S1.003 | S4   |          |       |



## Civil Engineering - Transport Planning - Flood Risk

GTA Civils & Transport, Gloucester House, 66a Church Walk, Burgess Hill, West Sussex, RH15 9AS

