

**Drainage Design Report  
for the**

**Proposed**

**Redevelopment**

**off**

**19 Low Cross St,**

**Crowle**

**DN17 4NA**

**Prepared for**

**W Mason & Sons Properties**

**Issue 01**

**June 2021**

***George Shuttleworth Ltd***  
***Consulting Engineers***

1 Fulmar Court, Fulmar Rd,  
Lincoln LN6 3NE

Tel: 07940 927285

[geo.shuttleworth@btconnect.com](mailto:geo.shuttleworth@btconnect.com)

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Author : G Shuttleworth BSc C Eng. MICE.  
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## **1.0 INTRODUCTION**

- 1.1. Planning Approvals was obtained for the proposed development under the planning reference PA/2020/599
- 1.2. The Decision Notice contained the following conditions relating to surface water drainage.
  - 11. No development shall take place until a detailed Flood Risk Statement and Drainage Strategy is submitted to and approved in writing by the Local Planning Authority. This should outline all sources of flood risk (including surface water, ground water and ordinary watercourse) and proposals to mitigate this and include preliminary drainage layout plans. SuDS should be considered. Full ground investigations must be carried out along with a feasibility assessment for infiltration. Infiltration tests should comprise full scale tests to demonstrate long term effectiveness and suitability.*
  - 12. No development shall take place until details showing an effective method of preventing surface water run-off from hard paved areas within the site onto the highway have been approved in writing by the Local Planning Authority. These facilities shall be implemented prior to the access and parking facilities being brought into use and thereafter so retained.*
  - 13. No development shall take place until details showing an effective method of preventing surface water run-off from the highway onto the developed site is submitted to and approved in writing by the Local Planning Authority. These facilities shall be implemented prior to the access and parking facilities being brought into use and thereafter so retained.*
- 1.3. .It is understood that the Flood Risk information requested in Condition 11 has already been submitted is separate documents.
- 1.4. The Developer, W Mason & Sons Properties (WMSP) has appointed George Shuttleworth Ltd (GSL) to undertake the design of the surface water drainage system.
- 1.5. This report provides the information on the surface water design sufficient to enable North Lincolnshire Council to discharge the above planning conditions.

## **2.0 PROPOSED DEVELOPMENT**

- 2.1. The proposed development comprises a detached bungalow and two semi-detached houses and associated parking and hardstanding areas. The layout is shown on Drawing 736-002 contained in Appendix 1.
- 2.2. The existing dwelling at 19 Low Cross Street is to remain.
- 2.3. The development comprises of
  - a) 205m<sup>2</sup> of new roof areas
  - b) 147m<sup>2</sup> of new permeable parking areas
  - c) 262m<sup>2</sup> of new permeable access roads

### **3.0 PROPOSED SURFACE WATER DRAINAGE SYSTEM**

- 3.1. The hierarchy of drainage set out in Building Regulations Approved Document Part H and the Suds Manual the following disposal routes have been considered
  - a) Disposal via Infiltration
  - b) Disposal to a Watercourse
  - c) Disposal to Surface Water Sewer
- 3.2. In a consultation response, North Lincolnshire LLFA drainage Engineers had concerns over the effectiveness of soakaways in this area of Crowle.
- 3.3. The Developer was aware that the existing barn buildings on the site, which are to be demolished, discharge surface water via a piped connection to a 300mm surface water pipe on the south side of Low Cross Street.
- 3.4. This pipe is not an adopted public sewer but it is understood that NLC has adopted this pipe as a Highway Drain.
- 3.5. The Developer uncovered an inspection chamber within the site and a meeting was held with NLC Drainage Engineers on 08/06/21 to investigate the existing connection and establish that the site had a historic right to discharge to the 300mm pipe in Low Cross St.
- 3.6. Subsequent to the meeting NLC and the Developer used dye to confirm that the site connection does discharge to the 300mm pipe which in turn discharges to an open ditch some 200m west of the site.
- 3.7. At the same time a trial hole was excavated at the rear of the site which established that the standing groundwater level on 14/06/21 was 1.0m below ground level. Using LIDAR levels this was converted to a level of 3.977m AOD.
- 3.8. Details of the existing site, levels and key drainage features are shown on Drawing 736-001 contained in Appendix 1.
- 3.9. Given the relatively high groundwater level the use of pit soakaways was discounted but shallow SUDS features such as permeable access roads were considered practical
- 3.10. Therefore it is proposed to install a permeable access road and parking and discharge the roof drainage directly to the permeable sub-base.
- 3.11. The permeable access road and parking could be tanked or un-tanked. The decision will be based on the suitability of the strata at formation level to accept periodic wetting without degrading the stability of the road sub-grade.
- 3.12. The selection of the finished road surface could also influence the decision to tank the sub-base. A gravel surface would more readily accept localised deformation of the sub-grade.
- 3.13. The structural design of the road is beyond the scope of this report so both tanked and un-tanked options are considered in this report.
- 3.14. For the tanked solution the road sub-base would provide storage only and the discharge would be via the existing 100mm discharge pipe. Flow out would be self regulating, restricted by how quickly the water can enter the underdrain via the permeable sub-base.

- 3.15. The existing barns have a roof area of 155m<sup>2</sup> which at the Building Regulations run-off rate of 0.014l/s/m<sup>2</sup> would discharge 2.17l/s. Although difficult to quantify the discharge through the permeable sub-base is unlikely to be greater than the existing discharge.
- 3.16. Should it be assessed that periodic wetting of the sub-grade would not be detrimental to the performance of the access road then the permeable sub-base could be un-tanked.
- 3.17. As the hydraulic loading rate on the road is relatively low at 1.5 a low percolation rate of only 10mm/hr is needed so that adequate storage is provided in the permeable sub-base. A calculation sheet is presented in Appendix 1.
- 3.18. GSL are aware that percolation rates of around 35mm/hr have been achieved in the in close proximity to the site and as such there should be no issue in achieving 10mm/hr.
- 3.19. In addition, even with an un-tanked sub-base it is proposed that an underdrain is installed to provide an overflow/discharge via the existing surface water connection. In this way the maximum amount practical will be discharged via infiltration and any excess will be discharged via the surface water sewer.
- 3.20. NLC normally require a minimum of 1.0m between the base of any SUDS features the standing groundwater level, to cater for fluctuations in groundwater level. This is not achievable on this site.
- 3.21. A minimum of 450mm should be available at the lowest point of the road. Given the existing site connection and the presence of the 300mm surface water pipe in the south side of Low Cross Street it is considered unlikely that groundwater levels will rise significantly from the recorded level.
- 3.22. Often the issue with using permeable sub-base to attenuate roof water drainage is that long pipe runs at minimum gradients can mean the pipes are deeper than the sub-base. Checks have been undertaken to establish that it is practical to connect rainwater pipes from the rear of the properties to the permeable sub-base.
- 3.23. A calculation sheet is presented in Appendix 1.
- 3.24. It is proposed that direct discharges to the permeable sub-base are made with proprietary units such as the Permavoid Rainwater Disposal Unit by Polypipe or similar. For the connected areas at least three units will be required for each discharge to allow the water to discharge quickly enough to avoid surcharging of the pipework.
- 3.25. The permeable surface on the site access road will prevent any discharges from the site roads onto the public highway.
- 3.26. Grading the entrance to the site down to the existing level of the public highway will prevent any surface water from the public highway entering the site.
- 3.27. Details of the proposed surface water drainage system are shown Drawings 736-002 and 003 contained in Appendix 1.

#### **4.0 FOUL SEWERAGE**

- 4.1. The site has an existing connection to the public foul sewerage system.
- 4.2. Provided that the level of the rear properties are set high enough then it should be possible to connect to the existing connection by gravity.
- 4.3. The existing connection, from the site boundary, should have been transferred to Severn Trent Water in October 2011.
- 4.4. A section 106 application will need to be made to connect any new properties to the system. It is recommended that a new demarcation chamber is installed just inside the property boundary.
- 4.5. The existing manhole will need to be reconstructed in the access road and the connection from No 19 maintained.

#### **5.0 CONCLUSION**

- 5.1. This report demonstrates a practical way to deal with the surface water run-off from the development using the permeable sub-base of the access road for attenuation with discharge by infiltration or utilising the existing connection to the surface water sewer.
- 5.2. This report also demonstrates the proposed means of preventing run-off from the site entering the public highway and vice-versa
- 5.3. This report should contain sufficient information to allow Planning Conditions 11, 12 and 13 to be discharged.

## **6.0 APPENDIX 1 SUPPORTING INFORMATION**

- a) SW Calculations
- b) Drawing 736-001 - Existing Site Levels and Key Drainage Features
- c) Drawing 711-002 - Proposed Site Layout and SW Drainage
- d) Drawing 711-003 – Illustrative Cross Section

	Area(m2)
Semis	110
Bungalow	95
Total Roof Area	205
Parking	147
Access Road	262
Total Permeable Roads	409

**PERMEABLE ACCESS ROAD & PARKING**

Soil Infiltration Rate	10 mm/hr
	0.000003 m/s
Connected Impermeable Area	205
Area of Perm Sub-base	409
Catchment Area	614 m <sup>2</sup>
Hydr Loading Rate	1.50
Total rainfall ( 10 Year)	
M5-60	20
r	0.4
Min Sub-base Depth	0.25 m
Void Ratio	0.3
Storage Vol in Sub-base	30.675 m <sup>3</sup>
a50	419 m <sup>2</sup>
Percolation Outflow	0.00116 m <sup>3</sup> /s
	1.2 l/s
	4191 l/hr
Total Outflow	0.00116 m <sup>3</sup> /s

**1 in 10 year STORM EVENT**

D		15	30	60	120	240	360	720	1440
Z1		0.63	0.8	1	1.21	1.4	1.62	2	2.2
M5-D		12.6	16	20	24.2	28	32.4	40	44
Z2		1.23	1.24	1.24	1.23	1.23	1.21	1.2	1.18
M10-Dmin		15.498	19.84	24.8	29.766	34.44	39.204	48	51.92

D		15	30	60	120	240	360	720	1440
I	m <sup>3</sup>	10	12	15	18	21	24	29	32
Outflow	m <sup>3</sup>	1.0	2.1	4.2	8.4	16.8	25.1	50.3	100.6
S	m <sup>3</sup>	8.5	10.1	11.0	9.9	4.4	0.0	0.0	0.0
Time to Empty to 50%	hrs	1.0	1.2	1.3	1.2	0.5	0.0	0.0	0.0
Volume Check		OK	OK	OK	OK	OK	OK	OK	OK

**1 in 30 year STORM EVENT**

D		15	30	60	120	240	360	720	1440
Z1		0.63	0.8	1	1.21	1.4	1.62	2	2.2
M5-D		12.6	16	20	24.2	28	32.4	40	44
Z2		1.5	1.52	1.54	1.53	1.53	1.49	1.47	1.45
M30-Dmin		18.9	24.32	30.8	37.026	42.84	48.276	58.8	63.8

D		15	30	60	120	240	360	720	1440
I	m <sup>3</sup>	12	15	19	23	26	30	36	39
Outflow	m <sup>3</sup>	1.0	2.1	4.2	8.4	16.8	25.1	50.3	100.6
S	m <sup>3</sup>	10.6	12.8	14.7	14.4	9.5	4.5	0.0	0.0
Time to Empty to 50%	hrs	1.3	1.5	1.8	1.7	1.1	0.5	0.0	0.0
Volume Check		OK	OK	OK	OK	OK	OK	OK	OK

**1 in 100 year STORM EVENT**

Climate Change Volumetric Allowance

30.00%

D		15	30	60	120	240	360	720	1440
Z1		0.63	0.8	1	1.21	1.4	1.62	2	2.2
M5-D		12.6	16	20	24.2	28	32.4	40	44
Z2		1.94	1.99	2.03	2.02	2.01	1.95	1.92	1.86
M100-Dmin inc CC		31.78	41.39	52.78	63.55	73.16	82.13	99.84	106.39

D		15	30	60	120	240	360	720	1440
I	m <sup>3</sup>	19.5	25.4	32.4	39.0	44.9	50.4	61.3	65.3
Outflow	m <sup>3</sup>	1.0	2.1	4.2	8.4	16.8	25.1	50.3	100.6
S	m <sup>3</sup>	18.5	23.3	28.22	30.64	28.2	25.3	11.0	0.0
Time to Empty to 50%	hrs	2.2	2.8	3.4	3.7	3.4	3.0	1.3	0.0
Volume Check		OK	OK	OK	OK	OK	OK	OK	OK
Shortfall		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**SURFACE WATER LEVEL CHECK**

Existing SW	4.42
Block	0.08
Sand	0.05
HBCGA	0.125
CGA	0.15
Pavement Thickness	0.405
Min Road Level	4.84
IL Drain	4.420
Pipe	0.11
Cover to Underdrain	0.31

Rear Semis

FFL	5.35
Ground Level	5.2
Cover to Pipe	0.15
Pipe	0.11
Start IL	4.94
Gradient of Underdrain 1 in	100
Length to RDU	12
IL RDU	4.82
Road Level	4.84
Bottom of Sub-base	4.435
Spare	0.385

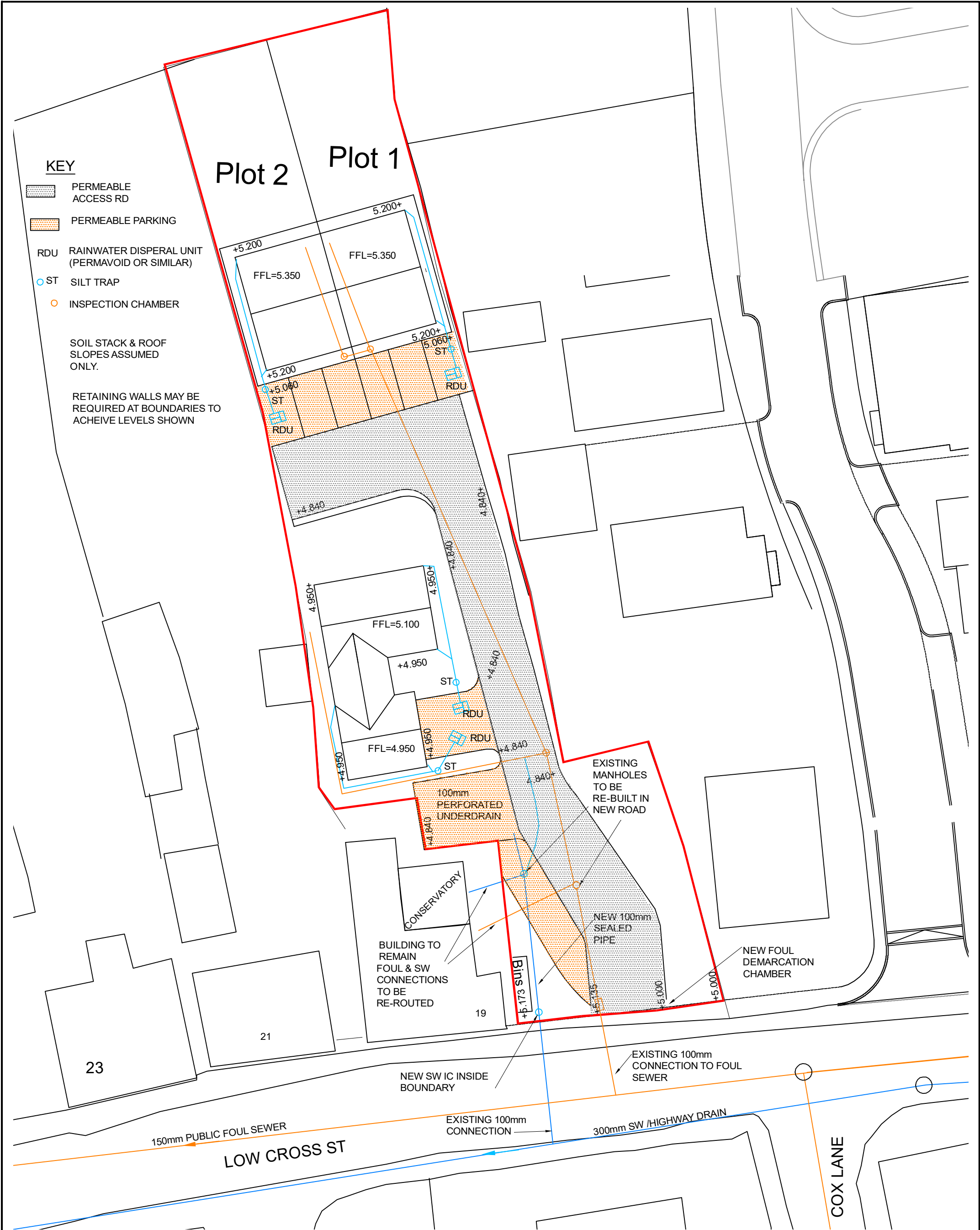
Side Semis

FFL	5.1
Ground Level	4.95
Cover to Pipe	0.15
Pipe	0.11
Start IL	4.69
Gradient of Underdrain 1 in	100
Length to RDU	16
IL RDU	4.53
Road Level	4.84
Bottom of Sub-base	4.435
Spare	0.095

**FOUL LEVEL CHECK**

Existing Foul	4.075
FFL Semi	5.35
Ground Level	5.2
Cover to FFL	0.25
Pipe Dia	0.1
IL Rest Bend	4.99
Fall under Slab 1 in	40
Distance to IC	10
IL IC	4.74
Cover to Pipe	0.35
Dist to Next IC	2
Gradient 1 in	80
IL Next IC	4.703
Distance to MH	32
Gradeint to MH	80
IL MH	4.291
Distance to MH	10
Gradeint to MH	80
IL MH	4.154 OK





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**NOTES**

- DO NOT SCALE FROM THIS DRAWING.
- SPOT LEVELS PLOTTED FROM A 2.0m GRID OF LIDAR LEVELS
- THIS DRAWING SHOWS AN OUTLINE DESIGN TO ILLUSTRATE THE PRINCIPLES OF DRAINAGE ONLY. THE DESIGN IS BASED ON THE OS PLAN & LIDAR LEVELS ONLY. IT IS RECOMMENDED THAT A FULL TOPOGRAPHICAL SURVEY IS UNDERTAKEN PRIOR TO COMMENCING THE DETAILED DESIGN

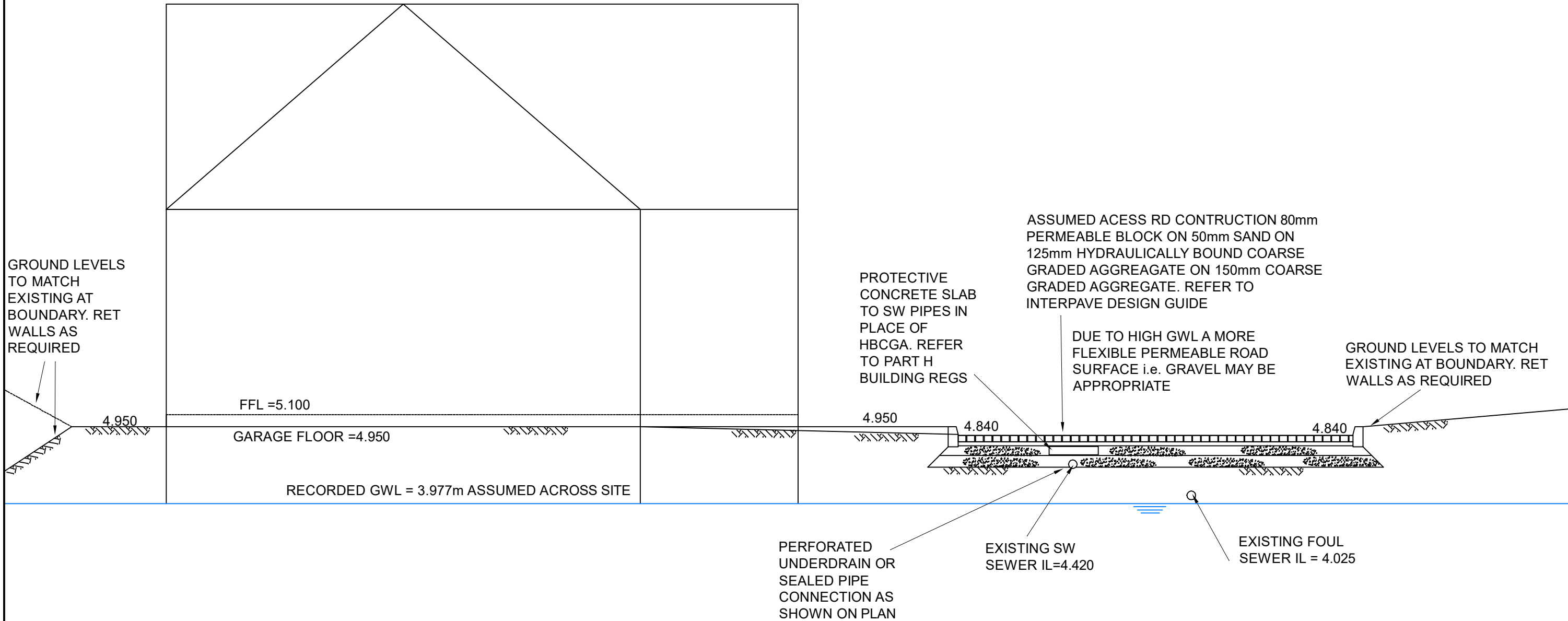
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CLIENT	W MASON & SONS PROPERTIES
PROJECT	REDEVELOPMENT OF LOW CROSS ST, CROWLE
DRAWING TITLE	OUTLINE DRAINAGE DESIGN
SCALE AT A3	1:250
DATE	JUN 21
APPROVED BY	GS

**George Shuttleworth Ltd**  
**Consulting Engineers**  
 www.georghuttleworthltd.co.uk  
 geo.shuttleworth@btconnect.com  
 1 Fulmar Court, Fulmar Rd, Lincoln, LN6 3NE  
 Tel 07940 927285

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DRG SIZE	DRAWING NO.	REV.
A3	736-002	-



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		PROJECT REDEVELOPMENT OF LOW CROSS ST, CROWLE							
		DRAWING TITLE ILLUSTRATIVE SECTION THROUGH ROAD							
REV	DESCRIPTION	AP	DATE	SCALE AT A3 1:50	DATE JUN 21	APPROVED BY GS	DRG SIZE A3	DRAWING NO. 736-003	REV. -

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