

**DEVELOPMENT OF
LAND AT MIDDLECLIFF**

**Rotherham Road
Little Houghton
BARNSLEY
S72 0HA**

**SuDS ASSESSMENT /
DRAINAGE STRATEGY / DESIGN REPORT**



1. INTRODUCTION

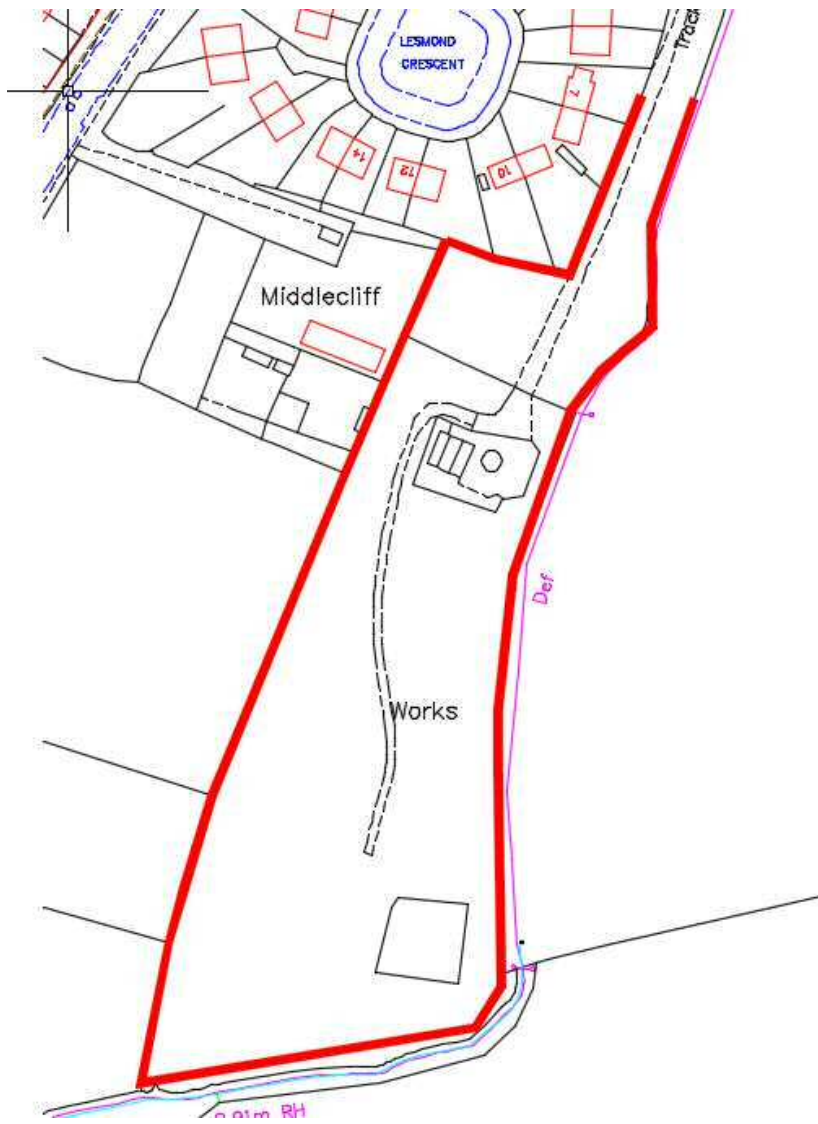
This SuDS assessment and drainage strategy report provides an overview of the flood risk at this site and proposes a post-development drainage strategy.

It proposes a strategy that will deal with foul and surface water flows from the site to ensure the development can be drained successfully with acceptable cost and minimal flood risk.

2. PRE-DEVELOPMENT SITE

The pre-development site is an existing area of grassland. It is brownfield as it was previously used as a sewage works. The sewage works have now been removed. The site extends to about 1 hectare.

A location plan and aerial view of the site are shown below.



LOCATION PLAN (ORDNANCE SURVEY PLAN)



LOCATION / AERIAL PLAN

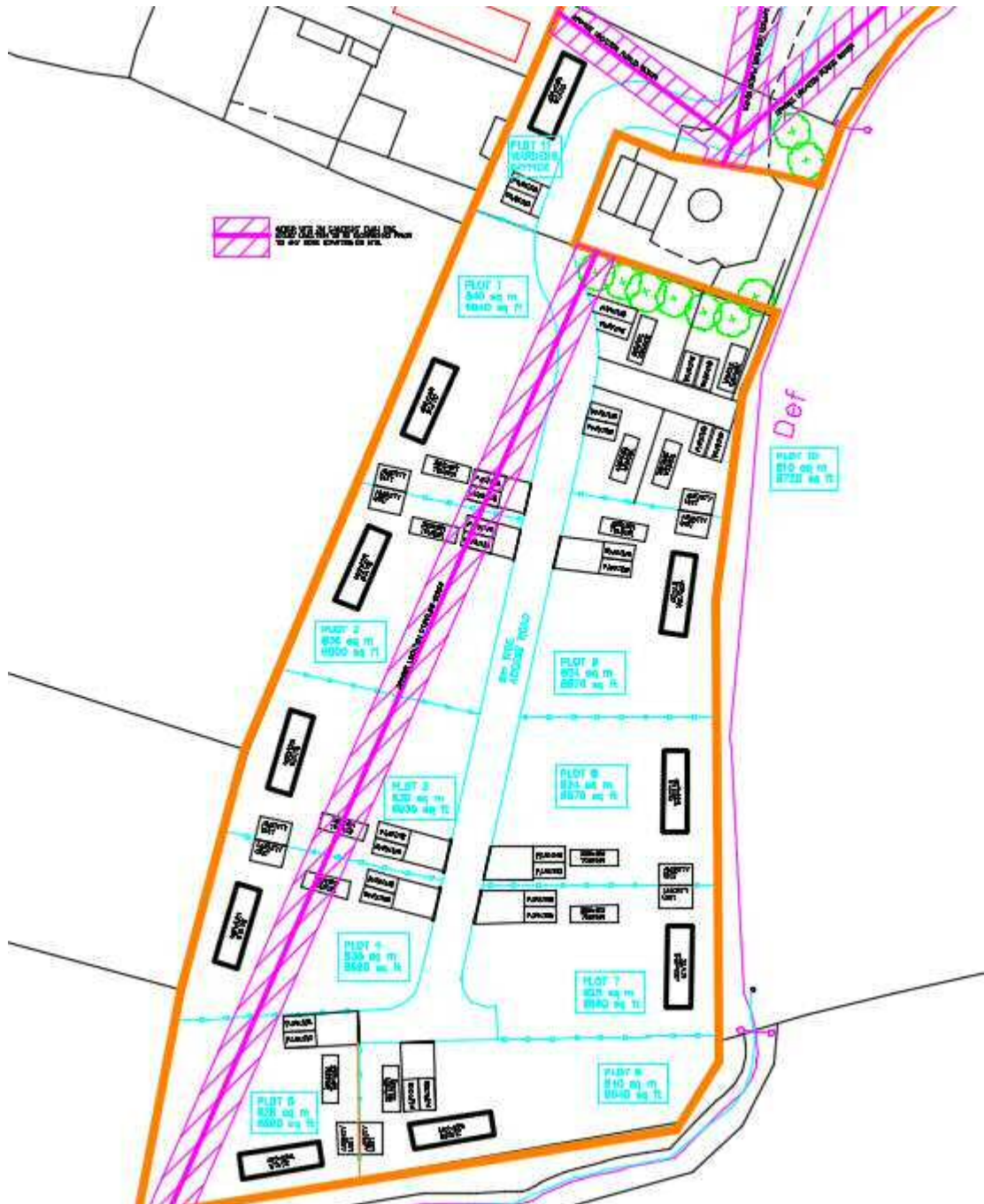
3. PROPOSALS

The development proposals for this site to be developed as a traveller site with 11 separate plots, including a wardens office plot.

Each plot would have space for a static caravan, a touring caravan, two parking spaces and a small amenity block.

The development would also have a 6m wide access road.

A plan of the proposed development is shown below.



DEVELOPMENT PROPOSALS

4. FLOOD RISK

The Environment Agency flood maps show that this site is within flood zone 1. And so is suitable for any type of development.

An ordinary watercourse is present to the south of the development site, but is not at risk of flooding on to the development site.

The extract for the Environment Agency flood map is shown below.



EA FLOOD RISK MAP

5. OTHER SOURCES OF FLOODING

Surface water flooding

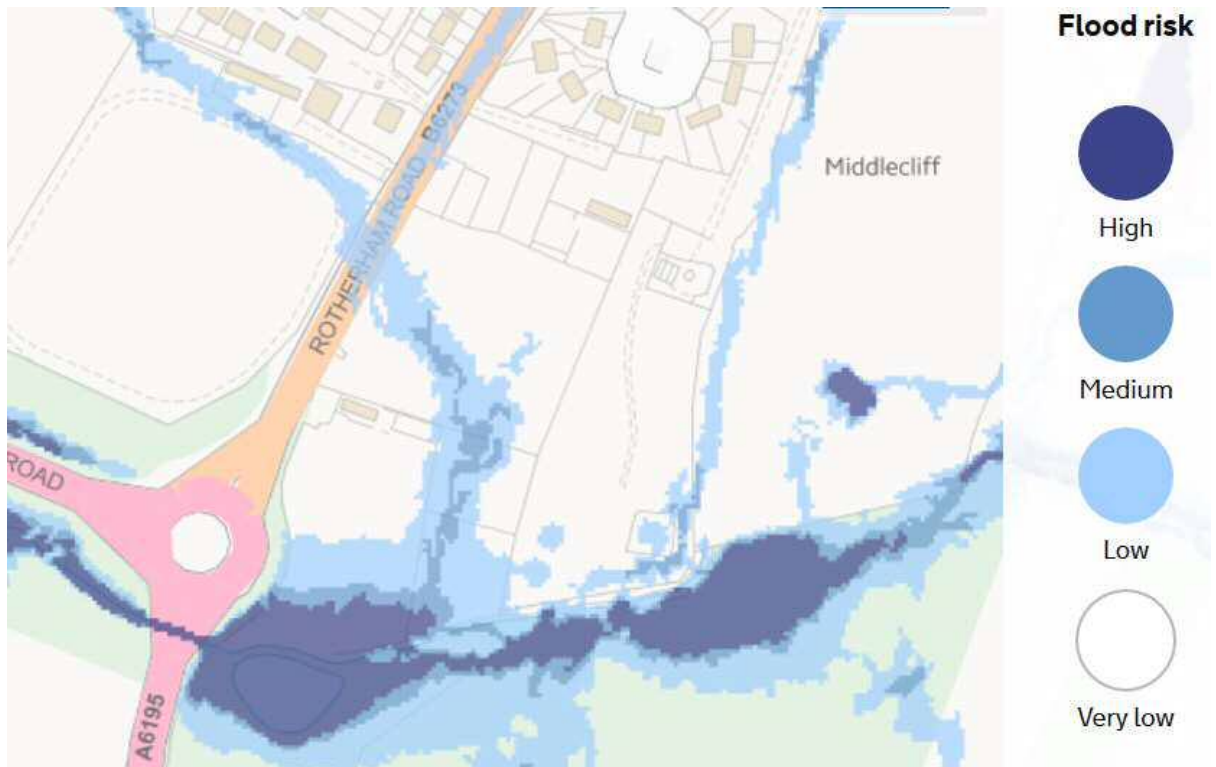
The Environment Agency also produce maps of areas for potential of surface water flooding.

The map for this development site area shows that the site has some low potential to flood from surface water near the southern boundary and some potential on the eastern boundary. The eastern boundary has an existing ditch which leads down to the watercourse which would be the route of the surface water flooding. The surface water flooding is shown as low risk and would be of minimal depth.

The development site falls to the south and any surface water would make its way to the watercourse on the southern boundary. Caravans and static caravans and their associated hard-standing would be elevated above ground level above the possible surface water flooding and ensure that a flood route is available southwards to the watercourse. This would ensure there is no possible surface water ingress in to any unit.

The flood risk from surface water flooding should be considered low.

Areas of potential of surface water flooding, from the Environment Agency website, is included below.



POTENTIAL FOR SURFACE WATER FLOODING MAP

Ground water

Ground water flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more prone to flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground.

The site is not low lying and any ground water would find its way to the watercourse and not remain on site. As such, this risk should be considered to be very low.

Reservoir Flooding

The flood risk from reservoirs is very small and unlikely to happen. The EA publish flood risk maps for areas that may be affected by a reservoir failure. The risk from reservoir flooding is very low and the map is shown here for completeness only, but does show the area is unaffected.



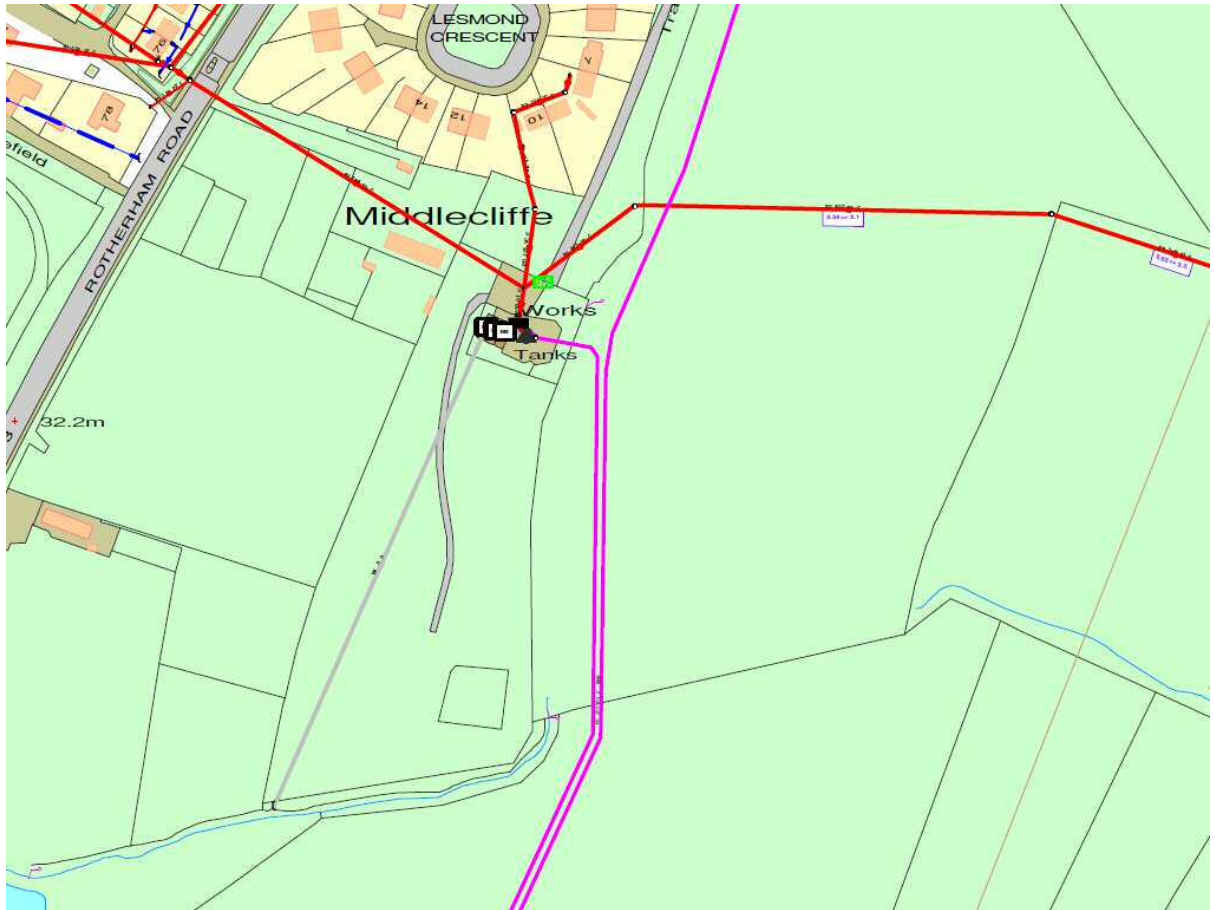
RESERVOIR FLOOD MAP

On-site sources

All paved areas on the development will be constructed using permeable paving and so all rainwater will infiltrate to ground mimicking the existing. Therefore, on-site sources of flooding should be considered low.

6. PUBLIC SEWER RECORDS

The public sewer records have been obtained for the site and are shown below.



PUBLIC SEWER RECORDS

7. EXISTING DRAINAGE - FOUL

The public sewer records show 3 combined sewers at the northern end of the site. They converge on a pumping station and the effluent is pumped off site.

There is also a disposal main running through the site. All these sewers should have a 3m easement provided both sides of the existing pipes.

The combined sewers to the northern side of the site are available to accept foul flows from the proposed site.

8. EXISTING DRAINAGE - SURFACE WATER

No existing surface water sewers are on site. Rainwater will infiltrate in to the ground on the pre-development site with run-off to the watercourse on the southern boundary.

9. POST-DEVELOPMENT FOUL DRAINAGE

The post-development foul drainage system serving the proposed amenity blocks will be connected to the public combined sewers on site.

No level information is available for the site, but the site does slope southwards towards the watercourse. Therefore, a small packaged pumping station may be required to pump effluent to the combined sewers.

10. POST-DEVELOPMENT SURFACE WATER DRAINAGE

A sustainable drainage system will be used on this development site, using source control techniques.

All new paved areas will be constructed using permeable paving. For the access road and the parking areas, an open textured course aggregate should be used for the sub-base and a layer of single size gravel used for the surface course.

The paved areas within the plots for the static caravans and the touring caravans should be constructed using permeable paving blocks for the surface course and again an open textured course aggregate sub-base.

The small amenity blocks should have down pipes from the roof areas, discharging to the adjacent permeable areas.

This method of surface water disposal will mimic the existing rainwater regime for the site and not increase any flows off site.

An outline of the proposed drainage is shown on HM Design drawing YH252/DD/1.

11. PERMEABLE PAVED AREAS - DESIGN

The permeable paving areas on site should be capable of structurally resisting the weight of vehicles and caravans and be able to provide sufficient hydraulic capacity to store rainfall in severe rainfall events and allow this to infiltrate to ground slowly.

The design guide ' Guide to the Design, Construction and Maintenance of Concrete Block Permeable pavements' published by Interpave has been used to assess the structural thickness required.

The total infiltration permeable paving will be used for this scheme, as per the detail below.

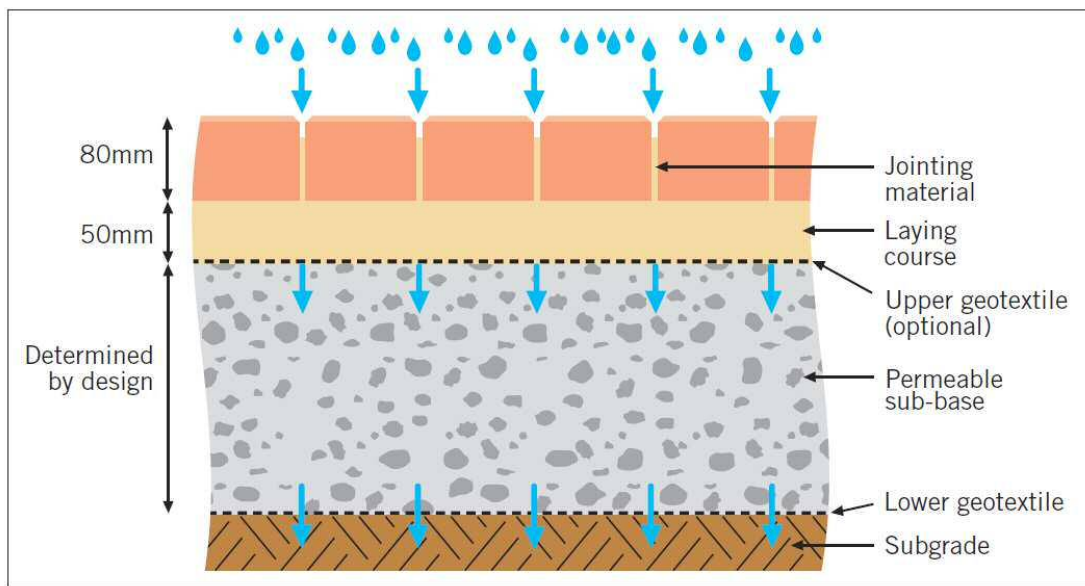
The loading category from the guide would suggest that the access road and drives should be parking areas (Cars and emergency large goods vehicles only). This pavement would be made up as follows:-

Geotextile on sub-grade
350mm course aggregate sub-base
50mm laying course
Permeable block paving.



For gravel surfacing, then laying course and permeable blocks should be replaced by a geotextile separation layer over the sub-base and then 35mm gravel surface course. So this pavement would be as follows:-

Geotextile on sub-grade
 350mm course aggregate sub-base
 Geotextile
 35mm deep gravel surfacing.



TYPICAL DETAIL OF PERMEABLE PAVEMENT

The course graded aggregate should be able to store rainwater from a severe event and this has been calculated on the following parameters:-

Design storm 1 in 100 year
 Climate change +30%
 M5-60 = 19mm
 $r = 0.363$

Infiltration coefficient used = 1×10^{-6} m/s (0.0036m/hr). (This coefficient value is the lowest recommended infiltration rate for infiltration drainage and so used here as a conservative figure).

Factor of safety used = 2

To determine if 350mm is an acceptable depth of course graded sub-base the microdrainage program has been used. A 10m x 10m representative area has been used. The microdrainage calculations are attached to the rear of this report



The microdrainage calculations have been run for all storm durations and this shows that the 350mm sub-base is sufficient to store rainwater prior to infiltration to ground.

12. POLLUTION CONTROL

The roof water from caravans will have very low pollution risk. The access road and driveways will have some minor pollution risk from oil / petrol/diesel droppings. The coarse aggregate sub-base within the permeable pavements will provide a level of treatment for any pollution on these surfaces.

13. SURFACE WATER EXCEEDENCE EVENTS

Long term provision should be made in case the surface water system is flooded. The overall site falls to the south towards the watercourse on the southern boundary. This will remain in the post-development site and any surface water on the surface of this site will drain away to the south.

14. CLIMATE CHANGE

The calculations of the permeable paving SuDS systems have been carried out to the 1 in 100 year storm condition and include an allowance for climate change of 30%.

15. MAINTENANCE

The installation of the permeable paving systems should be kept free from soil and other contaminants during construction to ensure they retain the voids ratio for storage of rainwater, allowing the systems to work satisfactorily.

Maintenance should be straight forward. The following is recommended.

BLOCK PAVED AREAS

- Regular maintenance. Keep surface clean by brushing.
- Annual. Inspect surface for loss of joint filling material and clogging by soil. Remove and /or re-fill as necessary.
- As required. Major deformations to be removed and replaced to same specification as original pavement.

GRAVEL SURFACED AREAS

- Regular maintenance. Keep the gravel surface clean and free from soil and mud and remove as necessary. Keep gravel surface topped up.



- Annual. Inspect surface for loss of gravel and clogging. Remove problem areas and re-gravel or top up gravel as necessary.
- As required. Major deformations in the pavement should be rectified by removal of gravel and replacement of course aggregate. Care taken to replace geotextiles. If the gravel is totally clogged with mud/soil then it may need to be removed down to the geotextile separation layer and replaced. Any damage to the geotextile layer will require it to be replaced.

16. CONCLUSIONS

- The development is in flood zone 1, at low risk of flooding and so is suitable for this development.
- Flooding risk will not be increased on or off site by this development.
- Foul water will drain to the public combined sewer on site.
- Foul water may require a small packaged pumping station, if levels dictate.
- Surface water will be controlled at source by SuDS source control.
- Agreement with the Local Planning Authority should be obtained.


Report by



Hugh Morris
BSc CEng MICE
2nd May 2017

APPENDIX - Microdrainage calculations.



HM Design		Page 1
10 The Green York YO26 SLR	MIDDLECLIFF	
Date 30/04/2017 20:11 File	Designed by HM Checked by	
Micro Drainage	Source Control 2017.1	

Summary of Results for 100 year Return Period (+30%)


Half Drain Time : 988 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	100.056	0.056	0.1	1.7	OK
30 min Summer	100.079	0.079	0.1	2.4	OK
60 min Summer	100.104	0.104	0.1	3.1	OK
120 min Summer	100.129	0.129	0.1	3.9	OK
180 min Summer	100.142	0.142	0.1	4.3	OK
240 min Summer	100.151	0.151	0.1	4.5	OK
360 min Summer	100.160	0.160	0.1	4.8	OK
480 min Summer	100.165	0.165	0.1	5.0	OK
600 min Summer	100.168	0.168	0.1	5.0	OK
720 min Summer	100.169	0.169	0.1	5.1	OK
960 min Summer	100.169	0.169	0.1	5.1	OK
1440 min Summer	100.166	0.166	0.1	5.0	OK
2160 min Summer	100.159	0.159	0.1	4.8	OK
2880 min Summer	100.149	0.149	0.1	4.3	OK
4320 min Summer	100.129	0.129	0.1	3.9	OK
5760 min Summer	100.111	0.111	0.1	3.3	OK
7200 min Summer	100.094	0.094	0.1	2.8	OK
8640 min Summer	100.080	0.080	0.1	2.4	OK
10080 min Summer	100.068	0.068	0.1	2.0	OK
15 min Winter	100.064	0.064	0.1	1.9	OK


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	117.218	0.0	19
30 min Summer	78.817	0.0	34
60 min Summer	49.937	0.0	64
120 min Summer	30.767	0.0	124
180 min Summer	22.850	0.0	182
240 min Summer	18.379	0.0	242
360 min Summer	13.462	0.0	362
480 min Summer	10.795	0.0	482
600 min Summer	9.088	0.0	600
720 min Summer	7.892	0.0	714
960 min Summer	6.311	0.0	818
1440 min Summer	4.597	0.0	1066
2160 min Summer	3.342	0.0	1468
2880 min Summer	2.662	0.0	1872
4320 min Summer	1.929	0.0	2680
5760 min Summer	1.533	0.0	3456
7200 min Summer	1.281	0.0	4176
8640 min Summer	1.107	0.0	4848
10080 min Summer	0.978	0.0	5544
15 min Winter	117.218	0.0	19

©1982-2017 XP Solutions



HM Design		Page 2			
10 The Green York YO26 5LR		MIDDLECLIFF			
Date 30/04/2017 20:11					
File					
Micro Drainage		Source Control 2017.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	100.091	0.091	0.1	2.7	O K
60 min Winter	100.119	0.119	0.1	3.6	O K
120 min Winter	100.147	0.147	0.1	4.4	O K
180 min Winter	100.163	0.163	0.1	4.9	O K
240 min Winter	100.172	0.172	0.1	5.2	O K
360 min Winter	100.183	0.183	0.1	5.5	O K
480 min Winter	100.190	0.190	0.1	5.7	O K
600 min Winter	100.194	0.194	0.1	5.8	O K
720 min Winter	100.196	0.196	0.1	5.9	O K
960 min Winter	100.196	0.196	0.1	5.9	O K
1440 min Winter	100.190	0.190	0.1	5.7	O K
2160 min Winter	100.179	0.179	0.1	5.4	O K
2880 min Winter	100.165	0.165	0.1	4.9	O K
4320 min Winter	100.134	0.134	0.1	4.0	O K
5760 min Winter	100.105	0.105	0.1	3.2	O K
7200 min Winter	100.081	0.081	0.1	2.4	O K
8640 min Winter	100.062	0.062	0.1	1.9	O K
10080 min Winter	100.050	0.050	0.1	1.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)		
30 min Winter	78.317	0.0	33		
60 min Winter	49.937	0.0	62		
120 min Winter	30.767	0.0	122		
180 min Winter	22.850	0.0	180		
240 min Winter	18.379	0.0	238		
360 min Winter	13.462	0.0	354		
480 min Winter	10.795	0.0	470		
600 min Winter	9.088	0.0	584		
720 min Winter	7.392	0.0	694		
960 min Winter	6.311	0.0	908		
1440 min Winter	4.597	0.0	1140		
2160 min Winter	3.342	0.0	1600		
2880 min Winter	2.662	0.0	2044		
4320 min Winter	1.929	0.0	2692		
5760 min Winter	1.533	0.0	3640		
7200 min Winter	1.281	0.0	4328		
8640 min Winter	1.107	0.0	4936		
10080 min Winter	0.978	0.0	5448		
©1982-2017 XP Solutions					



HM Design		Page 3
10 The Green York YO26 5LR	MIDDLECLIFF	
Date 30/04/2017 20:11 File	Designed by HM Checked by	
Micro Drainage	Source Control 2017.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.363	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30


Time Area Diagram

Total Area (ha) 0.010

Time (mins)	Area
From:	To: (ha)
0	4 0.010

©1982-2017 KP Solutions



HM Design		Page 4
10 The Green York YO26 5LR	MIDDLECLIFF	
Date 30/04/2017 20:11	Designed by HM	
File	Checked by	
Micro Drainage	Source Control 2017.1	

Model Details

Storage is Online Cover Level (m) 100.350

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00360	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	27.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	100.000	Membrane Depth (m)	0

©1982-2017 XP Solutions

