LANMOR Consulting

Civil Engineers & Transport Planners

Bicester Golf and Country Club

Drainage Strategy

January 2017

160842/DS/MK/KTP/01

LANMOR Consulting

Civil Engineers & Transport Planners

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● LONDON ● BIRMINGHAM

DOCUMENT STATUS

Project:	Bicester Golf and Country Club
Title:	Drainage Strategy
Client:	Bicester Hotel
Reference:	160842/DS/MK/KTP/01

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Issue/revision	Date	Status	Issued by
First	20/01/2016	For Approval	KP

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FIGURES

APPENDICES

1 INTRODUCTION

1.1 Scope

1.1.1 Lanmor Consulting has been appointed by Bicester Hotel to prepare a Drainage Strategy for the proposed development for a 62-bed extension to the current Bicester Hotel, Golf and Spa complex, Akeman Street, Chesterton, Bicester, Oxfordshire, OX26 1TE. This report has been prepared in support of the release of condition 12 of the planning permission reference (15/01068/F). This report has been commissioned to advise on the feasibility of providing a detailed scheme for the surface water and foul sewage drainage for the proposed development. Figure 1.1 below shows the location of the site.

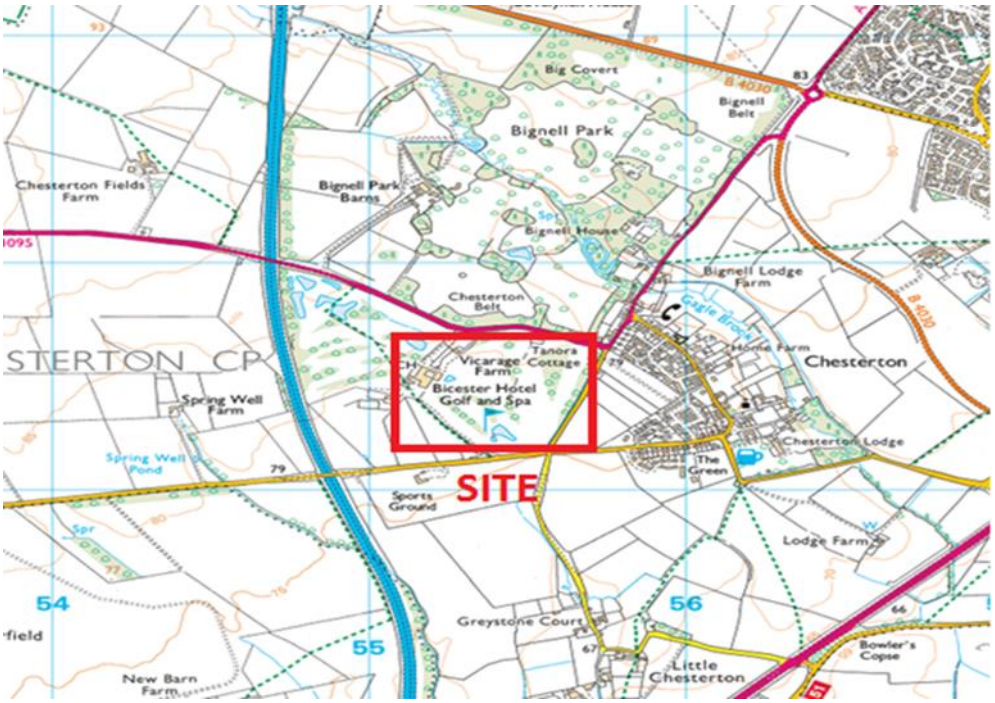


Figure 1.1 – Location Plan

1.1.2 This report will consider the proposed drainage regime for the site and set the drainage strategy for the development including discharge rates and any requirements for attention.

1.1.3 The information and detail within this report will be refined, modified, and updated as the detailed design is progressed. The scope of the works for this drainage strategy report is outlined below:

- Review available data relation to on-site drainage and other drainage networks near the site
- Review of the site's conditions for the suitability of Sustainable Urban Drainage Systems (SUDS)
- Consider the use of SUDS as an option for disposal of surface water runoff from the proposed development
- Undertake drainage assessments to establish attenuation requirements to deal with the increased surface water runoff from the development.

2 SITE LOCATION AND DESCRIPTION

2.1 Location

2.1.1 The hotel is located adjacent to Green Lane and approximately 4km to the west of Bicester North Station. The nearest watercourse, Gagle Brook is 2km east of the site. The existing site is a hotel and golf club providing a range of facilities such as health and fitness, spa, club house, driving range, tennis court, and various others. The total area of the existing site is approximately 54 hectares and the topographical survey is provided in Appendix A as drawing number HMX 803-FP-100-C2

2.2 Proposed Development

2.2.1 The application seeks approval for the erection of a two storey extension to existing hotel to form 62 new bedrooms (60 net increase). The site plan of the proposed development is included in Appendix A as drawing SK. 15-543-53A.

2.2.2 The overall area of the proposed development is approximately 2030m^2, Table 2.1 below shows the further areas in regards to hardstanding.

Proposed Hardstanding	Area
Roof	1366m^2
Hardstanding (Courtyard and Path)	334m^2
Total Area	1700m^2

Table 2.1 – Proposed Hard Areas

2.3 Regional Geology

2.3.1 The British Geological Survey (BGS) indicates that bedrock underlying the site consist of Cornbrash Formation, containing limestone and clay. This sedimentary bedrock was formed approximately 161 to 168 million years ago, in the Jurassic Period. These rocks were formed in warm shallow seas with carbonate deposited on platform, shelf, and slope areas; often rich in corals and shelly faunas. There is no indication that there are any superficial deposits overlaying the bedrock. Furthermore, the hotel has confirmed from experience that the ground has an extremely low permeability, therefore using infiltration techniques such as soakaways will not be suitable for the discharge of surface water runoff.

3 EXISTING DRAINAGE REGIME

3.1 Existing Foul Water Drainage

3.1.1 The current foul water drainage for the existing hotel comprises of two pumps, the first one is located adjacent to the health and fitness building and the other is positioned north east of the hotel near to the existing hotel. The foul network is then pumped 544m towards the north east of the site to an existing sewer network at the Little Chesterton single track road. Each pump chamber is operated on a float switch and contain a dual pump system.

3.1.2 These pumps are currently experiencing severe maintenance issues and are advised to be upgraded – in addition to this, the proposed erection of the extension to the hotel means the pumps and drainage network will need to be repositioned out of the footprint of the building. The redesign of the existing drainage network to accommodate the extension is beyond the scope of this report.

3.2 Existing Surface Water Drainage

3.2.1 Surface water is currently being drained through gutters and rain water pipes which discharge to the pond directly opposite the east side of the hotel. Several manholes have been identified around the hotel which are being utilized for the purpose of draining surface water runoff from the building/hard standing into the pond. The pond appears to provide some attenuation of runoff, discharge from the pond is through an overflow pipe culvert to a ditch located adjacent to the car park to the south west.

4 PROPOSED DRAINAGE REGIME

4.1 Proposed Foul Water Drainage

4.1.1 The proposed erection of a new section to the hotel to provide 62 extra bedrooms will have a separate foul drainage network which will discharge under gravity to a new sewage treatment plant positioned to the north of the plant area. The treated discharge from the sewage treatment plant will be pumped to a nearby manhole which will then drain under gravity to the existing outfall connection from the pond.

4.1.2 The sewage treatment plant should be situated at a minimum distance of 10m from any building or structure and should be within 30m of a hardstanding area for access for a desludging wagon maintenance work. It is not possible to provide a gravity connection from the package treatment plant to the ditch in the south. It will therefore be necessary to provide a pumping station downstream of the treatment unit.

4.1.3 Appendix B shows a detailed foul drainage network with, connections, gradients, pipe size, manholes, cover levels and invert levels.

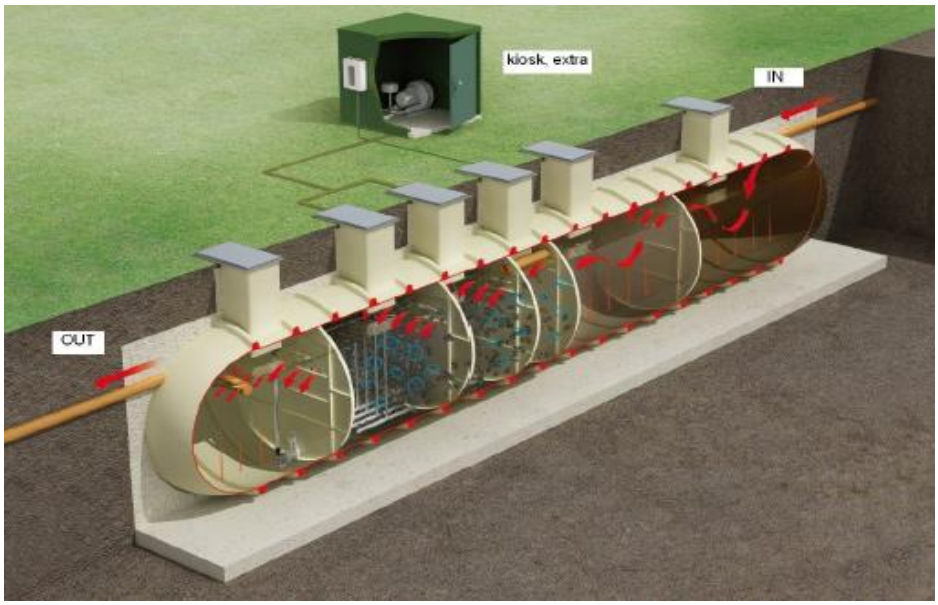


Figure 4.1 – Klargester Process Flow

4.1.4 An environmental permit will need to be obtained from the Environment Agency in order to discharge treated sewage to the ditch. The volumes generated from the hotel will exceed $5m^3$ and therefore a permit to discharge will be required Further details can be seen on:

https://www.gov.uk/government/collections/environmental-permit-application-forms-standard-permit-water-discharge.

4.2 Proposed Surface Water Drainage

4.2.1 Sustainable Urban Drainage systems (SUDs) were considered as part of this assessment for the disposal of surface water runoff from the proposed development. The proposed extension of the hotel will have pitched roofs so green roofs are not practical and were therefore discounted as a SUDs method for treating runoff from roof areas.

4.2.2 Rainwater harvesting was also considered for re-use of surface water runoff within the hotel however these systems require a separate network of pipework, tanks, and pumps in the property to store the rainwater and distribute it through the building.

4.2.3 Furthermore, should rainwater harvesting tanks be full at the start of the storm, they will not be able to receive any more runoff, therefore additional storage would be required to cater for all storms and the rainwater harvesting tank will provide no benefit in terms of attenuation. For those reasons, and the excessive cost of providing the system, this method has been discounted.

4.2.4 Next on the Sustainable Drainage Hierarchy is the use of ground infiltration techniques such as soakaways and infiltration basins. The British Geological Survey as well as bore hole records indicated the ground conditions to consist of Cornbrash Formation, comprising of limestone and clay. Therefore, infiltration of the surface water runoff is not a viable option. The exploratory records in Appendix B outlines the strata descriptions from the borehole tests, consisting of mainly clay.

4.2.5 Discharge to watercourses is the next option on the Sustainable Drainage Hierarchy. There is an adjacent pond with overflow to the ditch and is to be adopted for the drainage design for the proposed development. The surface water runoff will drain to the existing pond located next to the site and the ditch south west of the pond.

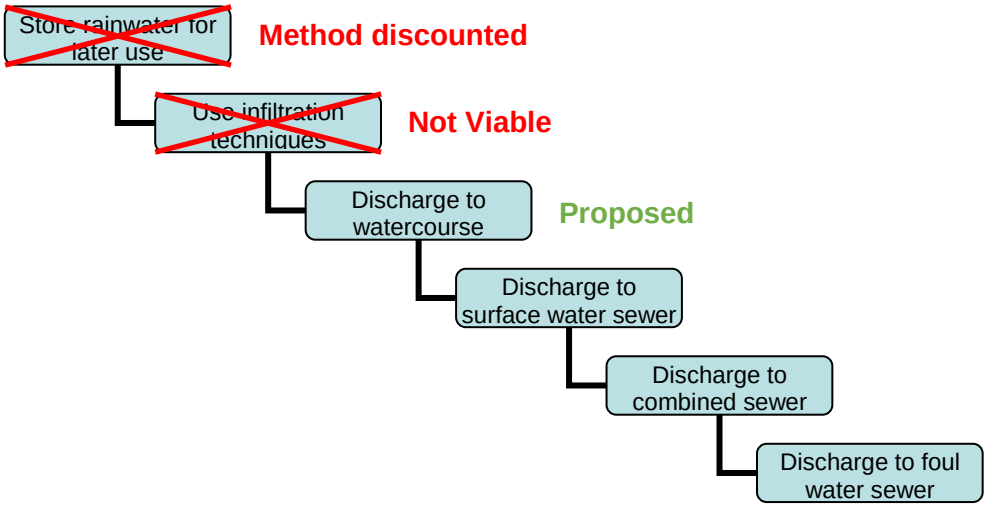


Figure 4.2 – Sustainable Drainage Hierarchy

4.2.6 A proposed drainage layout for the proposed development has been prepared and is included in Appendix B as drawing 160842/500/01-03, 160842/510/01-02 & 160842/520/01. This shows the surface water runoff from the proposed hotel and courtyard area will drain via a pipe network and outfall to the separated embanked area within the pond area and will have a restricted discharge rate of 4l/s controlled through a 50mm orifice plate.

4.2.7 Calculations have been undertaken to determine the greenfield runoff rates for the existing site, listed in Table 4.1 below. The full calculations are included in Appendix B.

Return Period	Rate
1 in 1	0.1 l/s
1 in 30	0.2 l/s
1 in 100	0.2 l/s

Table 4.1 – Greenfield Runoff Rates

4.2.8 Based on these greenfield runoff rates of 0.1l/s and 0.2l/s, it will not be practical to restrict the discharge from the site to this level, as using such low rates can lead to long term maintenance problems of blocking and flooding. To prevent this, the restricted discharge rate of 4l/s has been adopted.

4.2.9 It was considered inadequate to allow all surface water to be discharged into the existing pond as there is currently no restrictions on the outfall from it to the ditch. Drainage calculations have been undertaken to determine the size of a necessary attenuation facility required to accommodate the development.

4.2.10 The drainage design for the development and storage requirement for the attenuating surface water have been based on a 1in100 event plus 40% allowance for climate change. This means that 83m^3 of storage will need to be provided on site to accommodate the proposed development. The separated pond will cater for the 83m^3 volume of surface water runoff – this will be discharged into the other section of the pond at a restricted rate of 4l/s controlled by an orifice plate. This method of controlling surface water runoff within the pond will involve constructing a bund or dwarf wall to separate the runoff which will be generated from the proposed hotel. Full MicroDrainage calculations for the pond have been provided in Appendix B.

4.2.11 Appendix B shows a detailed surface drainage network with, connections, gradients, pipe size, manholes, cover levels and invert levels.

5 SUMMARY AND CONCLUSION

5.1.1 The development proposal will involve the construction of a new 62 bed extension to the existing Bicester Hotel.

5.1.2 The BGS record indicates that the site is located over the Cornbrash Formation which is not suitable for soakaways or infiltration techniques. The proposed drainage for this development will consist of a new separate foul and surface water networks. The foul water will be taken to a sewage treatment plant under gravity which will then be pumped upstream within the treatment system to fall under gravity to the existing culvert in the south before discharging to the ditch. Surface water runoff generated from the proposed development will have a different network which will also include 83m^3 of storage in a separate section of the existing pond. This will discharge into the main pond at a restricted rate of 4l/s.

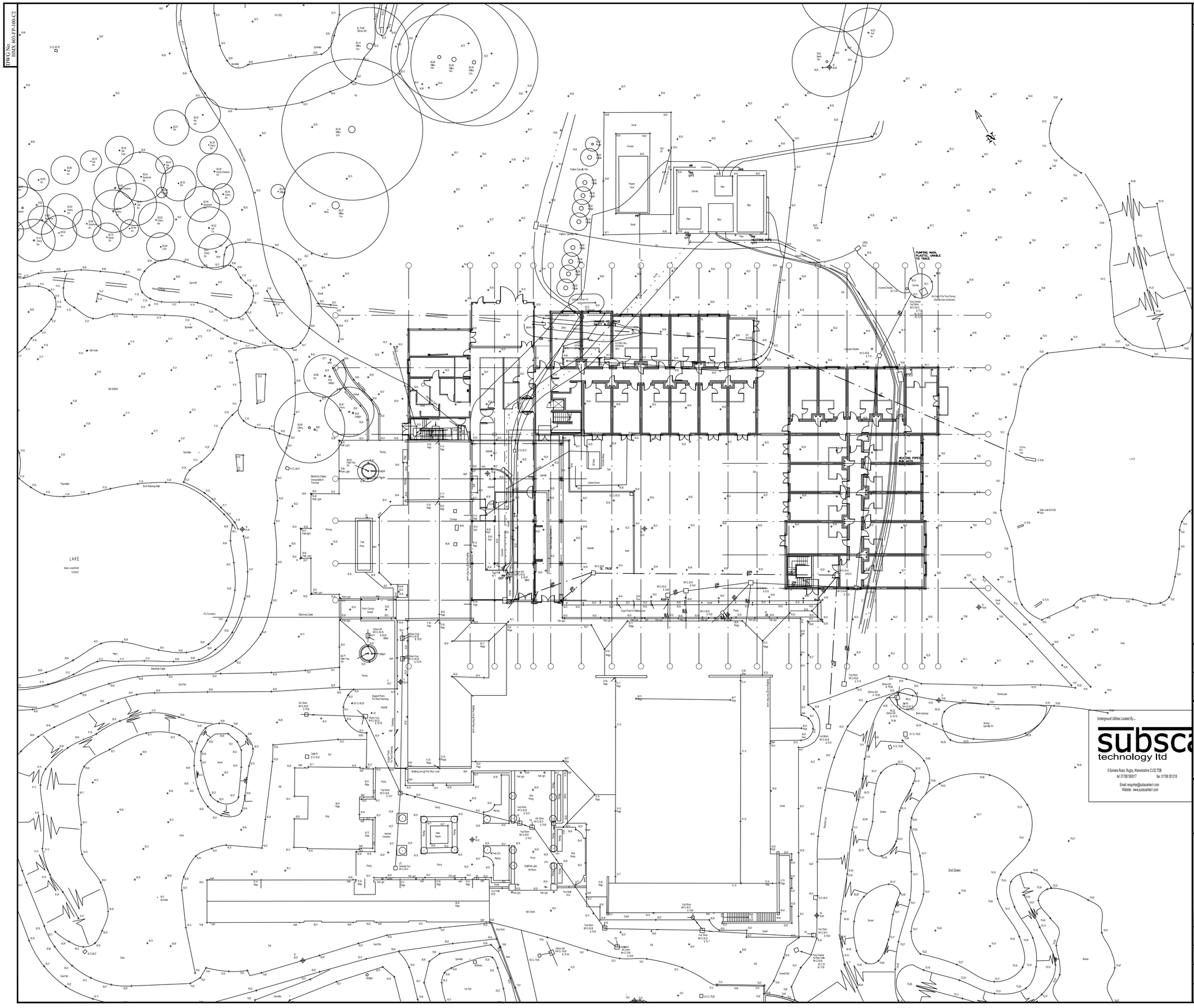
5.1.3 MicroDrainage calculations for the proposed development have been prepared to estimate storage requirements and show that no flooding will occur for a return period of 1 in 100 years plus 40% climate change. It is concluded the surface and foul water drainage for the extension to Bicester Hotel will not present any issues in regards to flooding and that adequate provision can be made to cater for the proposed development.

5.1.4 This report has found that an adequate drainage strategy can be provided from the proposed development at Bicester Hotel in accordance with the sustainable hierarchy and therefore condition 12 of the planning application should be released.

APPENDIX A

Topographical Survey – HMX 803-FP-100-C2

DWG No. HMX 803-FP-100-C2



NOTES

Rev	Amendment	Drawn	Checked	Approved	Date

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Bicester Hotel

Bicester Golf and Country Club

Topographical Survey

DRAWN MK	CHECKED KTP	APPROVED KBL	
DATE Jan 2017	DATE Jan 2017	DATE Jan 2017	
SCALE NTS	PRJ No. 160842	SIZE A1	REV
DWG No. HMX 803-FP-100-C2			

Drawing SK. 15-543-53A - Site Plan

Note: All dimensions must be checked on site and not scaled from this drawing.

Pond
Pond
Pond
Pond
G1
G2
G7
G7
G8
G9
S1
T1
dwelling
Vicarage Farm
Vicarage Farm
Tanks
HOTEL
CLUB HOUSE
HEALTH & FITNESS
proposed extension
New Lake
NORTH
NORTH
parking
overflow culvert
open ditch
Access Driveway
Golf Course

SITE PLAN scale 1:1250

Rev.	Date	Revisions

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steve.karpa@hotmail.com

Client: Bicester Hotel, Golf & Spa

Job Title: PROPOSED EXTENSION AT: BICESTER HOTEL, GOLF & SPA, CHESTERTON, OXON.

Drawing Title: SITE PLAN

Scale:	Date:	Drawn:
1:1250	May 2015	SJK

Drawing Number: SK.15-543-53A

APPENDIX B

Exploratory Records (Borehole Tests)

SP 52 SE

2

(For Survey use only)

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA If measurements start below ground surface, state how far ...	THICKNESS Feet ...	THICKNESS Inches ...	DEPTH Feet ...	DEPTH Inches ...	
Drift & Soil	Soil		3		3	
? Cornbrash	Limestone	12	9	13	0	3.96
	Blue clay	2	0	15	0	4.57
	Blue stone	3	0	18	0	5.49
? Forest Marble	Blue clay	2	0	20	0	6.10
	Hard blue stone	3	0	23	0	7.01
? Wht. Blandford Mbr.	Dark blue clay	5	0	28	0	8.53
Wht. Andle Member	Blue stone — water	33	0	61	0	18.58
	Blue clay	1	6	62	6	19.05
? White limestone	Blue stone	4	0	66	6	20.27
	Blue clay		6	67	0	20.42
	Blue stone	1	0	68	0	20.73
	Blue clay	2	0	70	0	21.36
Shipton Member	Blue stone	5	0	75	0	22.86
	Blue clay	5	0	80	0	24.38
? Hampton	Blue stone	4	0	84	0	25.60
~~Marly Beds~~	Blue clay	4	0	88	0	26.82
14' 6"	Grey stone	2	0	90	0	27.43
Rutland Fm	Soft blue clay	1	6	91	6	27.89
	Grey stone	3	0	94	6	28.8
? Tayuton Stone 14' 6"	Soft clay	3	6	98	0	29.87
	Grey stone — water	2	0	100	0	30.46
	Soft clay	1	0	101	0	30.78
Torrington Fm	Hard grey stone — water	5	0	106	0	32.31
	Soft stone	2	0	108	0	32.92 perfo
? Hook Norton & Sutcliffe Beds 24'	Hard stone — water	10	0	118	0	35.97
	Soft black sandstone — water	10	0	128	0	39.01
? Wind Sands	Hard sandstone	2	0	130	0	39.62

Suggested classif. 26-8-63 cf 219/97

Drawing 160842/500/01-03 – Proposed Drainage Layout

DWG No. 160684- 00-01

NOTES

- Proposed Foul Network
- Proposed Surface Network
- Existing Foul Network
- Existing Surface Network

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12. All precast concrete manhole units are to conform to B.S. 5911.
13. For details of size, invert level, number of branches and cover and frame spec, see the drainage schedules.
14. Downstream exit pipes of 600mm dia. and over should be fitted with heavy duty safety chains across their mouths.
15. Precast concrete cover slabs are to be heavy duty.
16. Where large differential settlement is probable, several short lengths of pipe with flexible joints should be laid on either side of the chamber.
17. Where drains pass through foundations, a flexible joint should be provided within 150mm of the face of the structure.
18. Fast setting resin mortars may be used in lieu of cement mortar for bedding manhole frames where agreed with the Engineer to enable early cover loading.
19. The concrete base slab shall be 225mm minimum thickness for chambers upto 4500mm deep. Manholes over 4500mm deep require a slab 450mm thick.
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23. Location of rain water pipes, stub-stacks and soil vent pipes to be determined by architect and inform engineer if changed. Provisional location has been made.

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BICESTER HOTEL golf and spa

Bicester Golf And Spa

Drainage Layout Site Plan

Sheet 1 of 6

DRAWN MK	CHECKED KTP	APPROVED KBL
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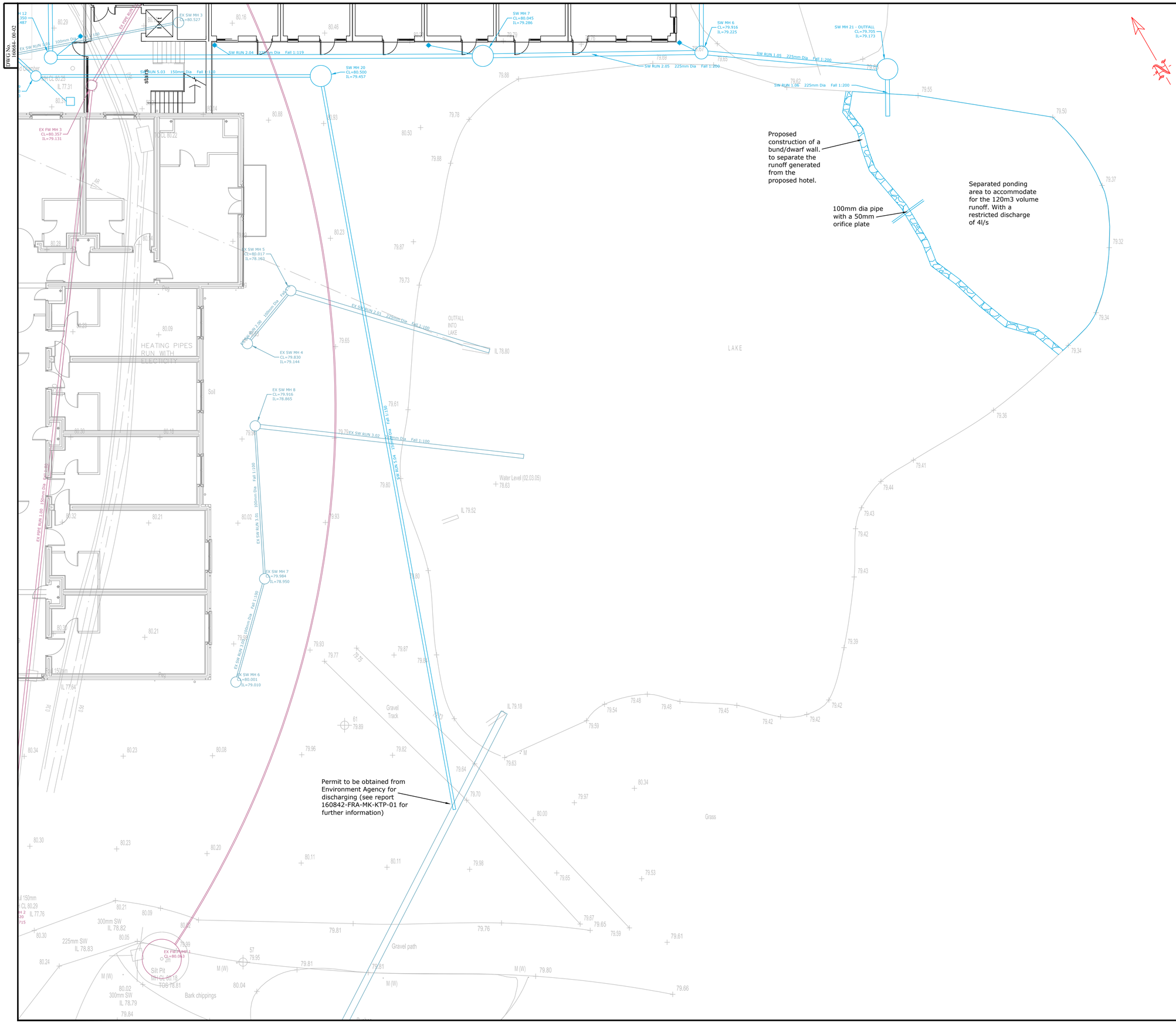
SCALE 1:100	JOB No. 160684	SIZE A1 / REV
DWG No. 160684-00-01		

DWG No. 160684 - 00-02



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BICESTER HOTEL golf and spa

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Sheet 2 of 6

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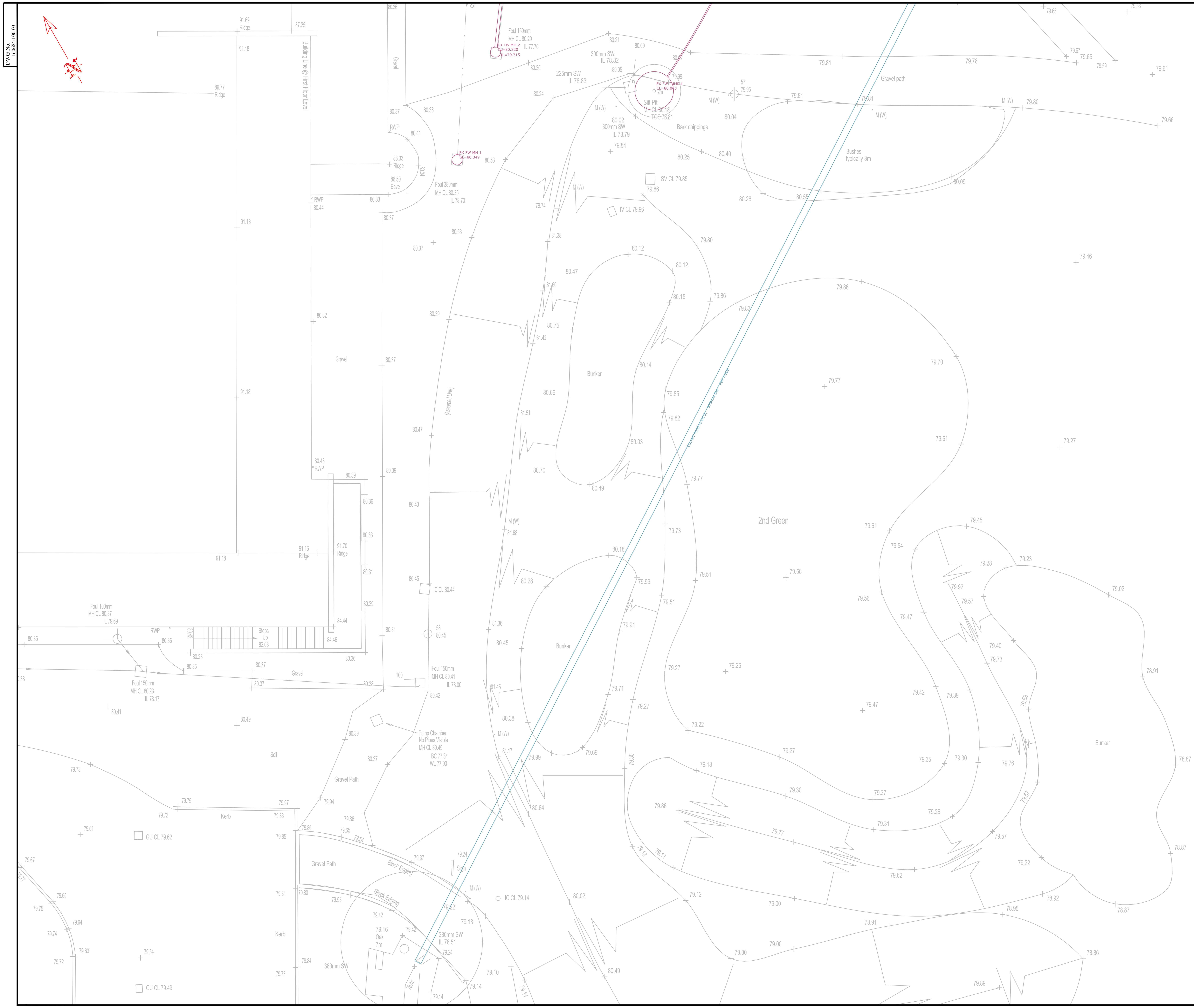
DWG No. 160684-00-02		



DWG No. 160684- 00-03

NOTES

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Proposed Surface Network

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BICESTER HOTEL golf and spa

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Drainage Layout
Site Plan
Sheet 3 of 6

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SCALE 1:100	JOB No. 160684	SIZE A1	REV
DWG No. 160684-□00-03			

Drawing 160842/510/01-02 – Manhole and Sewer Schedules

DWG No. 160684 - 10-01

SURFACE WATER MANHOLE SCHEDULE

MH Ref	MH Internal Diameter	Cover Level	Depth of MH	Sump Depth	MH Type	MH Cover	Pipe Connections	Comments
SW MH 1	450 mm	80.350 m	0.463 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 1 SW RUN 1.00 100 mm Dia IL=79.887 m	
SW MH 2	450 mm	80.350 m	0.571 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 1.00 100 mm Dia IL=79.779 m SW RUN 1.01 100 mm Dia IL=79.779 m	
SW MH 3	450 mm	80.339 m	0.683 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 1.01 100 mm Dia IL=79.656 m SW RUN 1.02 100 mm Dia IL=79.656 m	
SW MH 4	450 mm	80.226 m	0.655 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 1.02 100 mm Dia IL=79.571 m SW RUN 1.03 100 mm Dia IL=79.571 m	
SW MH 5	600 mm	80.044 m	0.589 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 1.03 100 mm Dia IL=79.455 m SW RUN 1.04 225 mm Dia IL=79.455 m	
SW MH 6	600 mm	79.916 m	0.691 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 3 SW RUN 1.04 225 mm Dia IL=79.384 m SW RUN 2.05 225 mm Dia IL=79.225 m SW RUN 1.05 225 mm Dia IL=79.225 m	
SW MH 7	1,050 mm	80.045 m	0.759 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 2.04 225 mm Dia IL=79.286 m SW RUN 2.05 225 mm Dia IL=79.286 m	
SW MH 8	450 mm	80.338 m	0.471 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 1 SW RUN 2.00 100 mm Dia IL=79.867 m	
SW MH 9	450 mm	80.287 m	0.546 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 2.00 100 mm Dia IL=79.741 m SW RUN 2.01 100 mm Dia IL=79.741 m	
SW MH 10	450 mm	80.336 m	0.684 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 2.01 100 mm Dia IL=79.653 m SW RUN 2.02 150 mm Dia IL=79.653 m	
SW MH 11	600 mm	80.350 m	0.781 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 4 SW RUN 3.01 100 mm Dia IL=79.569 m SW RUN 2.02 150 mm Dia IL=79.569 m SW RUN 4.00 100 mm Dia IL=79.716 m SW RUN 2.03 225 mm Dia IL=79.569 m	
SW MH 12	600 mm	80.350 m	0.863 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 2.03 225 mm Dia IL=79.487 m SW RUN 2.04 225 mm Dia IL=79.487 m	
SW MH 13	450 mm	80.350 m	0.483 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 1 SW RUN 3.00 100 mm Dia IL=79.867 m	
SW MH 14	450 mm	80.350 m	0.609 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 3.00 100 mm Dia IL=79.741 m SW RUN 3.01 100 mm Dia IL=79.741 m	
SW MH 15	450 mm	80.625 m	0.758 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 1 SW RUN 4.00 100 mm Dia IL=79.867 m	
SW MH 16 - PUMP	1,050 mm	80.267 m	2.150 m	0.000 m	Kingspan Twin Effluent Pump Chamber	Provided With Unit	No of pipe connections 1 SW RUN 5.00 75 mm Dia IL=78.115 m	
SW MH 17	450 mm	80.283 m	0.494 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 5.00 75 mm Dia IL=79.789 m SW RUN 5.01 150 mm Dia IL=79.789 m	
SW MH 18	450 mm	80.341 m	0.666 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 5.01 150 mm Dia IL=79.675 m SW RUN 5.02 150 mm Dia IL=79.675 m	
SW MH 19	450 mm	80.350 m	0.787 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 5.02 150 mm Dia IL=79.563 m SW RUN 5.03 150 mm Dia IL=79.563 m	
SW MH 20	1,050 mm	80.500 m	1.428 m	0.000 m	PVC	Max Opening 300 x 300 Grade B125	No of pipe connections 2 SW RUN 5.03 150 mm Dia IL=79.457 m SW RUN 5.04 150 mm Dia IL=79.457 m	
SW MH 21 - OUTFALL	1,050 mm	79.705 m	0.532 m	0.000 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 SW RUN 1.05 225 mm Dia IL=79.173 m SW RUN 1.06 225 mm Dia IL=79.173 m	

SURFACE WATER PIPE SCHEDULE

Pipe Name	Diameter	Length	Slope	Material	Pipe Bed	Upstream Manhole	Upstream Invert	Downstream Manhole	Downstream Invert
SW RUN 1.00	100 mm	16.185 m	1:150	PVC	B, F, N or Z	SW MH 1	79.887 m	SW MH 2	79.779 m
SW RUN 1.01	100 mm	18.504 m	1:150	PVC	B, F, N or Z	SW MH 2	79.779 m	SW MH 3	79.656 m
SW RUN 1.02	100 mm	13.058 m	1:153	PVC	B, F, N or Z	SW MH 3	79.656 m	SW MH 4	79.571 m
SW RUN 1.03	100 mm	17.375 m	1:150	PVC	B, F, N or Z	SW MH 4	79.571 m	SW MH 5	79.455 m
SW RUN 1.04	225 mm	14.155 m	1:200	PVC	B, F, N or Z	SW MH 5	79.455 m	SW MH 6	79.384 m
SW RUN 1.05	225 mm	10.387 m	1:200	PVC	B, F, N or Z	SW MH 6	79.225 m	SW MH 21 - OUTFALL	79.173 m
SW RUN 1.06	225 mm	2.610 m	1:200	Clay	B, F, N or Z	SW MH 21 - OUTFALL	79.173 m		79.160 m
SW RUN 2.00	100 mm	17.451 m	1:139	PVC	Z	SW MH 8	79.867 m	SW MH 9	79.741 m
SW RUN 2.01	100 mm	13.279 m	1:150	PVC	Z	SW MH 9	79.741 m	SW MH 10	79.653 m
SW RUN 2.02	150 mm	12.725 m	1:152	PVC	Z	SW MH 10	79.653 m	SW MH 11	79.569 m
SW RUN 2.03	225 mm	12.258 m	1:150	PVC	Z	SW MH 11	79.569 m	SW MH 12	79.487 m
SW RUN 2.04	225 mm	24.047 m	1:119	PVC	Z	SW MH 12	79.487 m	SW MH 7	79.286 m
SW RUN 2.05	225 mm	12.169 m	1:200	PVC	B, F, N or Z	SW MH 7	79.286 m	SW MH 6	79.225 m
SW RUN 3.00	100 mm	12.578 m	1:100	PVC	B, F, N or Z	SW MH 13	79.867 m	SW MH 14	79.741 m
SW RUN 3.01	100 mm	20.516 m	1:119	PVC	B, F, N or Z	SW MH 14	79.741 m	SW MH 11	79.569 m
SW RUN 4.00	100 mm	13.171 m	1:87	PVC	B, F, N or Z	SW MH 15	79.867 m	SW MH 11	79.716 m
SW RUN 5.00	63 mm	9.089 m	-1:5	MDPE	Z	SW MH 16 - PUMP	78.115 m	SW MH 17	79.789 m
SW RUN 5.01	150 mm	17.112 m	1:150	PVC	Z	SW MH 17	79.789 m	SW MH 18	79.675 m
SW RUN 5.02	150 mm	16.869 m	1:150	PVC	Z	SW MH 18	79.675 m	SW MH 19	79.563 m
SW RUN 5.03	150 mm	15.860 m	1:150	PVC	Z	SW MH 19	79.563 m	SW MH 20	79.457 m
SW RUN 5.04	150 mm	41.509 m	1:150	Clay	B, F, N or Z	SW MH 20	79.457 m		79.180 m

NOTES

Proposed Foul Network

Proposed Surface Network

Existing Foul Network

Existing Surface Network

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11. Bed type B,F and N shall be used for rigid pipes. Bed type Z shall be used for all gully connections and pipes under proposed carriageways with less than 700mm cover. The concrete bed and surround is to extend to the side of the trench or be of minimum width and voids filled with well compacted selected backfill.
12. All precast concrete manhole units are to conform to B.S. 5911.
13. For details of size, invert level, number of branches and cover and frame spec, see the drainage schedules.
14. Downstream exit pipes of 600mm dia. and over should be fitted with heavy duty safety chains across their mouths.
15. Precast concrete cover slabs are to be heavy duty.
16. Where large differential settlement is probable, several short lengths of pipe with flexible joints should be laid on either side of the chamber.
17. Where drains pass through foundations, a flexible joint should be provided within 150mm of the face of the structure.
18. Fast setting resin mortars may be used in lieu of cement mortar for bedding manhole frames where agreed with the Engineer to enable early cover loading.
19. The concrete base slab shall be 225mm minimum thickness for chambers upto 4500mm deep. Manholes over 4500mm deep require a slab 450mm thick.
20. All manholes over 2000mm deep are to be fitted with a "DANGER TEST FOR OXYGEN" sign
21. Appropriate measures (to be agreed with the district council's building control section, are to be taken to discourage rodent entry into the properties.
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BICESTER HOTEL golf and spa

Bicester Golf
And Spa

Drainage Layout
Manhole □ Sewer Schedules
Sheet 4 of 6

DRAWN	MK	CHECKED	KTP	APPROVED	KBL
DATE	17/01/2017	DATE	17/01/2017	DATE	17/01/2017
SCALE	1:100	JOB No.	160684	SIZE	REV
DWG No.	160684-□10-01			A1	

DWG No. 160684 - 10-02

FOUL MANHOLE SCHEDULE

MH Ref	MH Internal Diameter	Cover Level	Depth of MH	MH Type	MH Cover	Pipe Connections	Comments
FW MH 1	450 mm	79.948 m	0.551 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 1 FW RUN 1.00 100 mm Dia IL=79.396 m	
FW MH 2	450 mm	80.139 m	0.912 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 FW RUN 1.00 100 mm Dia IL=79.227 m FW RUN 1.01 100 mm Dia IL=79.227 m	
FW MH 3	450 mm	80.244 m	1.172 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 FW RUN 1.01 100 mm Dia IL=79.073 m FW RUN 1.02 100 mm Dia IL=79.073 m	
FW MH 4	1,050 mm	80.336 m	1.394 m	Concrete	Max Opening 300 x 300 Grade B125	No of pipe connections 2 FW RUN 1.02 100 mm Dia IL=78.942 m FW RUN 1.03 100 mm Dia IL=78.942 m	
FW MH 5	1,050 mm	80.350 m	1.541 m	Concrete	Max Opening 300 x 300 Grade B125	No of pipe connections 2 FW RUN 1.03 100 mm Dia IL=78.809 m FW RUN 1.04 100 mm Dia IL=78.809 m	
FW MH 6	1,050 mm	80.350 m	1.680 m	Concrete	Max Opening 300 x 300 Grade B125	No of pipe connections 2 FW RUN 1.04 100 mm Dia IL=78.670 m FW RUN 1.05 100 mm Dia IL=78.670 m	
FW MH 7	1,050 mm	80.350 m	1.815 m	Concrete	Max Opening 300 x 300 Grade B125	No of pipe connections 2 FW RUN 1.05 100 mm Dia IL=78.535 m FW RUN 1.06 150 mm Dia IL=78.535 m	
FW MH 8	1,050 mm	80.350 m	1.912 m	Concrete	Max Opening 300 x 300 Grade B125	No of pipe connections 2 FW RUN 1.06 150 mm Dia IL=78.438 m FW RUN 1.07 150 mm Dia IL=78.438 m	
FW MH 9	1,050 mm	80.309 m	1.915 m	Concrete	Max Opening 300 x 300 Grade B125	No of pipe connections 3 FW RUN 2.07 150 mm Dia IL=78.854 m FW RUN 1.07 150 mm Dia IL=78.395 m FW RUN 1.08 150 mm Dia IL=78.395 m	
FW MH 10	450 mm	80.350 m	0.550 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 1 FW RUN 2.00 100 mm Dia IL=79.800 m	
FW MH 11	450 mm	80.466 m	0.796 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 FW RUN 2.00 100 mm Dia IL=79.670 m FW RUN 2.01 100 mm Dia IL=79.670 m	
FW MH 12	??? mm	80.571 m	0.992 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 FW RUN 2.01 100 mm Dia IL=79.579 m FW RUN 2.02 100 mm Dia IL=79.579 m	
FW MH 13	450 mm	80.638 m	1.117 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 FW RUN 2.02 100 mm Dia IL=79.522 m FW RUN 2.03 100 mm Dia IL=79.522 m	
FW MH 14	450 mm	80.431 m	0.997 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 FW RUN 2.03 100 mm Dia IL=79.434 m FW RUN 2.04 100 mm Dia IL=79.434 m	
FW MH 15	450 mm	80.346 m	1.174 m	PVC	Min Opening 430 x 430 Grade B125	No of pipe connections 2 FW RUN 2.04 100 mm Dia IL=79.173 m FW RUN 2.05 150 mm Dia IL=79.173 m	
FW MH 16	1,050 mm	80.311 m	1.257 m	PVC	Max Opening 300 x 300 Grade B125	No of pipe connections 2 FW RUN 2.05 150 mm Dia IL=79.055 m FW RUN 2.06 150 mm Dia IL=79.055 m	
FW MH 17	1,050 mm	80.280 m	1.334 m	PVC	Max Opening 300 x 300 Grade B125	No of pipe connections 2 FW RUN 2.06 150 mm Dia IL=78.946 m FW RUN 2.07 150 mm Dia IL=78.946 m	
KLARGESTER	300 mm	80.265 m	2.000 m	Kinspan Biificient Treatment Plant	Provided With Unit	No of pipe connections 1 FW RUN 1.08 150 mm Dia IL=78.265 m	

FOUL PIPE SCHEDULE

Pipe Name	Diameter	Length	Slope	Material	Pipe Bed	Upstream Manhole	Upstream Invert	Downstream Manhole	Downstream Invert
FW RUN 1.00	100 mm	11.911 m	1:70	PVC	B, F, N or Z	FW MH 1	79.396 m	FW MH 2	79.227 m
FW RUN 1.01	100 mm	12.327 m	1:80	PVC	B, F, N or Z	FW MH 2	79.227 m	FW MH 3	79.073 m
FW RUN 1.02	100 mm	10.597 m	1:81	PVC	B, F, N or Z	FW MH 3	79.073 m	FW MH 4	78.942 m
FW RUN 1.03	100 mm	10.667 m	1:80	PVC	B, F, N or Z	FW MH 4	78.942 m	FW MH 5	78.809 m
FW RUN 1.04	100 mm	11.085 m	1:80	PVC	B, F, N or Z	FW MH 5	78.809 m	FW MH 6	78.670 m
FW RUN 1.05	100 mm	11.264 m	1:83	PVC	B, F, N or Z	FW MH 6	78.670 m	FW MH 7	78.535 m
FW RUN 1.06	150 mm	14.536 m	1:150	PVC	B, F, N or Z	FW MH 7	78.535 m	FW MH 8	78.438 m
FW RUN 1.07	150 mm	6.212 m	1:143	PVC	B, F, N or Z	FW MH 8	78.438 m	FW MH 9	78.395 m
FW RUN 1.08	150 mm	10.376 m	1:80	PVC	B, F, N or Z	FW MH 9	78.395 m	KLARGESTER	78.265 m
FW RUN 2.00	100 mm	10.412 m	1:80	PVC	B, F, N or Z	FW MH 10	79.800 m	FW MH 11	79.670 m
FW RUN 2.01	100 mm	7.247 m	1:80	PVC	B, F, N or Z	FW MH 11	79.670 m	FW MH 12	79.579 m
FW RUN 2.02	100 mm	4.593 m	1:80	PVC	B, F, N or Z	FW MH 12	79.579 m	FW MH 13	79.522 m
FW RUN 2.03	100 mm	7.018 m	1:80	PVC	B, F, N or Z	FW MH 13	79.522 m	FW MH 14	79.434 m
FW RUN 2.04	100 mm	20.890 m	1:80	PVC	B, F, N or Z	FW MH 14	79.434 m	FW MH 15	79.173 m
FW RUN 2.05	150 mm	9.471 m	1:80	PVC	B, F, N or Z	FW MH 15	79.173 m	FW MH 16	79.055 m
FW RUN 2.06	150 mm	8.699 m	1:80	PVC	B, F, N or Z	FW MH 16	79.055 m	FW MH 17	78.946 m
FW RUN 2.07	150 mm	8.679 m	1:95	PVC	B, F, N or Z	FW MH 17	78.946 m	FW MH 9	78.854 m

NOTES

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BICESTER HOTEL golf and spa

Bicester Golf And Spa

Drainage Layout Manhole □ Sewer Schedules

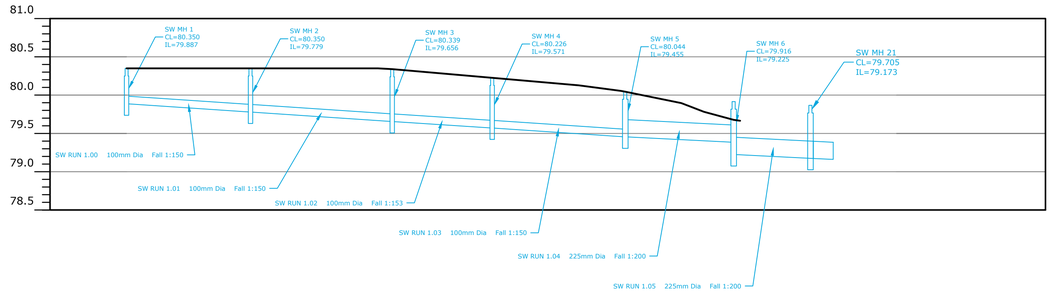
Sheet □of 6

DRAWN MK	CHECKED KTP	APPROVED KBL
DATE 17/01/2017	DATE 17/01/2017	DATE 17/01/2017
SCALE 1:100	JOB No. 160684	SIZE A1 / REV
DWG No. 160684-□10-02		

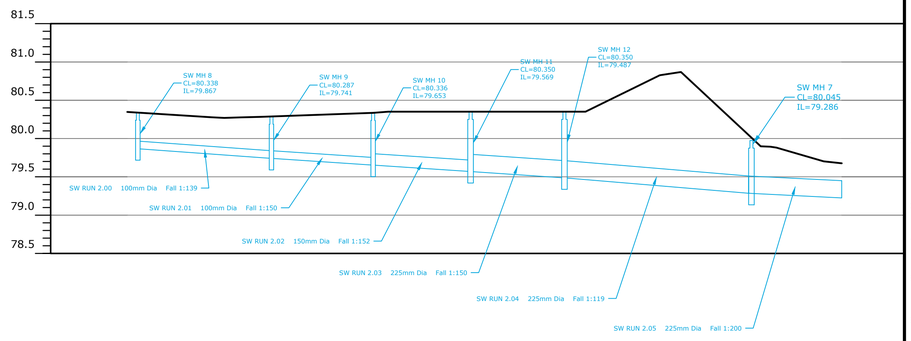
Drawing 160842/520/01 – Drainage Layout & Sewer Long Sections

DWG No. (160684 - 00-03)

SW Run 1.00



SW Run 2.00



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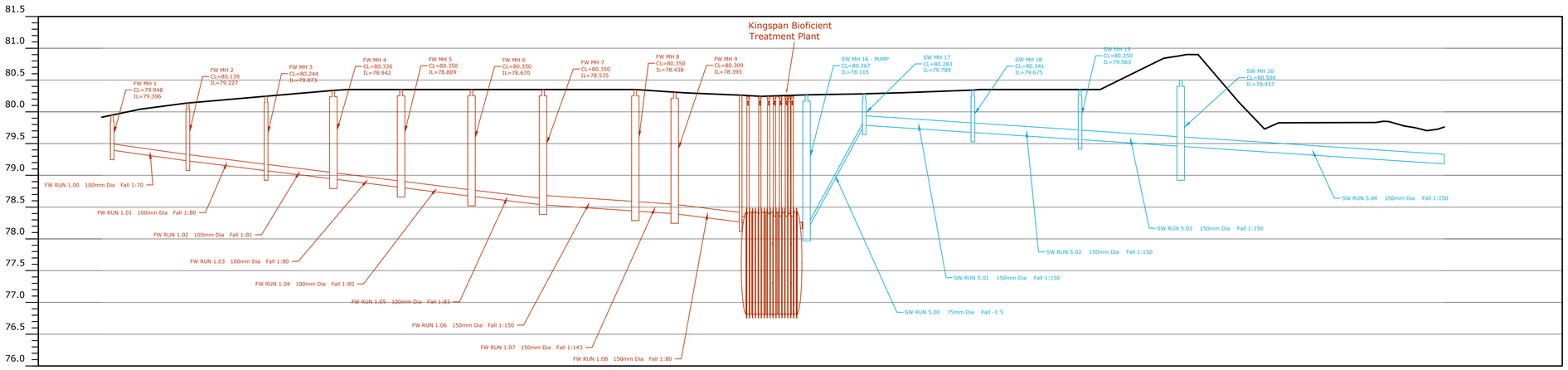
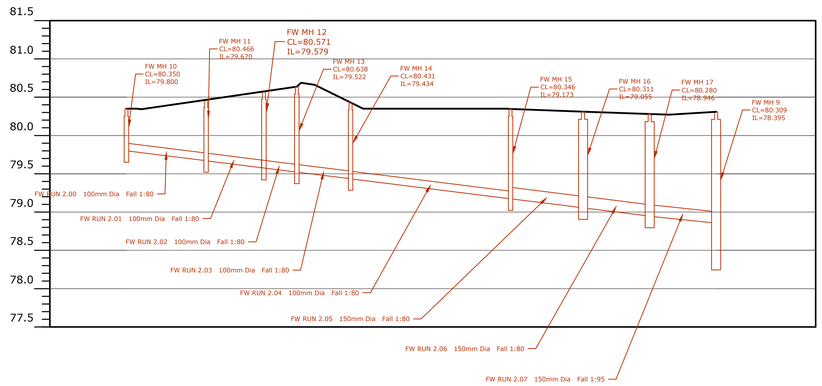


FW Run 2.00



NOTES

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- Proposed Surface Network
- Existing Foul Network
- Existing Surface Network

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BICESTER HOTEL golf and spa

Bicester Golf And Spa

Drainage Layout Sewer LongSections

Sheet 6 of 6

DRAWN MK	CHECKED KTP	APPROVED KBL
DATE 17/01/2017	DATE 17/01/2017	DATE 17/01/2017
SCALE H□1:400,V □1:40	JOB No. 160684	SIZE A1 / REV
DWG No. 160684-□20-01		

MicroDrainage - Greenfield Runoff Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.150
Area (ha)	0.203	Urban	0.000
SAAR (mm)	684	Region Number	Region 4

Results l/s

QBAR Rural	0.1
QBAR Urban	0.1
Q100 years	0.2
Q1 year	0.1
Q30 years	0.2
Q100 years	0.2

MicroDrainage – Pond Calculations

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	79.475	0.295	2.7	42.5	O K
30 min Summer	79.558	0.378	3.1	54.4	O K
60 min Summer	79.630	0.450	3.4	64.9	O K
120 min Summer	79.676	0.496	3.6	71.5	O K
180 min Summer	79.684	0.504	3.6	72.5	O K
240 min Summer	79.683	0.503	3.6	72.5	O K
360 min Summer	79.675	0.495	3.6	71.3	O K
480 min Summer	79.662	0.482	3.5	69.4	O K
600 min Summer	79.647	0.467	3.5	67.2	O K
720 min Summer	79.630	0.450	3.4	64.8	O K
960 min Summer	79.598	0.418	3.3	60.2	O K
1440 min Summer	79.541	0.361	3.0	52.0	O K
2160 min Summer	79.476	0.296	2.7	42.6	O K
2880 min Summer	79.427	0.247	2.5	35.6	O K
4320 min Summer	79.363	0.183	2.1	26.4	O K
5760 min Summer	79.323	0.143	1.8	20.6	O K
7200 min Summer	79.297	0.117	1.6	16.9	O K
8640 min Summer	79.279	0.099	1.4	14.2	O K
10080 min Summer	79.266	0.086	1.3	12.4	O K
15 min Winter	79.511	0.331	2.9	47.7	O K
30 min Winter	79.605	0.425	3.3	61.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.514	0.0	43.3	18
30 min Summer	90.826	0.0	57.0	33
60 min Summer	56.713	0.0	71.9	62
120 min Summer	34.204	0.0	86.8	120
180 min Summer	25.103	0.0	95.6	154
240 min Summer	20.035	0.0	101.8	186
360 min Summer	14.542	0.0	110.8	250
480 min Summer	11.583	0.0	117.7	320
600 min Summer	9.702	0.0	123.2	388
720 min Summer	8.391	0.0	127.9	456
960 min Summer	6.667	0.0	135.5	590
1440 min Summer	4.815	0.0	146.7	852
2160 min Summer	3.471	0.0	159.1	1232
2880 min Summer	2.749	0.0	168.0	1588
4320 min Summer	1.977	0.0	180.9	2332
5760 min Summer	1.563	0.0	191.1	3048
7200 min Summer	1.301	0.0	198.9	3744
8640 min Summer	1.120	0.0	205.4	4488
10080 min Summer	0.987	0.0	210.9	5152
15 min Winter	138.514	0.0	48.6	18
30 min Winter	90.826	0.0	63.9	32

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	79.688	0.508	3.6	73.1	O K
120 min Winter	79.744	0.564	3.8	81.2	Flood Risk
180 min Winter	79.753	0.573	3.9	82.6	Flood Risk
240 min Winter	79.749	0.569	3.8	81.9	Flood Risk
360 min Winter	79.735	0.555	3.8	79.9	Flood Risk
480 min Winter	79.714	0.534	3.7	76.9	Flood Risk
600 min Winter	79.690	0.510	3.6	73.5	O K
720 min Winter	79.666	0.486	3.5	70.0	O K
960 min Winter	79.619	0.439	3.4	63.2	O K
1440 min Winter	79.539	0.359	3.0	51.8	O K
2160 min Winter	79.453	0.273	2.6	39.3	O K
2880 min Winter	79.395	0.215	2.3	30.9	O K
4320 min Winter	79.324	0.144	1.8	20.8	O K
5760 min Winter	79.286	0.106	1.5	15.3	O K
7200 min Winter	79.264	0.084	1.3	12.1	O K
8640 min Winter	79.251	0.071	1.1	10.2	O K
10080 min Winter	79.245	0.065	1.0	9.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	80.6	60
120 min Winter	34.204	0.0	97.3	118
180 min Winter	25.103	0.0	107.1	170
240 min Winter	20.035	0.0	114.0	194
360 min Winter	14.542	0.0	124.2	270
480 min Winter	11.583	0.0	131.9	346
600 min Winter	9.702	0.0	138.1	420
720 min Winter	8.391	0.0	143.3	492
960 min Winter	6.667	0.0	151.8	634
1440 min Winter	4.815	0.0	164.3	906
2160 min Winter	3.471	0.0	178.2	1280
2880 min Winter	2.749	0.0	188.2	1648
4320 min Winter	1.977	0.0	202.7	2376
5760 min Winter	1.563	0.0	214.1	3064
7200 min Winter	1.301	0.0	222.8	3752
8640 min Winter	1.120	0.0	230.1	4408
10080 min Winter	0.987	0.0	236.3	5152

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.403	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.170

Time (mins) From:	To:	Area (ha)
0	4	0.170

Model Details

Storage is Online Cover Level (m) 80.000

Tank or Pond Structure

Invert Level (m) 79.180

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	144.0	0.600	144.0

Orifice Outflow Control

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 79.180

Event: 180 min Winter