AMENDED

Flood Risk Assessment

Site: Highfield Road, Minster, Kent

Client: New Homes and Land

Prepared by: DHA Environment
Eclipse House
Eclipse Park
Sittingbourne Road
Maidstone ME14 3EN

Date: July 2021

1.1 Introduction

1.1.1 DHA Environment has been commissioned by New Homes and Land to provide a Flood Risk Assessment (FRA) showing the possible impact of flooding and on a proposed development of 16 units on a 1.47 hectare greenfield site on land located off Highfield Road, Minster, Kent. This report has been prepared to support the outline planning application.

1.1.2 This FRA has been carried out in accordance with the National Planning Policy Framework (NPPF). The NPPF requires that an FRA is prepared for all developments that are located in Flood Zone 1 with a site area greater than one hectare.

1.1.3 Given the site consists of 16 units, it is considered to be major development as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010 and as such this report has been prepared to outline the surface water drainage for the site.

1.2 Summary of existing site

Location

1.2.1 The site is located on land off Highfield Road, Minster, Kent and is centred on approximate grid reference 593384,172610. The site occupies a total area of 1.47 hectares although only 0.793 hectares will be developed and currently consists entirely of part residential garden and grazing.

Existing Site

1.2.2 A topographical survey of the site is shown on drawing 15001-TS-01 contained within **Appendix A**. The site falls from a high point of between 33 and 35m AOD

on the North, South and West boundaries to a low point of 30.7m AOD on the East boundary. The site has the following boundary conditions:

- North - Residential development off Highfield Road.
- East - Oasis Academy
- South - Grazing paddocks.
- West - Reservoir off Southdown Road.

Existing Drainage regime and surface water run off

1.2.3 There are no watercourses or sewers on the site with any surface water following the existing topography running off land to the East.

1.2.4 The discharge rates from the site have been calculated by using the Flood Studies Report ICP (SuDS) method based on the total developable site area of 0.793 hectares. The calculations can be seen in **Appendix B** and have been summarised in table 1 below:

Catchment Reference	*Qbar (l/s)*	*1 in 1 year*	*1 in 30 years*	*1 in100 years*
Total	**2.1**	1.8	4.9	6.9

Table 1 - Summary of existing runoff rates

1.2.5 Reference has been made to Southern Water asset plans which indicate the location of public sewers in the area. These records do not indicate any private drainage that may be present. A copy of the record drawing is shown in **Appendix C**.

1.2.6 In October 2011 the ownership of any private sewer serving more than one property was automatically transferred to the Water Authority although many of these sewers are yet to be recorded on the asset plans.

Surface Water

1.2.7 Southern Water asset plans show there to be no surface water sewers within the site however there is a 150mm diameter surface water sewer located approximately 80m to the East of the North East corner of the site.

Foul Water

1.2.8 Southern Water asset plans show there to be 150mm diameter sewer crossing the northern part of the site.

Geology and Hydrogeology

1.2.9 The online British Geological Survey maps indicate that the site is underlain by the London Clay Formation made up of clay and silt. Given the low permeability of Clay bedrock, infiltration SuDS are unlikely to be possible for use on this site. Information published by the Environment Agency shows the site to lay outside of any source protection zones.

1.3 Site Specific Flood Risk Assessment

1.3.1 The National Planning Policy Framework provides guidance on assessing flood risk and seeks to guide development away from areas at risk of flooding from all sources. Planning Practice Guidance defines a number of Flood Zones based on the probability of flooding and provides guidance on the most appropriate form of development within each zone. The flood risk can be summarised as follows:

Zone	Annual probability in any year	
	River Flooding	Sea Flooding
Zone 1 : Low probability	Less than 1:1000 (<0.1%)	Less than 1:1000 (<0.1%)
Zone 2: Medium probability	Between 1:1000 and 1 in 100 (0.1% -1%)	Between 1:1000 and 1 in 200 (0.1% - 0.5%)
Zone 3a : High probability	Greater than 1:100 (>1%)	Greater than 1:200 (>0.5%)
Zone 3b: Functional floodplain	Greater than 1 in 20 (>5%)	N/A

Table 2 – NPPF Guidance

1.3.2 Reference has been made to the Environment Agency flood risk map shown in **Appendix D**. This indicates that the proposed development is situated within Flood Zone 1. This Flood Zone comprises of land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%) in any year.

Sequential Test

1.3.3 The National Planning Policy Framework, requires that a risk based Sequential Test should be applied at all stages of planning with the aim of steering new development to areas at the lowest probability of flooding (Flood Zone 1).

1.3.4 The site is located entirely within Flood Zone 1 and as such it is considered to satisfy the Sequential Test.

Vulnerability Classification

1.3.5 Planning Practice Guidance Table 2, "Flood Risk Vulnerability Classification", states that buildings used for residential dwellings are classified as "more vulnerable".

1.3.6 Planning Practice Guidance Table 3, "Flood Risk Vulnerability and Flood Zone Compatibility", confirms that 'more vulnerable' developments situated in Flood Zone 1 are appropriate and an exception test is not required for this development.

1.4 Proposed Development

1.4.1 The proposals consist of the construction of 16 dwellings on land located off Highfield Road, Minster, Kent. The proposed development proposals are contained within **Appendix E**.

Aims

1.4.2 Sustainable Urban Drainage (SuDS) techniques will be used to deal with the surface water generated by the development. This will replicate the existing drainage regime by dealing with the surface water at source, to prevent increasing the risk of downstream flooding.

Proposed Surface Water Drainage Strategy

1.4.3 The proposed impermeable areas are shown on drawing 14615-D-01 contained in **Appendix F** and show the total impermeable area to be 0.38 hectares.

1.4.4 The principles of the proposed surface water drainage are shown on drawing 14615-D-02 contained in **Appendix F**.

1.4.5 The access roads, roofs and areas of hardstanding will be drained via trapped gullies connected into a network of gravity surface water sewers that will discharge into an underground cellular storage tank.

1.4.6 Flows from the storage tank will connect into a surface water pumping station which will control the outlet to a flow rate of 2l/s which will discharge into a new gravity sewer located in Highfield Road. This in turn will drain to an existing 150mm diameter surface water sewer located approximately 80m to the East of the site in Highfield Road.

1.4.7 Based on the above, the proposed drainage system has been modelled using Windes to accommodate all return periods up to and including the 1:100 year + 40% climate change. Calculations are shown in **Appendix F**.

1.4.8 Any reinforcement of the existing network will be covered by the Infrastructure Charge required for the connection of each property.

Foul water drainage

1.4.9 A peak foul water flow of between 0.74 l/s has been calculated for a development of 16 residential units. This is based on the daily flow rate of 4,000 litres given in Sewers for Adoption 7th Edition for residential dwellings.

1.4.10 The proposed site will drain via a network of gravity sewers to a new foul water pumping station. This will pump to the existing 150mm diameter sewer located to the North of the site.

1.4.11 Any reinforcement of the existing network will be covered by the Infrastructure Charge required for the connection of each property.

1.5 Conclusions

1.5.1 The proposals consist of the provision of 16 dwellings land on located off Highfield Road, Minster, Kent.

1.5.2 The site-specific flood risk assessment determined that the site is located entirely in Flood Zone 1; low risk of flooding from rivers or other sources of flooding.

1.5.3 Planning Practice Guidance Table 2, "Flood Risk Vulnerability Classification", states that buildings used for dwellings are classified as "more vulnerable".

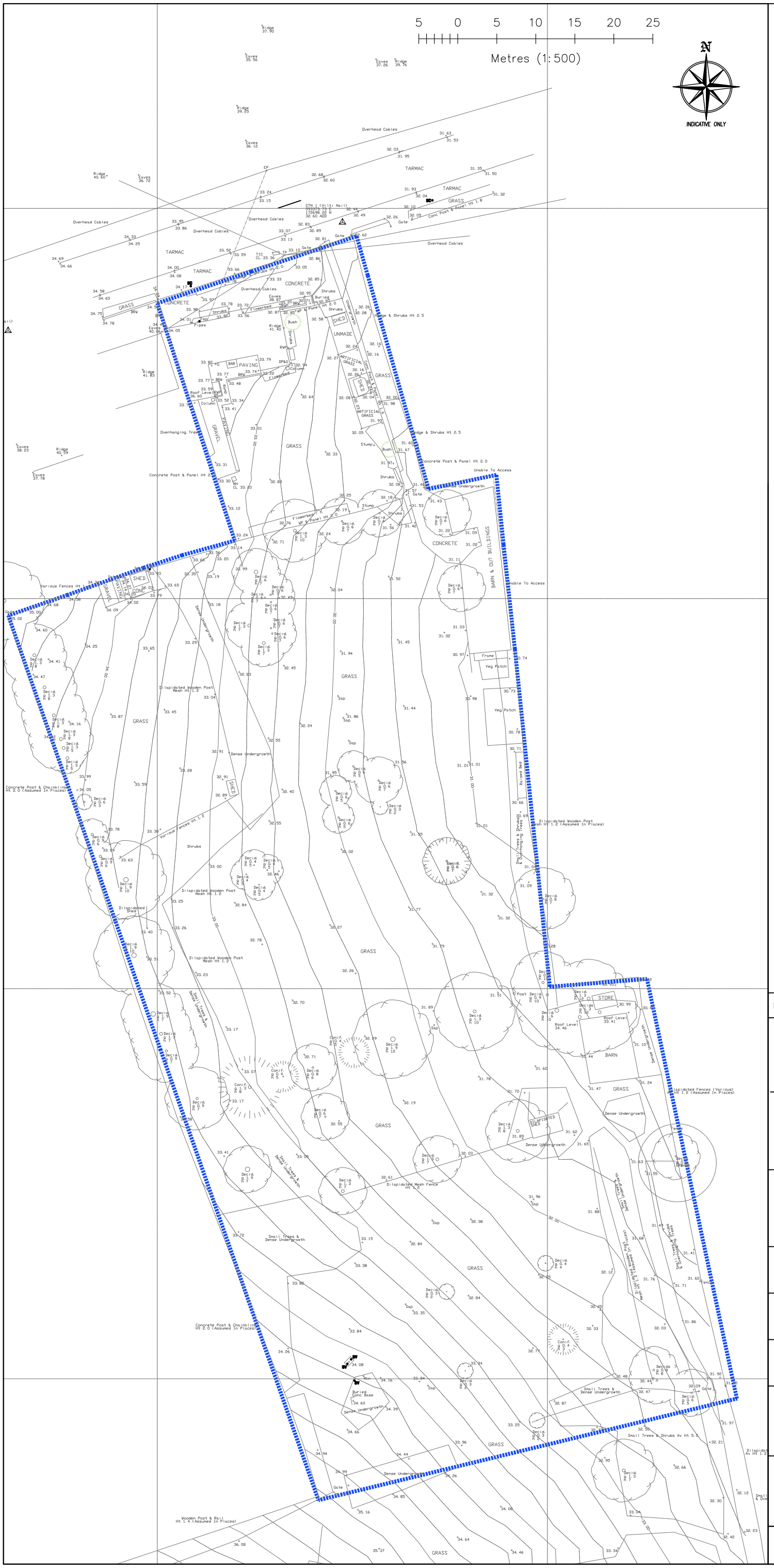
1.5.4 The development is located entirely within Flood Zone 1 and as such is considered to satisfy the sequential test. Planning Practice Guidance Table 1, "Flood Zones", determines all classes of land development are appropriate in Flood Zone 1 and an exception test is not required.

1.6 A Sustainable Urban Drainage system will be provided which incorporates an underground cellular tank with a controlled pumped outfall which will be used to accommodate the 1 in 100 year rainfall event with a 40% allowance for climate change. Surface water from the site will connect to an existing surface water sewer in Highfield Road via a new offsite sewer.

1.7 Foul drainage from the development will be via a new offsite sewer connecting to the existing foul sewer to the north of the site.

APPENDIX A

Existing Topographical Survey



DO NOT SCALE

REV	DATE	BY	DESCRIPTION	CHK	APD
P1	02.12.20	CS	First Issue	CS	CS

client

S W ATTWOOD

project

HIGHFIELD ROAD, MINSTER

title

TOPOGRAPHICAL SURVEY

project	drwg	rev
15001	TS-01	P1

Drawn	Checked	Approved	scale @ A3	date
CS	CS	CS	1:500	02.12.2020

status: FOR INFORMATION — P

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CAD Reference: A3

APPENDIX B

Greenfield Runoff Rates

ICP SUDS Mean Annual Flood

Input

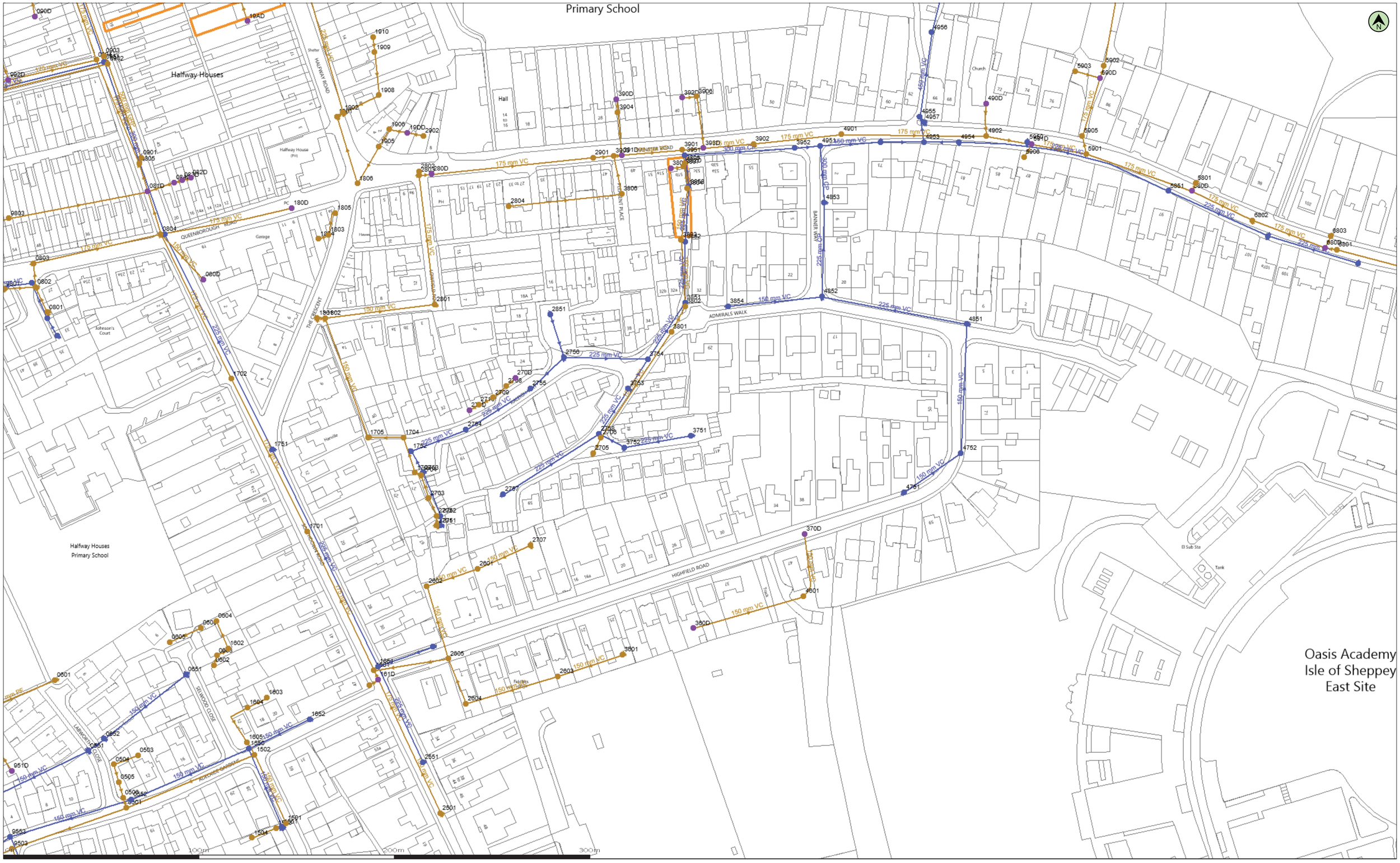
Return Period (years)	100	Soil	0.400
Area (ha)	0.793	Urban	0.000
SAAR (mm)	576	Region Number	Region 7

Results l/s

QBAR Rural	2.1
QBAR Urban	2.1
Q100 years	6.9
Q1 year	1.8
Q30 years	4.9
Q100 years	6.9

APPENDIX C

Southern Water Asset Plans



Date: 07/10/20

Scale: 1:1250

Map Centre: 593345,172761

Data updated: 21/09/20

Our Ref: 445506 - 1

Wastewater Plan A2

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 should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2020 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

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

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Foul Outfall
Surface Water Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
WTW Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

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10

WATER for LIFE

from Southern Water

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0501	F	17.46	15.56	
0503	F	0.00	0.00	
0504	F	0.00	0.00	
0505	F	0.00	0.00	
0506	F	0.00	0.00	
0601	F	15.74	14.23	
0602	F	0.00	0.00	
0603	F	0.00	0.00	
0604	F	0.00	0.00	
0605	F	0.00	0.00	
0606	F	0.00	0.00	
0801	F	10.92	9.40	
0802	F	10.56	9.18	
0803	F	10.15	8.40	
0804	F	10.42	7.83	
0805	F	9.48	7.10	
080D	F	0.00	0.00	
081D	F	0.00	0.00	
082D	F	0.00	0.00	
083D	F	0.00	0.00	
084D	F	0.00	0.00	
0901	F	9.46	6.82	
0902	F	8.13	5.54	
0903	F	8.01	5.44	
0904	F	7.99	6.24	
090D	F	0.00	0.00	
1501	F	22.59	20.06	
1502	F	20.06	17.89	
1503	F	0.00	0.00	
1504	F	0.00	0.00	
1601	F	21.08	19.47	
1602	F	0.00	0.00	
1603	F	0.00	0.00	
1604	F	0.00	0.00	
1605	F	0.00	0.00	
161D	F	0.00	0.00	
1701	F	17.33	15.73	
1702	F	13.46	11.83	
1703	F	16.84	14.86	
1704	F	16.04	14.51	
1705	F	15.81	14.15	
1801	F	12.73	12.16	
1802	F	12.75	12.09	
1803	F	0.00	0.00	
1804	F	0.00	0.00	
1805	F	0.00	0.00	
1806	F	0.00	0.00	
180D	F	0.00	0.00	
1901	F	10.00	8.29	
1902	F	9.84	0.00	
1905	F	0.00	0.00	
1906	F	0.00	0.00	
1908	F	0.00	0.00	
1909	F	0.00	0.00	
1910	F	0.00	0.00	
19AD	F	0.00	0.00	
19DD	F	0.00	0.00	
2501	F	22.69	20.80	
2601	F	24.20	22.96	
2602	F	0.00	0.00	
2603	F	32.40	0.00	
2604	F	0.00	0.00	
2605	F	23.39	20.69	
2701	F	20.01	18.38	
2702	F	19.53	17.83	
2703	F	18.30	16.70	
2704	F	17.07	15.53	
2705	F	23.24	21.69	
2706	F	22.61	20.93	
2707	F	27.90	26.80	
2708	F	0.00	0.00	
2709	F	0.00	0.00	
270D	F	0.00	0.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
2710	F	0.00	0.00	
271D	F	0.00	0.00	
2801	F	14.10	11.43	
2802	F	12.14	10.64	
2803	F	12.12	10.59	
2804	F	0.00	0.00	
280D	F	0.00	0.00	
2901	F	12.09	10.05	
2902	F	0.00	0.00	
3601	F	35.73	34.99	
360D	F	0.00	0.00	
370D	F	0.00	0.00	
3801	F	16.68	12.73	
3802	F	16.14	12.62	
3803	F	12.97	11.16	
3804	F	11.76	10.63	
3805	F	11.77	9.01	
3806	F	0.00	0.00	
3807	F	0.00	0.00	
380D	F	0.00	0.00	
382D	F	0.00	0.00	
3901	F	10.64	0.00	
3902	F	9.77	7.74	
3903	F	0.00	10.05	
3904	F	0.00	0.00	
3906	F	0.00	0.00	
390D	F	0.00	0.00	
391D	F	0.00	0.00	
392D	F	0.00	0.00	
393D	F	0.00	0.00	
4601	F	0.00	0.00	
4901	F	9.35	7.25	
4902	F	9.27	7.11	
490D	F	0.00	0.00	
5801	F	11.23	9.88	
580D	F	0.00	0.00	
5901	F	9.79	6.80	
5902	F	7.21	5.82	
5903	F	0.00	0.00	
5905	F	9.55	0.00	
5906	F	0.00	0.00	
590D	F	0.00	0.00	
591D	F	0.00	0.00	
6801	F	12.54	9.26	
6802	F	12.00	8.98	
6803	F	12.54	10.89	
680D	F	0.00	0.00	
9503	F	15.44	14.16	
951D	F	0.00	0.00	
9801	F	10.37	9.54	
9803	F	0.00	0.00	
992D	F	0.00	0.00	
0551	S	16.35	14.83	
0552	S	17.58	16.24	
0651	S	18.02	16.41	
0652	S	16.44	14.95	
0951	S	8.12	7.04	
1550	S	19.84	18.34	
1551	S	22.72	20.16	
1651	S	20.99	19.67	
1652	S	20.96	19.75	
1751	S	15.20	13.94	
1752	S	16.26	14.04	
2551	S	25.03	23.63	
2751	S	20.11	18.56	
2752	S	19.52	17.79	
2753	S	16.99	14.91	
2754	S	16.99	13.92	
2755	S	17.20	13.73	
2756	S	16.74	13.52	
2757	S	21.95	20.05	
2758	S	22.37	19.64	
2851	S	15.12	13.62	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
3751	S	25.48	23.84	
3752	S	23.62	21.07	
3753	S	19.56	17.54	
3754	S	18.20	13.08	
3851	S	15.47	12.55	
3852	S	13.03	11.45	
3853	S	11.58	10.68	
3854	S	16.18	15.02	
3951	S	10.75	8.93	
3952	S	9.53	8.63	
4751	S	25.83	24.48	
4752	S	22.71	21.47	
4851	S	16.41	15.15	
4852	S	15.13	11.84	
4853	S	10.37	8.86	
4951	S	9.31	0.00	
4953	S	9.19	7.84	
4954	S	9.21	8.08	
4955	S	8.95	7.35	
4956	S	7.73	6.67	
4957	S	9.31	8.34	
5851	S	10.98	10.03	
5950	S	9.28	0.00	
9553	S	15.67	14.04	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

APPENDIX D

Environment Agency Plans

Flood map for planning

Your reference	Location (easting/northing)	Created
15001	**593386/172588**	**3 Dec 2020 14:38**

Your selected location is in flood zone 1, an area with a low probability of flooding.

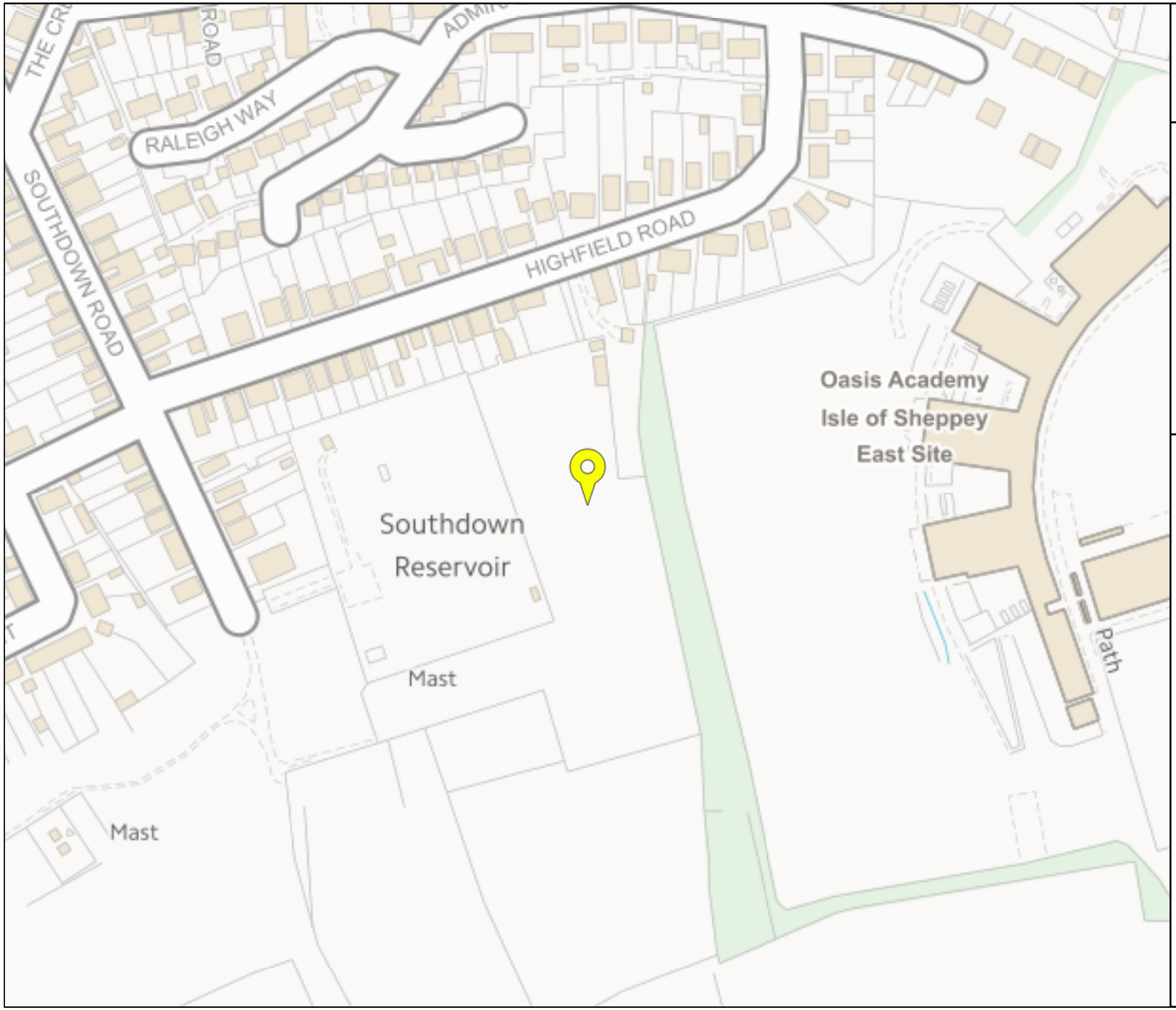
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
15001

Location (easting/northing)
593386/172588

Scale
1:2500

Created
3 Dec 2020 14:38

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

APPENDIX E

Proposed Site Plan

Plot	2 Bed	3 Bed	Parking spaces
1	●		2
2	●		2
3		●	2
4		●	2
5	●		2
6		●	2
7		●	2
8	●		2
9	●		2
10	●		2
11	●		2
12	●		2
13		●	2
14	●		2
15	●		2
16	●		2
Unallocated/visitor spaces			10
Total	**11**	**5**	**42**

Rev.	Date	Description
A	05.01.21	Scale bar added
B	24.05.21	Scheme amended to accommodate Southern Water easement.
C	10.06.21	Scheme amended to accommodate vehicular tracking.

Land at Highfield Road, Minster-on-Sea, Kent
ILLUSTRATIVE SITE LAYOUT PLAN

1602.003(C)

Scale: 1:1000 @ A3

0 25 50
metres

29/11/2020

planning associates
town planning and development consultants

Chells Manor, Chells Lane
STEVENAGE, SG2 7AA

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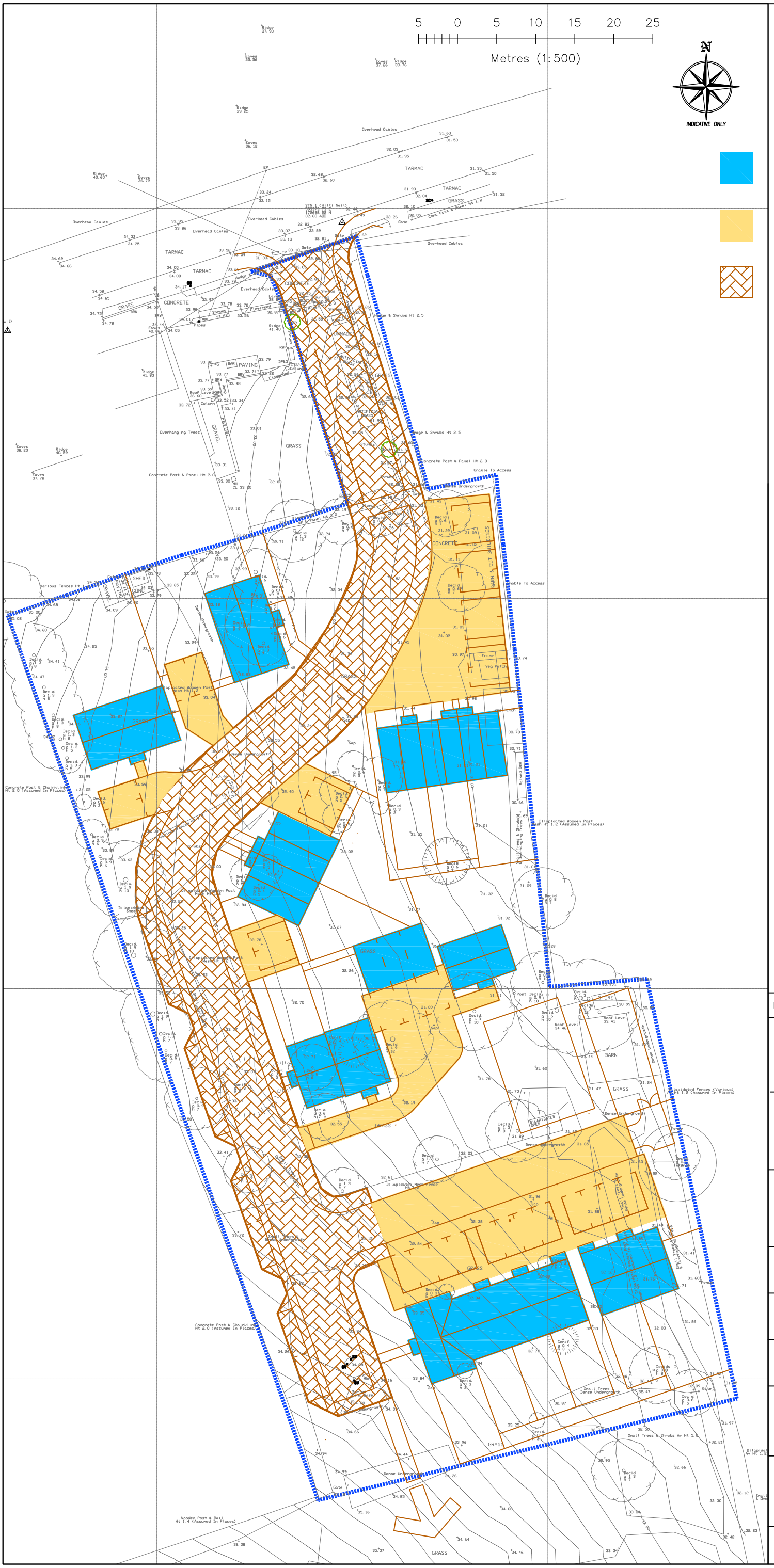
APPENDIX F

Proposed Drainage Strategy and Calculations



DO NOT SCALE

KEY

Proposed roof area - 0.093 Hectares

Proposed areas hardstanding - 0.119 Hectares

Proposed road - 0.166

Total impermeable - 0.378 Hectares

REV	DATE	BY	DESCRIPTION	CHK	APD
P2	07.07.21	CS	Layout amended	CS	CS
P1	02.12.20	CS	First Issue	CS	CS

client

NEW HOMES AND LAND

project

HIGHFIELD ROAD, MINSTER

title

PROPOSED CONTRIBUTING AREAS PLAN

project	drwg	rev
15001	D-01	P2

Drawn	Checked	Approved	scale @ A3	date
CS	CS	CS	1:500	02.12.2020

status: FOR INFORMATION — P

Eclipse House, Eclipse Park. Sittingbourne Road
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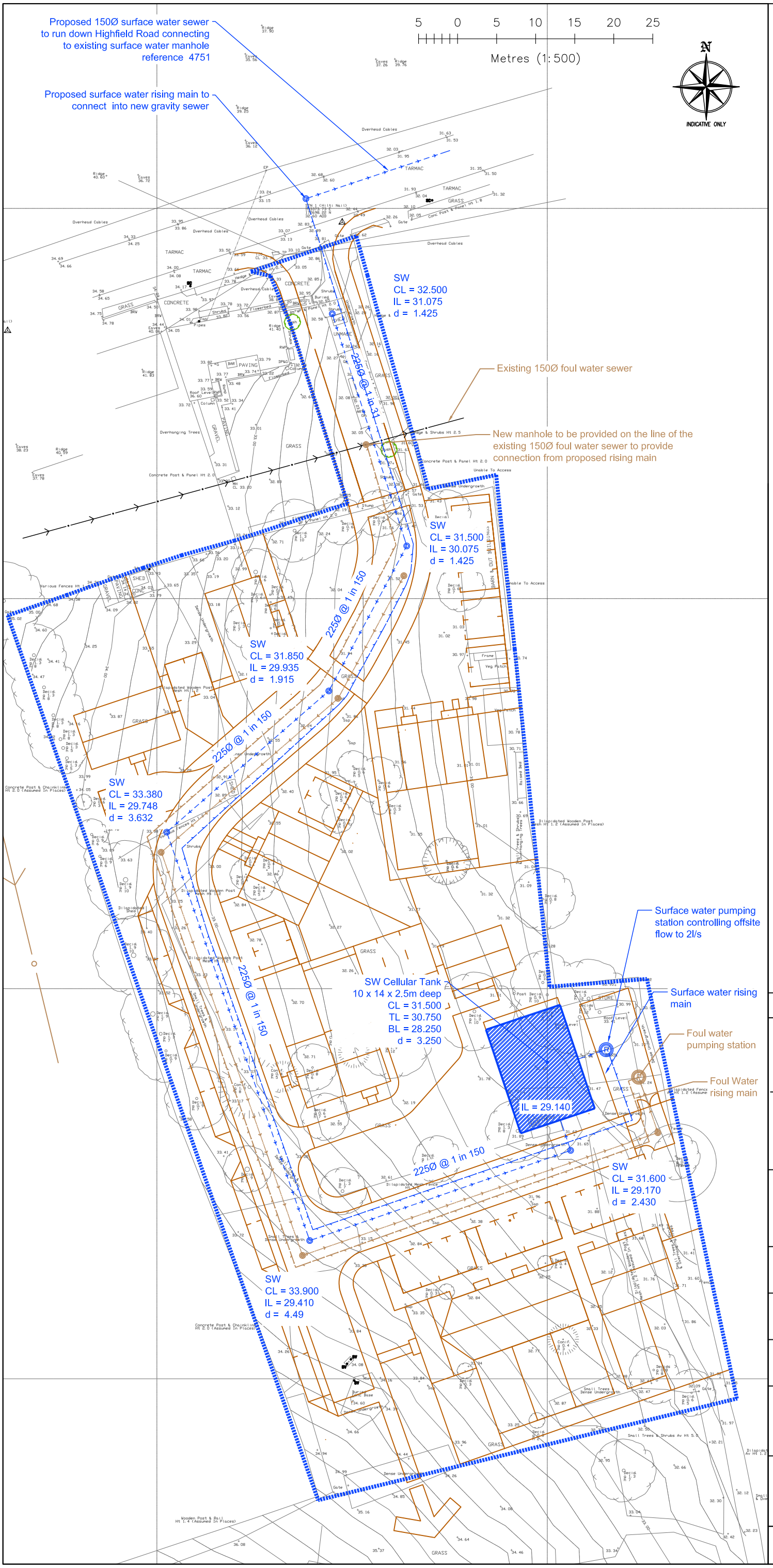
CAD Reference: A3



DO NOT SCALE

REV	DATE	BY	DESCRIPTION	CHK	APD
P2	07.07.21	CS	Layout amended	CS	CS
P1	02.12.20	CS	First Issue	CS	CS

client

NEW HOMES AND LAND

project

HIGHFIELD ROAD, MINSTER

title

PROPOSED DRAINAGE PLAN

project	drwg	rev
15001	D-02	P2

Drawn	Checked	Approved	scale @ A3	date
CS	CS	CS	1:500	02.12.2020

status: FOR INFORMATION — P

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Maidstone, Kent. ME14 3EN
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e: info@dhaplanning.co.uk w: www.dhaplanning.co.uk

CAD Reference: A3

Summary of Results for 2 year Return Period

Half Drain Time : 333 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	28.523	0.273	0.0	2.0	2.0	36.3	O K
30 min Summer	28.599	0.349	0.0	2.0	2.0	46.4	O K
60 min Summer	28.671	0.421	0.0	2.0	2.0	56.0	O K
120 min Summer	28.731	0.481	0.0	2.0	2.0	64.0	O K
180 min Summer	28.754	0.504	0.0	2.0	2.0	67.1	O K
240 min Summer	28.762	0.512	0.0	2.0	2.0	68.1	O K
360 min Summer	28.762	0.512	0.0	2.0	2.0	68.0	O K
480 min Summer	28.756	0.506	0.0	2.0	2.0	67.3	O K
600 min Summer	28.747	0.497	0.0	2.0	2.0	66.1	O K
720 min Summer	28.737	0.487	0.0	2.0	2.0	64.7	O K
960 min Summer	28.712	0.462	0.0	2.0	2.0	61.5	O K
1440 min Summer	28.661	0.411	0.0	2.0	2.0	54.7	O K
2160 min Summer	28.587	0.337	0.0	2.0	2.0	44.9	O K
2880 min Summer	28.522	0.272	0.0	2.0	2.0	36.2	O K
4320 min Summer	28.423	0.173	0.0	2.0	2.0	23.0	O K
5760 min Summer	28.364	0.114	0.0	2.0	2.0	15.2	O K
7200 min Summer	28.344	0.094	0.0	1.9	1.9	12.4	O K
8640 min Summer	28.333	0.083	0.0	1.7	1.7	11.0	O K
10080 min Summer	28.324	0.074	0.0	1.5	1.5	9.9	O K
15 min Winter	28.557	0.307	0.0	2.0	2.0	40.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	53.097	0.0	37.8	18
30 min Summer	34.506	0.0	49.1	33
60 min Summer	21.591	0.0	61.5	62
120 min Summer	13.202	0.0	75.2	122
180 min Summer	9.819	0.0	83.9	180
240 min Summer	7.948	0.0	90.5	240
360 min Summer	5.891	0.0	100.7	300
480 min Summer	4.760	0.0	108.5	362
600 min Summer	4.034	0.0	114.9	428
720 min Summer	3.524	0.0	120.5	496
960 min Summer	2.844	0.0	129.6	634
1440 min Summer	2.102	0.0	143.7	908
2160 min Summer	1.554	0.0	159.4	1296
2880 min Summer	1.255	0.0	171.6	1672
4320 min Summer	0.927	0.0	190.2	2376
5760 min Summer	0.747	0.0	204.3	3000
7200 min Summer	0.632	0.0	216.0	3680
8640 min Summer	0.551	0.0	226.1	4408
10080 min Summer	0.491	0.0	234.9	5144
15 min Winter	53.097	0.0	42.3	18

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	28.643	0.393	0.0	2.0	2.0	52.2	O K
60 min Winter	28.726	0.476	0.0	2.0	2.0	63.3	O K
120 min Winter	28.799	0.549	0.0	2.0	2.0	73.0	O K
180 min Winter	28.829	0.579	0.0	2.0	2.0	77.0	O K
240 min Winter	28.842	0.592	0.0	2.0	2.0	78.8	O K
360 min Winter	28.844	0.594	0.0	2.0	2.0	79.1	O K
480 min Winter	28.833	0.583	0.0	2.0	2.0	77.6	O K
600 min Winter	28.821	0.571	0.0	2.0	2.0	76.0	O K
720 min Winter	28.805	0.555	0.0	2.0	2.0	73.9	O K
960 min Winter	28.768	0.518	0.0	2.0	2.0	68.9	O K
1440 min Winter	28.686	0.436	0.0	2.0	2.0	58.0	O K
2160 min Winter	28.569	0.319	0.0	2.0	2.0	42.5	O K
2880 min Winter	28.471	0.221	0.0	2.0	2.0	29.3	O K
4320 min Winter	28.352	0.102	0.0	2.0	2.0	13.6	O K
5760 min Winter	28.332	0.082	0.0	1.6	1.6	11.0	O K
7200 min Winter	28.320	0.070	0.0	1.4	1.4	9.3	O K
8640 min Winter	28.311	0.061	0.0	1.2	1.2	8.2	O K
10080 min Winter	28.305	0.055	0.0	1.1	1.1	7.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	34.506	0.0	55.0	33
60 min Winter	21.591	0.0	68.9	62
120 min Winter	13.202	0.0	84.2	120
180 min Winter	9.819	0.0	94.0	176
240 min Winter	7.948	0.0	101.4	232
360 min Winter	5.891	0.0	112.8	340
480 min Winter	4.760	0.0	121.5	388
600 min Winter	4.034	0.0	128.7	464
720 min Winter	3.524	0.0	134.9	540
960 min Winter	2.844	0.0	145.2	692
1440 min Winter	2.102	0.0	161.0	982
2160 min Winter	1.554	0.0	178.5	1384
2880 min Winter	1.255	0.0	192.1	1732
4320 min Winter	0.927	0.0	213.0	2288
5760 min Winter	0.747	0.0	228.8	2992
7200 min Winter	0.632	0.0	241.9	3680
8640 min Winter	0.551	0.0	253.2	4416
10080 min Winter	0.491	0.0	263.1	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.380

Time (mins) From:	To:	Area (ha)
0	4	0.380

Model Details

Storage is Online Cover Level (m) 31.500

Cellular Storage Structure

Invert Level (m) 28.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	140.0	0.0	1.300	140.0	0.0
0.100	140.0	0.0	1.400	140.0	0.0
0.200	140.0	0.0	1.500	140.0	0.0
0.300	140.0	0.0	1.600	140.0	0.0
0.400	140.0	0.0	1.700	140.0	0.0
0.500	140.0	0.0	1.800	140.0	0.0
0.600	140.0	0.0	1.900	140.0	0.0
0.700	140.0	0.0	2.000	140.0	0.0
0.800	140.0	0.0	2.100	140.0	0.0
0.900	140.0	0.0	2.200	140.0	0.0
1.000	140.0	0.0	2.300	140.0	0.0
1.100	140.0	0.0	2.400	140.0	0.0
1.200	140.0	0.0	2.500	140.0	0.0

Pump Outflow Control

Invert Level (m) 28.250

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0000	0.900	2.0000	1.700	2.0000	2.500	2.0000
0.200	2.0000	1.000	2.0000	1.800	2.0000	2.600	2.0000
0.300	2.0000	1.100	2.0000	1.900	2.0000	2.700	2.0000
0.400	2.0000	1.200	2.0000	2.000	2.0000	2.800	2.0000
0.500	2.0000	1.300	2.0000	2.100	2.0000	2.900	2.0000
0.600	2.0000	1.400	2.0000	2.200	2.0000	3.000	2.0000
0.700	2.0000	1.500	2.0000	2.300	2.0000		
0.800	2.0000	1.600	2.0000	2.400	2.0000		

Summary of Results for 30 year Return Period

Half Drain Time : 674 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	28.780	0.530	0.0	2.0	2.0	70.5	O K
30 min Summer	28.928	0.678	0.0	2.0	2.0	90.1	O K
60 min Summer	29.065	0.815	0.0	2.0	2.0	108.4	O K
120 min Summer	29.182	0.932	0.0	2.0	2.0	123.9	O K
180 min Summer	29.238	0.988	0.0	2.0	2.0	131.4	O K
240 min Summer	29.268	1.018	0.0	2.0	2.0	135.3	O K
360 min Summer	29.288	1.038	0.0	2.0	2.0	138.1	O K
480 min Summer	29.281	1.031	0.0	2.0	2.0	137.2	O K
600 min Summer	29.263	1.013	0.0	2.0	2.0	134.7	O K
720 min Summer	29.244	0.994	0.0	2.0	2.0	132.2	O K
960 min Summer	29.206	0.956	0.0	2.0	2.0	127.2	O K
1440 min Summer	29.134	0.884	0.0	2.0	2.0	117.6	O K
2160 min Summer	29.030	0.780	0.0	2.0	2.0	103.8	O K
2880 min Summer	28.933	0.683	0.0	2.0	2.0	90.8	O K
4320 min Summer	28.760	0.510	0.0	2.0	2.0	67.8	O K
5760 min Summer	28.618	0.368	0.0	2.0	2.0	48.9	O K
7200 min Summer	28.509	0.259	0.0	2.0	2.0	34.4	O K
8640 min Summer	28.429	0.179	0.0	2.0	2.0	23.8	O K
10080 min Summer	28.378	0.128	0.0	2.0	2.0	17.0	O K
15 min Winter	28.845	0.595	0.0	2.0	2.0	79.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	101.239	0.0	72.1	19
30 min Summer	65.473	0.0	93.2	34
60 min Summer	40.257	0.0	114.7	64
120 min Summer	23.937	0.0	136.4	122
180 min Summer	17.563	0.0	150.1	182
240 min Summer	14.070	0.0	160.3	242
360 min Summer	10.271	0.0	175.6	360
480 min Summer	8.204	0.0	187.0	480
600 min Summer	6.888	0.0	196.2	548
720 min Summer	5.969	0.0	204.1	600
960 min Summer	4.758	0.0	216.9	722
1440 min Summer	3.453	0.0	236.1	982
2160 min Summer	2.503	0.0	256.7	1388
2880 min Summer	1.990	0.0	272.2	1788
4320 min Summer	1.441	0.0	295.5	2552
5760 min Summer	1.146	0.0	313.5	3288
7200 min Summer	0.960	0.0	328.2	3960
8640 min Summer	0.830	0.0	340.7	4592
10080 min Summer	0.735	0.0	351.7	5248
15 min Winter	101.239	0.0	80.7	19

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	29.012	0.762	0.0	2.0	2.0	101.3	O K
60 min Winter	29.169	0.919	0.0	2.0	2.0	122.2	O K
120 min Winter	29.305	1.055	0.0	2.0	2.0	140.3	O K
180 min Winter	29.374	1.124	0.0	2.0	2.0	149.5	O K
240 min Winter	29.413	1.163	0.0	2.0	2.0	154.7	O K
360 min Winter	29.448	1.198	0.0	2.0	2.0	159.4	O K
480 min Winter	29.453	1.203	0.0	2.0	2.0	160.0	O K
600 min Winter	29.441	1.191	0.0	2.0	2.0	158.4	O K
720 min Winter	29.419	1.169	0.0	2.0	2.0	155.5	O K
960 min Winter	29.366	1.116	0.0	2.0	2.0	148.4	O K
1440 min Winter	29.267	1.017	0.0	2.0	2.0	135.3	O K
2160 min Winter	29.113	0.863	0.0	2.0	2.0	114.7	O K
2880 min Winter	28.963	0.713	0.0	2.0	2.0	94.8	O K
4320 min Winter	28.700	0.450	0.0	2.0	2.0	59.8	O K
5760 min Winter	28.499	0.249	0.0	2.0	2.0	33.1	O K
7200 min Winter	28.373	0.123	0.0	2.0	2.0	16.3	O K
8640 min Winter	28.342	0.092	0.0	1.8	1.8	12.3	O K
10080 min Winter	28.332	0.082	0.0	1.6	1.6	10.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	65.473	0.0	104.4	33
60 min Winter	40.257	0.0	128.4	62
120 min Winter	23.937	0.0	152.8	120
180 min Winter	17.563	0.0	168.2	180
240 min Winter	14.070	0.0	179.6	238
360 min Winter	10.271	0.0	196.7	352
480 min Winter	8.204	0.0	209.5	464
600 min Winter	6.888	0.0	219.8	574
720 min Winter	5.969	0.0	228.6	678
960 min Winter	4.758	0.0	243.0	772
1440 min Winter	3.453	0.0	264.4	1070
2160 min Winter	2.503	0.0	287.5	1516
2880 min Winter	1.990	0.0	304.9	1932
4320 min Winter	1.441	0.0	331.1	2720
5760 min Winter	1.146	0.0	351.1	3392
7200 min Winter	0.960	0.0	367.6	3896
8640 min Winter	0.830	0.0	381.6	4416
10080 min Winter	0.735	0.0	393.9	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.380

Time (mins) From:	To:	Area (ha)
0	4	0.380

Model Details

Storage is Online Cover Level (m) 31.500

Cellular Storage Structure

Invert Level (m) 28.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	140.0	0.0	1.300	140.0	0.0
0.100	140.0	0.0	1.400	140.0	0.0
0.200	140.0	0.0	1.500	140.0	0.0
0.300	140.0	0.0	1.600	140.0	0.0
0.400	140.0	0.0	1.700	140.0	0.0
0.500	140.0	0.0	1.800	140.0	0.0
0.600	140.0	0.0	1.900	140.0	0.0
0.700	140.0	0.0	2.000	140.0	0.0
0.800	140.0	0.0	2.100	140.0	0.0
0.900	140.0	0.0	2.200	140.0	0.0
1.000	140.0	0.0	2.300	140.0	0.0
1.100	140.0	0.0	2.400	140.0	0.0
1.200	140.0	0.0	2.500	140.0	0.0

Pump Outflow Control

Invert Level (m) 28.250

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0000	0.900	2.0000	1.700	2.0000	2.500	2.0000
0.200	2.0000	1.000	2.0000	1.800	2.0000	2.600	2.0000
0.300	2.0000	1.100	2.0000	1.900	2.0000	2.700	2.0000
0.400	2.0000	1.200	2.0000	2.000	2.0000	2.800	2.0000
0.500	2.0000	1.300	2.0000	2.100	2.0000	2.900	2.0000
0.600	2.0000	1.400	2.0000	2.200	2.0000	3.000	2.0000
0.700	2.0000	1.500	2.0000	2.300	2.0000		
0.800	2.0000	1.600	2.0000	2.400	2.0000		

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

Half Drain Time : 1372 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.231	0.981	0.0	2.0	2.0	130.4	O K
30 min Summer	29.516	1.266	0.0	2.0	2.0	168.3	O K
60 min Summer	29.782	1.532	0.0	2.0	2.0	203.8	O K
120 min Summer	30.012	1.762	0.0	2.0	2.0	234.3	O K
180 min Summer	30.136	1.886	0.0	2.0	2.0	250.9	O K
240 min Summer	30.215	1.965	0.0	2.0	2.0	261.4	O K
360 min Summer	30.305	2.055	0.0	2.0	2.0	273.3	O K
480 min Summer	30.345	2.095	0.0	2.0	2.0	278.6	O K
600 min Summer	30.358	2.108	0.0	2.0	2.0	280.3	O K
720 min Summer	30.353	2.103	0.0	2.0	2.0	279.6	O K
960 min Summer	30.310	2.060	0.0	2.0	2.0	273.9	O K
1440 min Summer	30.187	1.937	0.0	2.0	2.0	257.6	O K
2160 min Summer	30.035	1.785	0.0	2.0	2.0	237.4	O K
2880 min Summer	29.906	1.656	0.0	2.0	2.0	220.2	O K
4320 min Summer	29.672	1.422	0.0	2.0	2.0	189.2	O K
5760 min Summer	29.463	1.213	0.0	2.0	2.0	161.4	O K
7200 min Summer	29.273	1.023	0.0	2.0	2.0	136.1	O K
8640 min Summer	29.101	0.851	0.0	2.0	2.0	113.2	O K
10080 min Summer	28.948	0.698	0.0	2.0	2.0	92.8	O K
15 min Winter	29.350	1.100	0.0	2.0	2.0	146.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	185.630	0.0	132.0	19
30 min Summer	120.567	0.0	167.1	34
60 min Summer	73.889	0.0	210.6	64
120 min Summer	43.472	0.0	247.8	124
180 min Summer	31.706	0.0	271.1	184
240 min Summer	25.287	0.0	288.2	242
360 min Summer	18.336	0.0	313.0	362
480 min Summer	14.573	0.0	329.8	482
600 min Summer	12.186	0.0	339.1	602
720 min Summer	10.523	0.0	339.3	720
960 min Summer	8.342	0.0	336.7	960
1440 min Summer	6.003	0.0	329.6	1200
2160 min Summer	4.312	0.0	442.4	1560
2880 min Summer	3.407	0.0	466.0	1960
4320 min Summer	2.442	0.0	501.1	2768
5760 min Summer	1.930	0.0	528.2	3576
7200 min Summer	1.609	0.0	550.2	4328
8640 min Summer	1.386	0.0	568.9	5096
10080 min Summer	1.222	0.0	585.2	5840
15 min Winter	185.630	0.0	147.3	19

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	29.671	1.421	0.0	2.0	2.0	189.0	O K
60 min Winter	29.972	1.722	0.0	2.0	2.0	229.1	O K
120 min Winter	30.237	1.987	0.0	2.0	2.0	264.3	O K
180 min Winter	30.384	2.134	0.0	2.0	2.0	283.8	O K
240 min Winter	30.479	2.229	0.0	2.0	2.0	296.5	O K
360 min Winter	30.593	2.343	0.0	2.0	2.0	311.6	O K
480 min Winter	30.652	2.402	0.0	2.0	2.0	319.4	O K
600 min Winter	30.680	2.430	0.0	2.0	2.0	323.2	O K
720 min Winter	30.688	2.438	0.0	2.0	2.0	324.3	O K
960 min Winter	30.668	2.418	0.0	2.0	2.0	321.6	O K
1440 min Winter	30.548	2.298	0.0	2.0	2.0	305.6	O K
2160 min Winter	30.343	2.093	0.0	2.0	2.0	278.4	O K
2880 min Winter	30.165	1.915	0.0	2.0	2.0	254.7	O K
4320 min Winter	29.820	1.570	0.0	2.0	2.0	208.8	O K
5760 min Winter	29.503	1.253	0.0	2.0	2.0	166.6	O K
7200 min Winter	29.215	0.965	0.0	2.0	2.0	128.4	O K
8640 min Winter	28.962	0.712	0.0	2.0	2.0	94.7	O K
10080 min Winter	28.746	0.496	0.0	2.0	2.0	65.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	120.567	0.0	172.2	33
60 min Winter	73.889	0.0	235.9	64
120 min Winter	43.472	0.0	277.5	122
180 min Winter	31.706	0.0	303.4	180
240 min Winter	25.287	0.0	321.8	240
360 min Winter	18.336	0.0	341.5	356
480 min Winter	14.573	0.0	341.1	474
600 min Winter	12.186	0.0	340.0	590
720 min Winter	10.523	0.0	339.0	702
960 min Winter	8.342	0.0	336.7	930
1440 min Winter	6.003	0.0	331.2	1356
2160 min Winter	4.312	0.0	495.5	1688
2880 min Winter	3.407	0.0	521.9	2136
4320 min Winter	2.442	0.0	561.0	3024
5760 min Winter	1.930	0.0	591.5	3864
7200 min Winter	1.609	0.0	616.1	4616
8640 min Winter	1.386	0.0	637.2	5360
10080 min Winter	1.222	0.0	655.6	6048

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)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.380

Time (mins) From:	To:	Area (ha)
0	4	0.380

Model Details

Storage is Online Cover Level (m) 31.500

Cellular Storage Structure

Invert Level (m) 28.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	140.0	0.0	1.300	140.0	0.0
0.100	140.0	0.0	1.400	140.0	0.0
0.200	140.0	0.0	1.500	140.0	0.0
0.300	140.0	0.0	1.600	140.0	0.0
0.400	140.0	0.0	1.700	140.0	0.0
0.500	140.0	0.0	1.800	140.0	0.0
0.600	140.0	0.0	1.900	140.0	0.0
0.700	140.0	0.0	2.000	140.0	0.0
0.800	140.0	0.0	2.100	140.0	0.0
0.900	140.0	0.0	2.200	140.0	0.0
1.000	140.0	0.0	2.300	140.0	0.0
1.100	140.0	0.0	2.400	140.0	0.0
1.200	140.0	0.0	2.500	140.0	0.0

Pump Outflow Control

Invert Level (m) 28.250

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0000	0.900	2.0000	1.700	2.0000	2.500	2.0000
0.200	2.0000	1.000	2.0000	1.800	2.0000	2.600	2.0000
0.300	2.0000	1.100	2.0000	1.900	2.0000	2.700	2.0000
0.400	2.0000	1.200	2.0000	2.000	2.0000	2.800	2.0000
0.500	2.0000	1.300	2.0000	2.100	2.0000	2.900	2.0000
0.600	2.0000	1.400	2.0000	2.200	2.0000	3.000	2.0000
0.700	2.0000	1.500	2.0000	2.300	2.0000		
0.800	2.0000	1.600	2.0000	2.400	2.0000		