FLOOD RISK ASSESSMENT

Fewcott Road, Fritwell

Prepared for: CALA Homes
Issue 1: 3 August 2016
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Document History

Issue	Date	Description	Prepared By	Checked By
1	3 Aug. 16	First Issue	A. Horswell	K. Rayner

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Glanville Consultants is a multi-disciplinary engineering, design and surveying consultancy with the following expertise:

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Appendices

1.0 Introduction

1.1 This Flood Risk Assessment has been prepared by Glanville Consultants on behalf of CALA Homes (Chiltern) Ltd in support of a planning application to develop land off Fewcott Road, Fritwell to provide 34 new homes.

1.2 The purpose of this document is to assess the existing level of flood risk to the site and its surroundings within the context of the development proposals and to outline a surface water drainage strategy.

1.3 This appraisal has been prepared in accordance with the National Planning Policy Framework (NPPF), dated March 2012, and the Planning Practice Guidance (PPG) to the NPPF, dated March 2014.

1.4 Local guidance concerning flood risk is provided within the Cherwell and West Oxfordshire Level 1 Strategic Flood Risk Assessment.

1.5 This assessment was undertaken with reference to publicly available information provided and/or published by the following bodies:

- Ordnance Survey;
- British Geological Survey;
- Buckinghamshire County Council;
- Aylesbury Vale District Council; and
- Environment Agency.

1.6 This report concludes that the site is at the lowest possible risk of flooding and can be developed safely without increasing flood risk elsewhere, and with due consideration to the potential effects of climate change.

2.0 Site Description and Proposed Development

Site Description

2.1 The site is located in the village of Fritwell, approximately 7km from Bicester which is located to the south east. The site is accessed from the north east corner via Fewcott Road. The site is bound by undeveloped land to the north, east and south and residential buildings to the west. The location of the site is shown on the plan included as Appendix A.

2.2 The approximate centre of the site is located at Ordnance Survey National Grid reference SP 52957 29070.

2.3 The site is approximately 1.2ha in area, and is currently used for agricultural purposes.

Topographical Survey

2.4 A copy of the detailed topographical survey of the site by Groundsurveys Ltd, drawing numbers 6028-01 and 6028-02 are included as Appendix B. The survey indicates that the site has an approximate falls to the south of the site with levels ranging from approximately 128.20m AOD to 125.20m AOD.

Existing Watercourses

2.5 There is a large pond located approximately 200m to the south west of the site. The closest main river, as classified by the Environment agency, is located 3.4km to the west.

2.6 The feasibility study for the site identifies ditches located along both the northern and southern boundaries.

Geological Characteristics

2.7 Geological maps published by the British Geological Survey (BGS) indicates that the site is underlain by bedrock geology of Great Oolite Group – Limestone and Argillaceous Rocks. The BGS mapping does not indicate any superficial geology underlying the site. Extract from the BGS online mapping are included in Appendix C for reference.

2.8 A borehole log located close to the proposed entrance to the site indicates geology of limestone, sand and mudstone.

2.9 An intrusive site investigation was undertaken by The Brownfield Consultancy in November 2015 (report ref BC195 L001/JT). The ground conditions were consistent with the BGS mapping, indicating Topsoil or Made Ground overlaying the Great Oolite Group. Their interpretive report also concluded that infiltration drainage would be feasible, subject to further testing to confirm design rates.

Groundwater Vulnerability

2.10 The EA publish on their website details of indicative Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. The Zones define areas where a range of human activities may damage/pollute groundwater. The site is not indicated to be located within a source protection zone.

Existing Surface Water Drainage

2.11 Drainage records obtained from Anglian Water are included as Appendix D. The records indicate a 300mm surface water sewer running through the middle of the site to an outfall located to the south east. A manhole is located within the site, approximately 25m from the eastern boundary.

2.12 The records show only those sewers that are known to be maintained by Thames Water, other privately owned sewers may be present in the vicinity of the site that are not shown on public records.

Proposed Development

2.13 It is proposed to develop the site to provide 34 dwellings with associated access roads, and hard and soft landscaping. A copy of the illustrative site layout for the proposed development is included within Appendix E.

3.0 Planning Policy and Guidance

3.1 Set out below is a summary of the national and local planning policy and guidance relating to flood risk and surface water management that are relevant to the development proposals.

National

3.2 At a national level, the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) to the NPPF ensure flood risk is taken into account at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development towards areas at lowest flood risk. The NPPF retains a risk based approach to the planning process and defines four Flood Zones to be used as the basis for applying the sequential test to consider a development in terms of Flood Risk Vulnerability Classifications, which define the type of development that is considered appropriate within each zone.

3.3 The NPPF establishes the Flood Zones as the starting point for assessment with the overarching aim to steer new development to areas with the lowest probability of flooding. The Flood Zones are defined as follows:

- Flood Zone 1 (Low Probability) comprises land assess as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).

- Flood Zone 2 (Medium Probability) comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

- Flood Zone 3a (High Probability) comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

- Flood Zone 3b (The Functional Floodplain) compromises land where water has to flow or be stored in times of flood.

Local Policy and Guidance

Cherwell District Council (CDC) and West Oxfordshire District Council (WODC) Strategic Flood Risk Assessment (SFRA), April 2009

3.4 This SFRA was produced by CDC and WODC to inform the planning process. The SFRA includes flood maps covering the entire district as well as strategic sites and key settlements. It also summarises the flood risk from each source of flooding in the districts.

3.5 The SFRA provides a reference and policy document to advise and inform developers of their obligations under the NPPF. The maps and accompanying report and guidance provide a sound framework enabling consistent and sustainable decisions to be made when making future planning decisions.

4.0 Flood Risk Assessment

4.1 This section of the report assesses flood risk at the site from all sources and including appropriate allowance for climate change required by relevant national and local planning policy.

Tidal

4.2 Given that there are no tidally influenced watercourses on or within the vicinity of the site it is considered that tidal flooding is not an issue that would prevent the development of the site for its intended end use.

Reservoir Flooding

4.3 The EA publishes indicative mapping on its website which shows the maximum extent of reservoir flooding in the unlikely event that a reservoir should fail. The mapping indicates the site is not at risk of reservoir flooding. The reservoir flood map is included as Appendix F.

Fluvial

4.4 The EA publishes Flood Zone mapping on its website which shows the maximum extent of fluvial flooding. The Flood Zone mapping indicates that the site lies entirely in Flood Zone 1. An extract from the EA mapping is included as Appendix F.

4.5 Table 1 of the Planning Practice Guidance to the NPPF defines land located within Flood Zone 1 as areas which are outside the floodplain and have little or no chance of flooding. These are areas with an indicative probability of flooding of 1 in 1,000 years or greater (i.e. less than 0.1% chance in any given year) from fluvial sources. As such, the majority of the development is considered to be at the lowest possible risk of fluvial sources.

4.6 Table 3 of the PPG to the NPPF confirms that all forms of development are appropriate for Flood Zone 1.

Surface Water

4.7 The EA publishes mapping on its website which indicates the predicted risk of surface water flooding in the event that rainwater does not drain away through normal drainage systems or soak into the ground. The mapping indicates that the entire site is at very low risk from surface water flooding. An extract from the EA's surface water flood map is included within Appendix F.

4.8 It should be noted that the EA mapping only provides a high level overview to indicate where there may be an increased risk and further investigation warranted.

4.9 There is no known evidence to indicate that the site has been affected by this form of flooding in the past.

Groundwater

4.10 The Cherwell and West Oxfordshire Level 1 SFRA considers the site to be materially affected by flooding from groundwater. Therefore it is reasonable to conclude that groundwater flooding is not an issue that would prevent the development of the site for its intended end use and no site-specific mitigation measures are anticipated to be required.

Sewer

4.11 The Cherwell and West Oxfordshire Level 1 SFRA does not record any form of sewer flooding within or in the vicinity of the site, and there is no known evidence to indicate that the site is at risk of flooding from these sewers. It is reasonable to conclude that sewer flooding is not an issue that would prevent the development of the site for its intended end use.

4.12 Therefore it is reasonable to conclude that the risk of sewer flooding to the site is low and is not an issue that would prevent the development of the site for its intended end use.

Historic Flooding

4.13 The Cherwell and West Oxfordshire Level 1 SFRA does not record any historical flood incidence occurring in or around the site.

Summary

4.14 The site is considered to be at low risk from all sources of flooding examined.

5.0 Flood Risk Assessment

5.1 Table 2 of the PPG to the NPPF categorises different types of development into five flood risk vulnerability classifications:

- Essential Infrastructure;
- Highly Vulnerable;
- More Vulnerable;
- Less Vulnerable; and
- Water Compatible Development.

5.2 The NPPF encourages a sequential, risk based approach to determine the suitability of land for development. This document advises that the development of sites within Flood Zone 1 should be given preference where available. Table 3 of the PPG to the NPPF advises that all land uses are appropriate in Flood Zone 1.

Consideration for Flood Risk Mitigation Measures

5.3 Given that the development is located within Flood Zone 1, the lowest risk of flood zone, flood compensation or resilience measures will not be required to mitigate against the risk of fluvial flooding.

5.4 A review of sources of potential flooding in Section 4 of this assessment has also concluded that there is a low risk from all other sources examined.

5.5 Given that the development is located wholly within an area outside of the floodplain and is not located within an EA defined dry island, the site is accessible to other areas outside of the floodplain in times of flooding.

6.0 Surface Water Drainage

6.1 The PPG recommends that priority should be given to the use of sustainable drainage systems as they are designed to control surface water run-off where it falls and mimic natural drainage as closely as possible. Sustainable drainage systems also provide opportunities for the following:

- Reduce the causes and impacts of flooding;
- Remove pollutants from urban run-off at source; and
- Combine water management with green space with benefits for amenity, recreation and wildlife.

6.2 SuDS encompass a wide range of drainage techniques intended to minimise the rate of discharge, volume and environmental impact of run-off and include:

- Permeable pavements;
- Swales and basins;
- Green roofs and rainwater reuse;
- Infiltration trenches and filter drains; and
- Ponds and wetlands.

6.3 Infiltration based techniques are high up in the hierarchy of techniques available due to the ability for close to source dispersion of surface water. These techniques are considered the closest solution to mimic the natural drainage of undeveloped sites.

6.4 Sustainable infiltration techniques include the use of permeable paving (typically 30% void volume), lined soakaways and crated (geocellular) soakaways. When used across a site these techniques control the rate of discharge, attenuate flow, provide storage and recharge groundwater. Storage capacity within infiltration and attenuation schemes can be increased with the use of geocellular storage crates (typically 95% void volume).

6.5 As well as allowing infiltration and attenuation, permeable paving also degrades pollutants such as hydrocarbons, which thereby improves the quality of surface water to ground.

6.6 The Building Regulations part H3 stipulates that rainwater from roofs and paved areas is carried away from surface to discharge to one of the following, listed in order of priority:

a) an adequate soakaway or some other adequate infiltration system; where that is not practical;
b) a watercourse; or, where that is not practical
c) a sewer.

<u>Proposed Surface Water Drainage Strategy</u>

6.7 As discussed in Section 2, the site is underlain by a bedrock geology Great Oolite Group, Limestone. The use of infiltration drainage techniques is therefore considered feasible as a means of draining surface water from the proposed development.

6.8 An intrusive site investigation was undertaken by The Brownfield Consultancy. Their interpretive report (ref BC195 L001/JT) concluded that infiltration drainage would be feasible, subject to further testing to confirm design rates.

6.9 At the detailed design stage infiltration testing and rates on the site will be calculated in accordance with the guidance given in BRE Digest 365. The estimated size of the infiltration devices included in this proposed drainage strategy assumes that the underlying ground conditions will support infiltration at a relatively conservative rate of $2x10^{-5}$ m/s.

6.10 The proposed strategy will utilise sustainable drainage techniques in accordance with the guidance described in Ciria C753. The strategy employs the use of paving with a voided (porous) subbase to facilitate the discharge of surface water by infiltration to the underlying soil strata. A copy of the surface water drainage strategy is included in Appendix G.

6.11 Permeable paving is identified in the SuDS manual as improving water quality and providing treatment as runoff percolates through the layers of the system.

6.12 All SuDS features will be designed to accommodate surface water runoff from all rainfall events up to and including the 1 in 100 year event, including a 30% increase in rainfall intensity as allowance for the potential effects of climate change.

6.13 Copies of associated MicroDrainage calculations are provided in Appendix H. These demonstrate that the SuDS features provide storage for the 1 in 100 + 30% climate change storm event without flooding from surface water.

6.14 In the strategy, porous paved driveways and roads will discharge surface water run-off from their own footprint by infiltration to ground. For the purpose of sizing, a 20m long, 4.8m wide section of road has been used.

6.15 The site is generally flat, with a slight fall from north to south. In order to provide maximum infiltration and attenuation the formation of the porous paving will be level.

6.16 Domestic soakaways will be used to drain roof areas. These will be located at minimum of 5m from dwellings as per building regulations.

6.17 Water butts will be used to collect rainwater from the roofs of all dwellings; these structures will provide additional attenuation and water for reuse (irrigation of private gardens).

Pollution Control Measures

6.18 CIRIA 156 Infiltration Drainage – Manual of Good Practice suggests that surface water runoff from roofs and public amenity areas are permissible without pollution control measures. The use of permeable paving to drain the site means that no pollution control measures are anticipated.

7.0 Summary and Conclusions

Summary

7.1 This document includes an assessment of the existing level of flood risk to the site and its surroundings within the context of the development proposals and includes a proposed surface water drainage strategy for the site once developed.

7.2 This assessment has been prepared in accordance with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), and with reference to the Oxford City Council Strategic Flood Risk Assessment.

7.3 The development is not considered to be at risk from any potential sources of flooding.

7.4 The development is located within Flood Zone 1, which the NPPF considers to be the most suitable zone for residential development in terms of flood risk.

7.5 The proposed strategy utilises sustainable drainage techniques in accordance with the guidance described in Ciria C753 and employs the use of soakaways and porous paving to facilitate the discharge of surface water by infiltration to the underlying soil strata.

7.6 Proposed infiltration features will provide storage for the 1 in 100 + 30% climate change storm event without flooding from surface water. As a consequence of the proposed development there shall therefore be no on site or off site increase in flood risk to properties.

7.7 Intrusive investigations will be undertaken to confirm infiltration rates at the appropriate stage of the planning process.

Conclusion

7.8 In conclusion, this report has demonstrated that the proposed residential development:

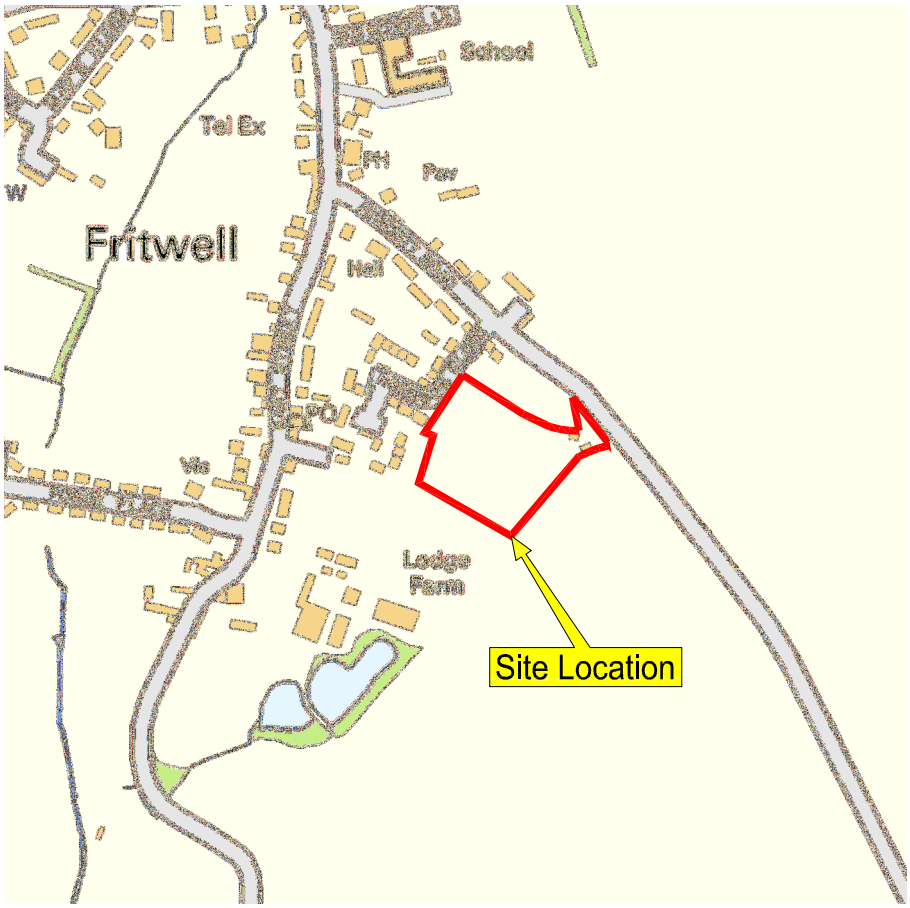
- is in accordance with the National Planning Policy Framework;
- will not be at an unacceptable risk from fluvial flooding;
- will not increase flood risk elsewhere; and
- will employ a surface water drainage strategy based on the principles of sustainable drainage.

7.9 On this basis, the proposals are considered to fully comply with National, Regional and Local planning policy.

Appendices

Appendix A

Location Plan



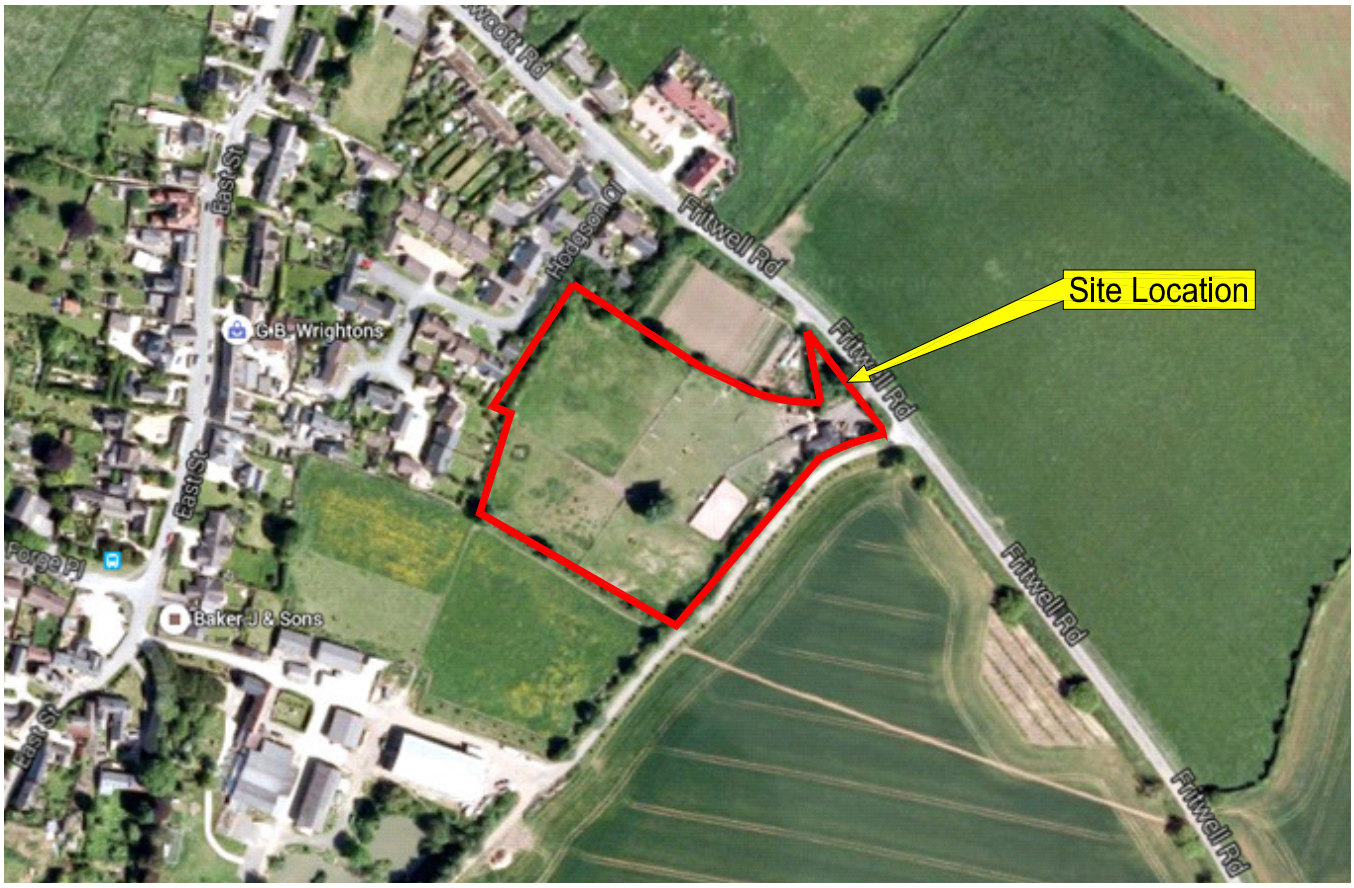
NOTES

1. This drawing is to be read in conjunction with all relevant documents and specifications.
2. Dimensions not to be scaled.

LOCATION

Address: Fewcott Road
Fritwell
Oxfordshire
OX27 7QA

Grid reference: SP 52957 29070



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Project :	Fewcott Road, Fritwell				
Title :	Site Location Plan				
Project Engineer :		Scale :	N.T.S	Drawing No. Appendix A	Rev -
Project Director :	K. Rayner	Date :	June 2016		

Appendix B

Topographical Survey

LEGEND

FEATURE STYLES

SURVEY CONTROL
FENCE
HEDGE
FWS
SWS
WATER
POWER LINE (OVERHEAD)
TELECOM LINE (OVERHEAD)
ELECTRIC MAIN
GAS MAIN
EMBANKMENT

FEATURE ABREVIATIONS

AV	Air Valve
BS	Bus Stop
BT	British Telecom
BW	Brick Wall
CB	Conc Bollard
CL	Cover Level
CTO	cable TV outlet
EB	Electric Box
EC	Electric Cover
EP	Electricity Pole
FH	Fire Hydrant
FL	Floor level
G	Gully
GM	Gas Meter
GV	Gas Valve
IL	Invert Level
IC	Inspection Chamber
KLS	Keep Left Sign
KO	Kerb Offset
LB	Letter Box
LP	Lamp Post
MKR	Marker
MP	Metal Post
MH	Manhole
MB	Metal Bollard
P	Post
PI	Petrol Interceptor
RG	Road Gully
RNB	Road Name Board
RS	Road Sign
RW	Retaining Wall
SA	Soakaway
SC	Stopcock
SV	Sluice Valve
TP	Telegraph Pole
TCB	Telephone Box
TJB	Tel.Junc.Box
TL	Traffic Light
V	Valve
VP	Vent Pipe
WL	Water Level
WM	Water Meter
WO	Water Outlet
WV	Water Valve

FENCE TYPES

BWR	Barbed Wire
CB	Close Board
CI	Corrugated Iron
CL	Chain Link
CPL	Conc Panel
CP	Chestnut Paling
CW	Chicken Wire
IW	Interwoven
IR	Iron Railing
OB	Openboard
PR	Post and rail
PW	Post and Wire

DATUM
GRID – ORDNANCE SURVEY NATIONAL GRID (OSTN02)
LEVELS – ORDNANCE SURVEY (OSGM02)

SURVEY CONTROL

STN	-E-	-N-	-Z-
1	453098.798	229038.354	127.100
2	453045.301	229093.712	126.744
3	452946.238	229192.346	128.894
4	452980.212	229165.128	128.285
5	452997.564	229152.205	127.922
6	453021.184	229133.381	127.537
7	453061.771	229073.692	126.657
8	453035.424	229089.210	126.369
9	453017.653	229079.663	126.189
10	453003.942	229069.623	125.814
11	452995.371	229043.822	125.588
12	452976.260	229025.033	125.383
13	452958.114	229006.157	125.840
14	452973.618	228999.991	124.897
15	452919.379	229034.302	126.413
16	452896.099	229046.709	126.808
17	452889.960	229084.231	127.344
18	452896.154	229087.128	127.622
19	452918.782	229134.633	128.101
20	452921.059	229145.340	128.283
21	452911.774	229137.000	128.131
22	452939.571	229132.278	127.785
23	452912.952	229151.726	128.383
24	452916.243	229162.762	128.544
25	452891.203	229121.823	128.202
26	453032.567	229063.815	125.661
27	453017.004	229050.181	125.355
28	453002.595	229032.302	125.034
29	452989.268	229013.878	124.920
30	452963.877	228986.222	124.642

NOTES

Surveyed boundaries are not necessarily the site legal boundaries. Client should refer to the relevant Land Registry document for confirmation of title.

Drainage and service covers that were buried, obscured or not visible at the time of the survey cannot be shown. Sewer connections between manholes are assumed to be straight and only pipes visible from the cover are shown.

Tree canopy measured values are written as maximum spreads.
Tree species and condition to be confirmed by an arboriculturist

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CLIENT

CALA HOMES (CHILTERN) LTD

SITE

FEWCOTT ROAD
FRITWELL
OX27

TITLE

SITE SURVEY

AS EXISTING

SCALE	DATE
1/200 (A0)	MAY 2015
DRAWING No. 01	JOB No. 6028

TREE SCHEDULE

TREE	GIRTH	HEIGHT	SPREAD	SPECIES
1	0.7	6.0	3.0	PURPLE PRUNUS
2	3X0.5	12.0	5.0	ASH
3	3X0.5	12.0	5.0	ASH
4	2X0.4	8.0	6.0	ASH
5	MB	12.0	5.0	FIELD MAPLE
6	MB	12.0	5.0	ELM
7	5X0.4	10.0	5.0	FIELD MAPLE
8	0.6	9.0	3.0	ELM
9	MB	10.0	5.0	ASH
10	0.4	10.0	3.0	HAWTHORN
11	0.4	8.0	3.0	HAZEL
12	MB	8.0	5.0	HAZEL
13	MB	7.0	3.0	PRUNUS
14	MB	7.0	3.0	PRUNUS
15	10X0.7	15.0	7.0	MAPLE
16	1.5	13.0	7.0	ASH
17	1.5	13.0	5.0	ASH
18	1.0	12.0	5.0	ASH
19	2.6	13.0	6.0	OAK
20	MB	7.0	3.5	MAPLE
21	0.6	9.0	3.5	ASH
22	0.4	7.0	2.5	ELM
23	0.4	7.0	2.5	ELM
24	0.4	6.0	1.5	HAWTHORN
25	0.6	6.0	2.0	HAWTHORN
26	0.6	4.0	1.5	HAWTHORN
27	0.4	6.0	2.0	HAZEL
28	0.4/0.6	6.0	2.5	HAZEL
29	MB	4.0	2.0	HAWTHORN
30	0.6	5.0	2.0	PRUNUS
31	2X0.7	8.0	3.5	PRUNUS
32	2X0.8	10.0	5.0	MAPLE
33	0.9	7.0	3.0	ELDER
34	MB	6.0	3.5	HAWTHORN
35	2.6	15.0	9.0	MAPLE
36	1.4	13.0	6.5	WILLOW
37	1.4	16.0	6.0	MAPLE
38	1.6	16.0	7.0	MAPLE
39	0.4	9.0	2.0	PRUNUS
40	0.6	9.0	3.0	PRUNUS
41	0.7	9.0	3.0	PRUNUS
42	3X0.4	6.0	2.0	HAZEL
43	0.4	6.0	1.5	SPRUCE
44	3X0.4	8.0	3.0	MAPLE
45	0.5	6.0	2.0	SILVER BIRCH
46	0.4	6.0	2.0	SILVER BIRCH
47	0.4	6.0	2.0	SILVER BIRCH
48	0.4	5.0	2.0	MAPLE
49	2X0.6	8.0	4.0	MAPLE
50	MB	9.0	5.0	HAWTHORN

TREE SCHEDULE

TREE	GIRTH	HEIGHT	SPREAD	SPECIES
51	0.4/2X0.6	9.0	5.0	MAPLE
52	MB	6.0	3.5	ELDER
53	3X1.4	16.0	7.0	ASH
54	1.6	15.0	7.0	ASH
55	0.7	6.0	3.0	OAK
56	0.7	10.0	4.0	PRUNUS
57	2X0.6	12.0	4.0	FIELD MAPLE
58	0.4	6.0	2.0	BEECH
59	0.7	9.0	4.0	FIELD MAPLE
60	0.4	8.0	3.0	FIELD MAPLE
61	0.5	10.0	4.0	BEECH
62	0.7	8.0	4.0	FIELD MAPLE
63	0.7	9.0	4.0	FIELD MAPLE
64	0.6	7.0	3.0	WHITEBEAM
65	0.6	9.0	3.0	PRUNUS
66	0.6	9.0	4.0	FIELD MAPLE
67	0.5	10.0	5.0	FIELD MAPLE
68	MB	10.0	5.0	HAWTHORN
69	0.7	9.0	5.0	HAWTHORN
70	MB	9.0	5.0	HAWTHORN
71	2X0.5	10.0	3.0	FIELD MAPLE
72	0.6	10.0	3.0	FIELD MAPLE
73	3X0.4	10.0	3.0	FIELD MAPLE
74	0.4	10.0	3.0	FIELD MAPLE
75	0.6	10.0	4.0	FIELD MAPLE
76	0.6	8.0	4.0	PRUNUS
77	0.5	8.0	2.0	PRUNUS
78	0.5	8.0	3.0	FIELD MAPLE
79	0.5	9.0	4.0	PRUNUS
80	2X0.4	8.0	3.0	ASH
81	0.4	8.0	3.0	FIELD MAPLE
82	0.5	8.0	3.0	PRUNUS
83	2.0	13.0	5.0	ASH
84	0.6	9.0	3.0	PRUNUS
85	0.6	5.0	2.5	WALNUT
86	2X0.4	5.0	2.0	WALNUT
87	2X0.4	5.0	3.0	WALNUT
88	1.3	12.0	5.0	FIELD MAPLE
89	0.5	4.0	2.0	WALNUT
90	0.5	4.0	2.0	WALNUT
91	0.4	3.0	2.0	WALNUT
92	0.7	4.0	3.0	WALNUT
93	0.4	4.0	2.0	WALNUT
94	0.4	9.0	2.5	ASH
95	0.4	9.0	2.5	ASH
96	0.4	8.0	3.0	WALNUT
97	0.5	9.0	4.0	WALNUT
98	0.4	12.0	3.0	FIELD MAPLE
99	1.1	14.0	7.0	ASH
100	2X1.0	14.0	4.0	FIELD MAPLE

TREE SCHEDULE

TREE	GIRTH	HEIGHT	SPREAD	SPECIES
101	2X0.7	9.0	2.5	HAWTHORN
102	0.5	9.0	4.0	ASH
103	0.6	6.0	3.0	SPRUCE
104	0.5	6.0	2.5	WALNUT
105	0.5	6.0	3.0	FIELD MAPLE
106	MB	9.0	3.0	HAWTHORN

TREE SCHEDULE				
TREE	GIRTH	HEIGHT	SPREAD	SPECIES
1	0.7	6.0	3.0	PURPLE PRUNUS
2	3X0.5	12.0	5.0	ASH
3	3X0.5	12.0	5.0	ASH
4	2X0.4	8.0	6.0	ASH
5	MB	12.0	5.0	FIELD MAPLE
6	MB	12.0	5.0	ELM
7	5X0.4	10.0	5.0	FIELD MAPLE
8	0.6	9.0	3.0	ELM
9	MB	10.0	5.0	ASH
10	0.4	10.0	3.0	HAWTHORN
11	0.4	8.0	3.0	HAZEL
12	MB	8.0	5.0	HAZEL
13	MB	7.0	3.0	PRUNUS
14	MB	7.0	3.0	PRUNUS
15	10X0.7	15.0	7.0	MAPLE
16	1.5	13.0	7.0	ASH
17	1.5	13.0	5.0	ASH
18	1.0	12.0	5.0	ASH
19	2.6	13.0	6.0	OAK
20	MB	7.0	3.5	MAPLE
21	0.6	9.0	3.5	ASH
22	0.4	7.0	2.5	ELM
23	0.4	7.0	2.5	ELM
24	0.4	6.0	1.5	HAWTHORN
25	0.6	6.0	2.0	HAWTHORN
26	0.6	4.0	1.5	HAWTHORN
27	0.4	6.0	2.0	HAZEL
28	0.4/0.6	6.0	2.5	HAZEL
29	MB	4.0	2.0	HAWTHORN
30	0.6	5.0	2.0	PRUNUS
31	2X0.7	8.0	3.5	PRUNUS
32	2X0.8	10.0	5.0	MAPLE
33	0.9	7.0	3.0	ELDER
34	MB	6.0	3.5	HAWTHORN
35	2.6	15.0	9.0	MAPLE
36	1.4	13.0	6.5	WILLOW
37	1.4	16.0	6.0	MAPLE
38	1.6	16.0	7.0	MAPLE
39	0.4	9.0	2.0	PRUNUS
40	0.6	9.0	3.0	PRUNUS
41	0.7	9.0	3.0	PRUNUS
42	3X0.4	6.0	2.0	HAZEL
43	0.4	6.0	1.5	SPRUCE
44	3X0.4	8.0	3.0	MAPLE
45	0.5	6.0	2.0	SILVER BIRCH
46	0.4	6.0	2.0	SILVER BIRCH
47	0.4	6.0	2.0	SILVER BIRCH
48	0.4	5.0	2.0	MAPLE
49	2X0.6	8.0	4.0	MAPLE
50	MB	9.0	5.0	HAWTHORN

TREE SCHEDULE				
TREE	GIRTH	HEIGHT	SPREAD	SPECIES
51	0.4/2X0.6	9.0	5.0	MAPLE
52	MB	6.0	3.5	ELDER
53	3X1.4	16.0	7.0	ASH
54	1.6	15.0	7.0	ASH
55	0.7	6.0	3.0	OAK
56	0.7	10.0	4.0	PRUNUS
57	2X0.6	12.0	4.0	FIELD MAPLE
58	0.4	6.0	2.0	BEECH
59	0.7	9.0	4.0	FIELD MAPLE
60	0.4	8.0	3.0	FIELD MAPLE
61	0.5	10.0	4.0	BEECH
62	0.7	8.0	4.0	FIELD MAPLE
63	0.7	9.0	4.0	FIELD MAPLE
64	0.6	7.0	3.0	WHITEBEAM
65	0.6	9.0	3.0	PRUNUS
66	0.6	9.0	4.0	FIELD MAPLE
67	0.5	10.0	5.0	FIELD MAPLE
68	MB	10.0	5.0	HAWTHORN
69	0.7	9.0	5.0	HAWTHORN
70	MB	9.0	3.0	HAWTHORN
71	2X0.5	10.0	3.0	FIELD MAPLE
72	0.6	10.0	3.0	FIELD MAPLE
73	3X0.4	10.0	3.0	FIELD MAPLE
74	0.4	10.0	3.0	FIELD MAPLE
75	0.6	10.0	4.0	FIELD MAPLE
76	0.6	8.0	4.0	PRUNUS
77	0.5	8.0	2.0	PRUNUS
78	0.5	8.0	3.0	FIELD MAPLE
79	0.5	9.0	4.0	PRUNUS
80	2X0.4	8.0	3.0	ASH
81	0.4	8.0	3.0	FIELD MAPLE
82	0.5	8.0	3.0	PRUNUS
83	2.0	13.0	5.0	ASH
84	0.6	9.0	3.0	PRUNUS
85	0.6	5.0	2.5	WALNUT
86	2X0.4	5.0	2.0	WALNUT
87	2X0.4	5.0	3.0	WALNUT
88	1.3	12.0	5.0	FIELD MAPLE
89	0.5	4.0	2.0	WALNUT
90	0.5	4.0	2.0	WALNUT
91	0.4	3.0	2.0	WALNUT
92	0.7	4.0	3.0	WALNUT
93	0.4	4.0	2.0	WALNUT
94	0.4	9.0	2.5	ASH
95	0.4	9.0	2.5	ASH
96	0.4	8.0	3.0	WALNUT
97	0.5	9.0	4.0	WALNUT
98	0.4	12.0	3.0	FIELD MAPLE
99	1.1	14.0	7.0	ASH
100	2X1.0	14.0	4.0	FIELD MAPLE

TREE SCHEDULE				
TREE	GIRTH	HEIGHT	SPREAD	SPECIES
101	2X0.7	9.0	2.5	HAWTHORN
102	0.5	9.0	4.0	ASH
103	0.6	6.0	3.0	SPRUCE
104	0.5	6.0	2.5	WALNUT
105	0.5	6.0	3.0	FIELD MAPLE
106	MB	9.0	3.0	HAWTHORN

LEGEND

FEATURE STYLES

SURVEY CONTROL
FENCE
HEDGE
FWS
SWS
WATER
POWER LINE (OVERHEAD)
TELECOM LINE (OVERHEAD)
ELECTRIC MAIN
GAS MAIN
EMBANKMENT

FENCE TYPES

BWR Barbed Wire
CB Close Board
CI Corrugated Iron
CL Chain Link
CPL Conc Panel
CP Chestnut Paling
CW Chicken Wire
IW Interwoven
IR Iron Railing
OB Openboard
PR Post and rail
PW Post and Wire

FEATURE ABREVIATIONS

AV Air Valve
BS Bus Stop
BT British Telecom
BW Brick Wall
CB Conc Bollard
CL Cover Level
CTO cable TV outlet
EB Electric Box
EC Electric Cover
EP Electricity Pole
FH Fire Hydrant
FL Floor level
G Gully
GM Gas Meter
GV Gas Valve
IL Invert Level
IC Inspection Chamber
KLS Keep Left Sign
KO Kerb Offset
LB Letter Box
LP Lamp Post
MKR Marker
MP Metal Post
MH Manhole
MB Metal Bollard
P Post
PI Petrol Interceptor
RG Road Gully
RNB Road Name Board
RS Road Sign
RW Retaining Wall
SA Soakaway
SC Stopcock
SV Sluice Valve
TP Telegraph Pole
TCB Telephone Box
TJB Tel.Junc.Box
TL Traffic Light
V Valve
VP Vent Pipe
WL Water Level
WM Water Meter
WO Water Outlet
WV Water Valve

DATUM
GRID – ORDNANCE SURVEY NATIONAL GRID (OSTN02)
LEVELS – ORDNANCE SURVEY (OSGM02)

SURVEY CONTROL			
STN	-E-	-N-	-Z-
1	453098.798	229038.354	127.100
2	453045.301	229093.712	126.744
3	452946.238	229192.346	128.894
4	452980.212	229165.128	128.285
5	452897.564	229152.205	127.922
6	453021.184	229133.381	127.537
7	453061.771	229073.692	126.657
8	453035.424	229089.210	126.369
9	453017.653	229079.663	126.189
10	453003.942	229069.623	125.814
11	452995.371	229043.822	125.588
12	452976.260	229025.033	125.383
13	452958.114	229006.157	125.840
14	452973.618	228999.991	124.897
15	452919.379	229034.302	126.413
16	452896.099	229046.709	126.808
17	452889.960	229064.231	127.344
18	452896.154	229087.128	127.622
19	452918.782	229134.633	128.101
20	452921.059	229145.340	128.283
21	452911.774	229137.002	128.131
22	452939.571	229132.278	127.785
23	452912.952	229151.726	128.383
24	452916.243	229162.762	128.544
25	452891.203	229121.823	128.202
26	453032.567	229063.815	125.661
27	453017.004	229050.181	125.355
28	453002.595	229032.302	125.034
29	452989.268	229013.878	124.920
30	452963.877	228986.222	124.642

NOTES

Surveyed boundaries are not necessarily the site legal boundaries. Client should refer to the relevant Land Registry document for confirmation of title.

Drainage and service covers that were buried, obscured or not visible at the time of the survey cannot be shown. Sewer connections between manholes are assumed to be straight and only pipes visible from the cover are shown.

Tree canopy measured values are written as maximum spreads. Tree species and condition to be confirmed by an arboriculturist

SURVEYED BY
groundsurveys ltd
land & engineering surveyors

units 9&10
woodlands farm
spring lane
cookham dean
berkshire
SL6 9PN

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www.groundsurveys.com

CLIENT

CALA HOMES (CHILTERN) LTD

SITE

FEWCOTT ROAD
FRITWELL
OX27

TITLE

SITE SURVEY

AS EXISTING

SCALE 1/200 (A0)	DATE MAY 2015
DRAWING No. 02	JOB No. 6028

Appendix C

British Geological Survey Mapping Extracts

KEY

Approximate site boundary

Bedrock Geology

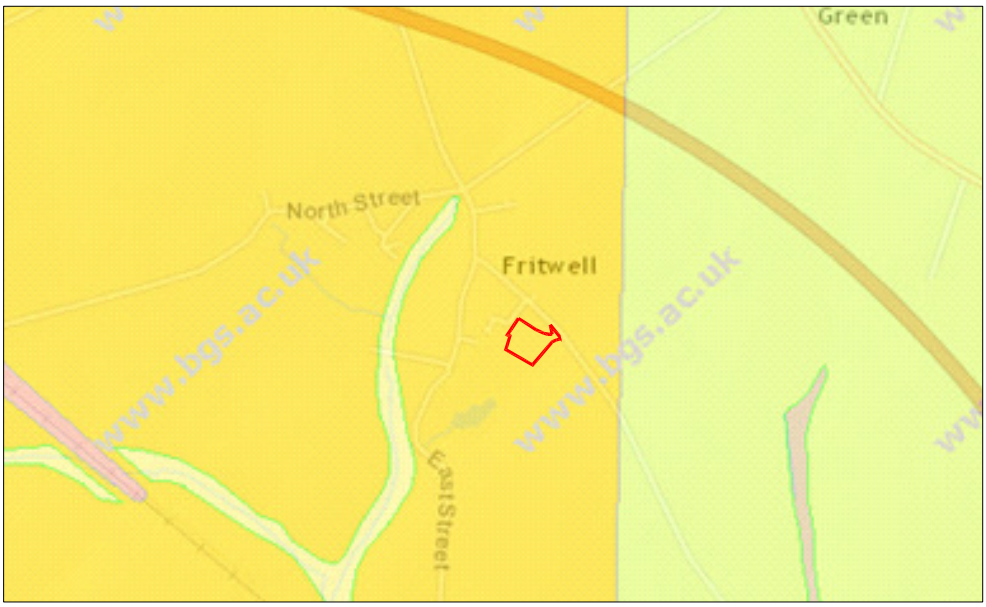
Great Oolite Group - Limestone and Argillaceous Rocks

N

NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing

Bedrock Geology



Superficial Deposits

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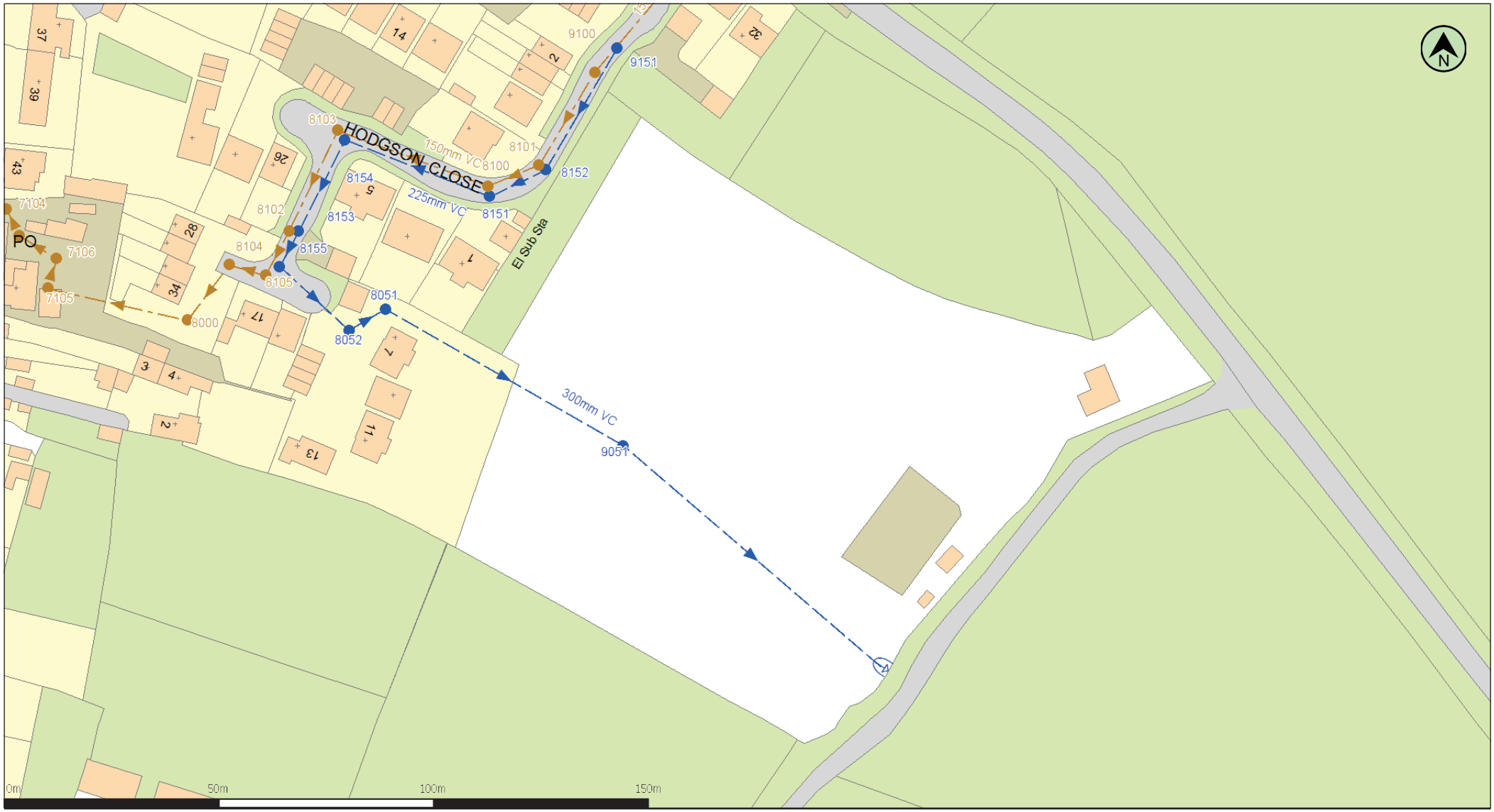
Project :	Fewcott Road, Fritwell		
Title :	British Geological Survey Mapping Extract		
Project Engineer :	Scale : NTS	Drawing No. Appendix C	Rev –
Project Director : K. Rayner	Date : June 2016		

Appendix D

Anglian Water Records



(c) Crown copyright and database rights 2016 Ordnance Survey 100022432 | Date: 15/06/16 | Scale: 1:1250 | Map Centre: 452945,229073 | Data updated: 04/12/15 | Our Ref: 188740 - 1 | Wastewater Plan A4

- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Rising Main (Colour denotes effluent type)
- Private Sewer (Colour denotes effluent type)
- Decommissioned Sewer (Colour denotes effluent type)
- Outfall (Colour denotes effluent type)
- Inlet (Colour denotes effluent type)
- Manhole (Colour denotes effluent type)
- Sewage Treatment Works
- Pumping Station

dwigston@glanvillegroup.com

CV8160423

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
7103	F	127.3	125.035	2.265
7104	F	127.3	124.989	2.311
7105	F	127.81	125.183	2.627
7106	F	127.77	125.129	2.641
8000	F	128.2	125.454	2.746
8100	F	128.3	126.325	1.975
8101	F	128.2	126.445	1.755
8102	F	128.2	125.766	2.434
8103	F	128.6	125.94	2.66
8104	F	128.36	126.586	1.774
8105	F	128.1	126.652	1.448
9100	F	128.4	126.7	1.7
8051	S	128	125.701	2.299
8052	S	128.15	125.784	2.366
8151	S	128.3	126.625	1.675
8152	S	128.2	126.75	1.45
8153	S	128.2	125.065	3.135
8154	S	128.6	126.24	2.36
8155	S	128.1	126.025	2.075
9051	S	126.7	125.195	1.505
9151	S	128.5	127	1.5

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix E

Design Proposals

No.	DATE	DESCRIPTION
A	27.07.15	Revised for Sewer Easement
B	22.09.15	Revised following tree survey
C	27.10.15	Revised for house types
D	03.12.15	Revised Following Technical Note
E	07.12.15	Revised Following Technical Note
F	14.12.15	Layout Amendment
G	21.01.16	Layout Amendment
H	25.01.16	Layout Amendment
J	18.04.16	Layout Amendment, Gas Tanks Shown
K	18.05.16	Plot 12/13 detached - Tree removed
L	25.05.16	Revied following P.B Comments

CALA HOMES
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FEWCOTT ROAD, FRITWELL

FEASIBILITY STUDY

1 : 500 @ A2

Scale (@ A2) 1 : 500	Dwg No. SK.01
Date 03.06.15	Rev L
Drawn T. McEwen	

Appendix F

Environment Agency Map Extracts

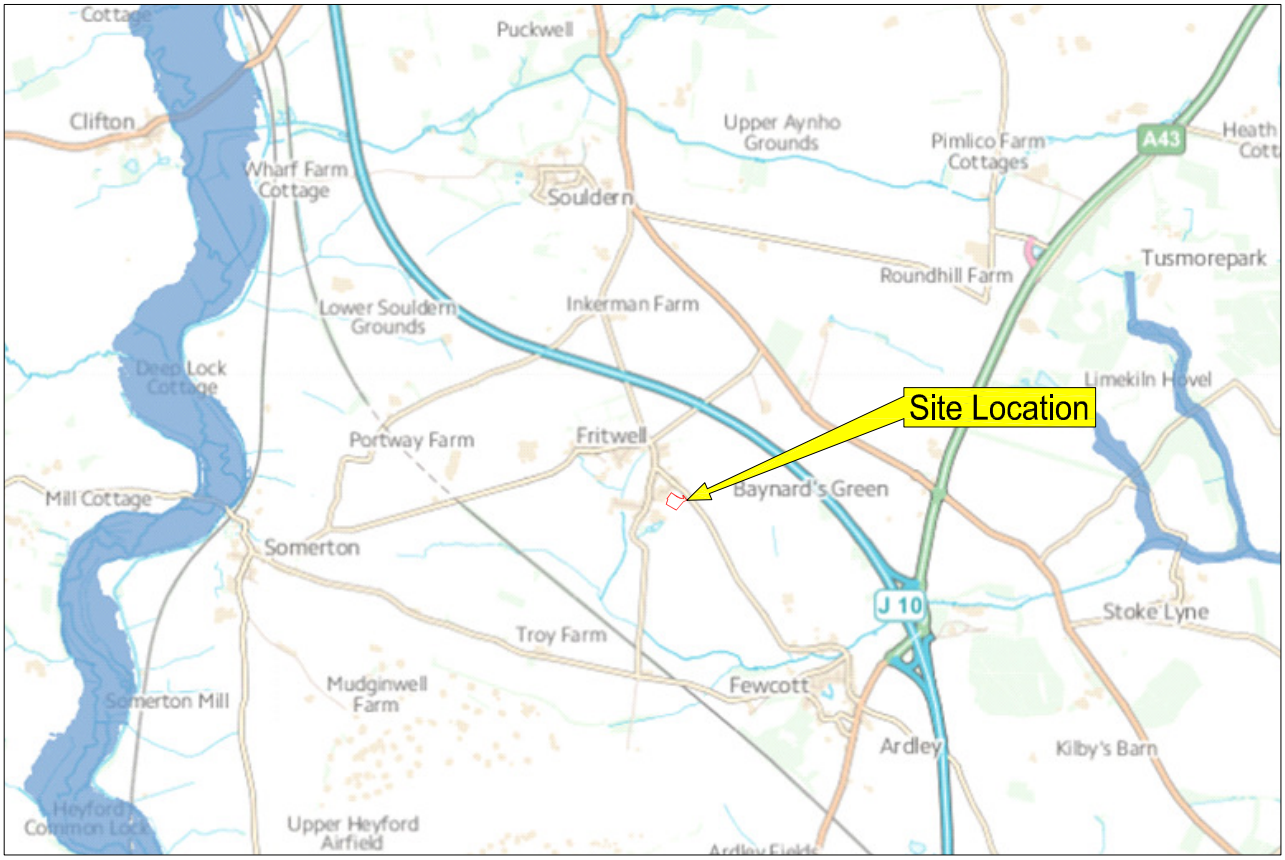
KEY

Maximum extent of flooding

N

NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing



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Project :	Fewcott Road, Fritwell		
Title :	Environment Agency Reservoir Flood Risk Map		
Project Engineer :	Scale : NTS	Drawing No. Appendix F	Rev –
Project Director : K. Rayner	Date : June 2016		

KEY

Flood zone 2

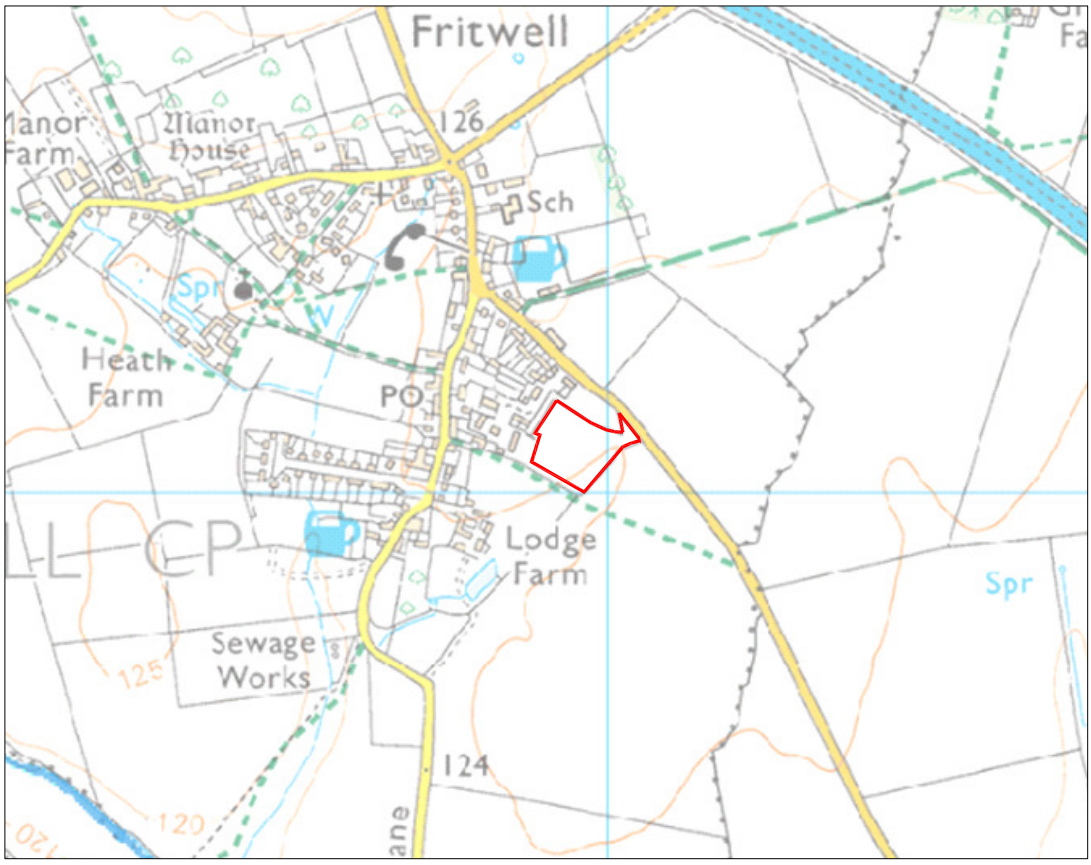
Flood zone 3

Approximate site boundary

N

NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing



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Project :	Fewcott Road, Fritwell		
Title :	Environment Agency Flood Zone Map		
Project Engineer :	Scale : NTS	Drawing No. Appendix F	Rev –
Project Director : K. Rayner	Date : June 2016		

KEY

Low risk of surface water flooding

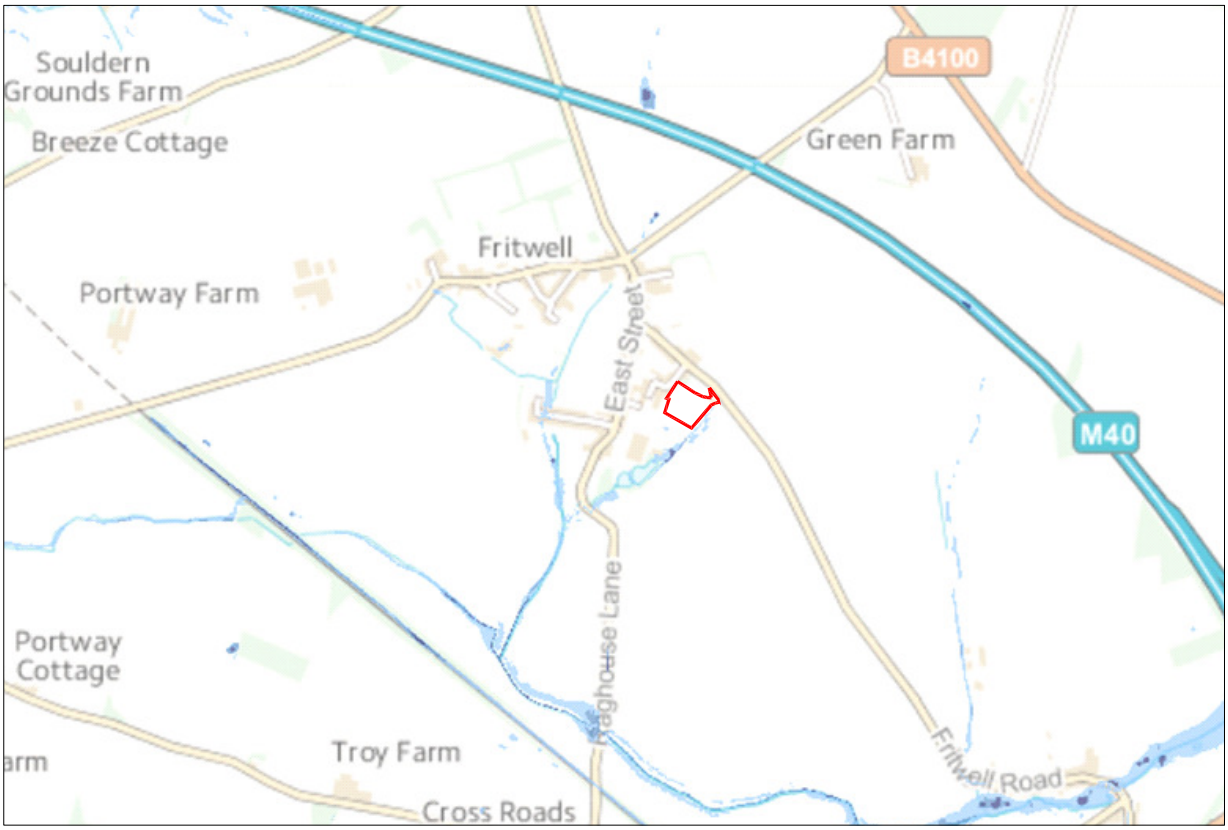
Medium risk of surface water flooding

High risk of surface water flooding

N

NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing



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Project :	Fewcott Road, Fritwell		
Title :	Environment Agency Surface Water Flood Risk Map		
Project Engineer :	Scale : NTS	Drawing No. Appendix F	Rev –
Project Director : K. Rayner	Date : June 2016		

Appendix G

Surface Water Drainage Strategy

Proposed diversion of existing Anglian Water surface water sewer.

NOTES

1. This drawing to be read in conjunction with all relevant documents and specifications.
2. Dimensions not to be scaled.

KEY

- Approximate site boundary
- Proposed surface water sewer
- Existing Anglian water surface water sewer
- Indicative size and location of soakaway
- Proposed permeable paved roads
- Proposed permeable paved driveways

N

DRAINAGE STRATEGY NOTES

1. The drainage strategy will use Sustainable Drainage (SuDS) techniques in order to mimic the site's natural pre-development drainage arrangements through the use of soakaways and permeable paving.
2. It is proposed that roof areas from houses and garages will drain by infiltration to ground via domestic soakaways located within the gardens.
3. Permeable paved driveways and roads will discharge surface water from their own footprint.
4. Infiltration features will provide storage for the 1 in 100 + 30% climate change storm event without flooding from surface water and discharge volumes from the site will not increase as a result of the proposed development for all storm durations up to and including this event.

Calculation	File Ref.
Porous Paved Roads and Driveways	Porous Paved Road.srcx
Crate Soakaway - Plots 6, 20, 21, 24, 25, 26, 27, 28, 31, 32	50m2.srcx
Crate Soakaway - Plots 2, 8, 9, 11, 12, 13, 14, 17, 18, 19, 22/23, 29, 30,	90m2.srcx
Crate Soakaway - Plots 1, 3, 4, 5, 7, 10, 15, 16, 33	120m2.srcx
Crate Soakaway - Plots 34	160m2.srcx

Rev.	Description	Date	Chkd

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Client : CALA Homes Chiltern Ltd

Project : Fewcott Road Fritwell

Title : Indicative Surface Water Drainage Strategy

Project Engineer :	A. Horswell	Scale :	1:250 @ A1
Project Director :	K. Rayner	Date :	July 2016
Status :			

Drawing No. Appendix G | Rev –

Appendix H

MicroDrainage Calculations

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

Half Drain Time : 206 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	126.052	0.202	0.1	1.2	O K
30 min Summer	126.107	0.257	0.1	1.5	O K
60 min Summer	126.154	0.304	0.1	1.7	O K
120 min Summer	126.180	0.330	0.1	1.9	O K
180 min Summer	126.180	0.330	0.1	1.9	O K
240 min Summer	126.175	0.325	0.1	1.9	O K
360 min Summer	126.161	0.311	0.1	1.8	O K
480 min Summer	126.147	0.297	0.1	1.7	O K
600 min Summer	126.132	0.282	0.1	1.6	O K
720 min Summer	126.117	0.267	0.1	1.5	O K
960 min Summer	126.090	0.240	0.1	1.4	O K
1440 min Summer	126.043	0.193	0.1	1.1	O K
2160 min Summer	125.988	0.138	0.1	0.8	O K
2880 min Summer	125.949	0.099	0.1	0.6	O K
4320 min Summer	125.904	0.054	0.1	0.3	O K
5760 min Summer	125.893	0.043	0.1	0.2	O K
7200 min Summer	125.886	0.036	0.0	0.2	O K
8640 min Summer	125.881	0.031	0.0	0.2	O K
10080 min Summer	125.878	0.028	0.0	0.2	O K
15 min Winter	126.077	0.227	0.1	1.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	130.382	0.0	21
30 min Summer	84.926	0.0	35
60 min Summer	52.662	0.0	64
120 min Summer	31.557	0.0	122
180 min Summer	23.087	0.0	160
240 min Summer	18.392	0.0	192
360 min Summer	13.299	0.0	256
480 min Summer	10.568	0.0	324
600 min Summer	8.836	0.0	392
720 min Summer	7.631	0.0	462
960 min Summer	6.050	0.0	596
1440 min Summer	4.356	0.0	854
2160 min Summer	3.131	0.0	1232
2880 min Summer	2.475	0.0	1584
4320 min Summer	1.775	0.0	2248
5760 min Summer	1.401	0.0	2936
7200 min Summer	1.165	0.0	3672
8640 min Summer	1.002	0.0	4400
10080 min Summer	0.882	0.0	5136
15 min Winter	130.382	0.0	21

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	126.140	0.290	0.1	1.7	O K
60 min Winter	126.194	0.344	0.1	2.0	O K
120 min Winter	126.228	0.378	0.1	2.2	O K
180 min Winter	126.231	0.381	0.1	2.2	O K
240 min Winter	126.222	0.372	0.1	2.1	O K
360 min Winter	126.205	0.355	0.1	2.0	O K
480 min Winter	126.184	0.334	0.1	1.9	O K
600 min Winter	126.163	0.313	0.1	1.8	O K
720 min Winter	126.142	0.292	0.1	1.7	O K
960 min Winter	126.103	0.253	0.1	1.4	O K
1440 min Winter	126.035	0.185	0.1	1.1	O K
2160 min Winter	125.960	0.110	0.1	0.6	O K
2880 min Winter	125.912	0.062	0.1	0.4	O K
4320 min Winter	125.890	0.040	0.1	0.2	O K
5760 min Winter	125.882	0.032	0.0	0.2	O K
7200 min Winter	125.876	0.026	0.0	0.1	O K
8640 min Winter	125.873	0.023	0.0	0.1	O K
10080 min Winter	125.870	0.020	0.0	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.926	0.0	35
60 min Winter	52.662	0.0	62
120 min Winter	31.557	0.0	118
180 min Winter	23.087	0.0	174
240 min Winter	18.392	0.0	202
360 min Winter	13.299	0.0	274
480 min Winter	10.568	0.0	352
600 min Winter	8.836	0.0	426
720 min Winter	7.631	0.0	500
960 min Winter	6.050	0.0	642
1440 min Winter	4.356	0.0	910
2160 min Winter	3.131	0.0	1276
2880 min Winter	2.475	0.0	1588
4320 min Winter	1.775	0.0	2212
5760 min Winter	1.401	0.0	2936
7200 min Winter	1.165	0.0	3680
8640 min Winter	1.002	0.0	4376
10080 min Winter	0.882	0.0	5128

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

Half Drain Time : 295 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	126.045	0.295	0.1	2.1	O K
30 min Summer	126.128	0.378	0.1	2.7	O K
60 min Summer	126.201	0.451	0.1	3.2	O K
120 min Summer	126.251	0.501	0.1	3.6	O K
180 min Summer	126.261	0.511	0.1	3.6	O K
240 min Summer	126.256	0.506	0.1	3.6	O K
360 min Summer	126.241	0.491	0.1	3.5	O K
480 min Summer	126.225	0.475	0.1	3.4	O K
600 min Summer	126.208	0.458	0.1	3.3	O K
720 min Summer	126.191	0.441	0.1	3.1	O K
960 min Summer	126.159	0.409	0.1	2.9	O K
1440 min Summer	126.102	0.352	0.1	2.5	O K
2160 min Summer	126.030	0.280	0.1	2.0	O K
2880 min Summer	125.971	0.221	0.1	1.6	O K
4320 min Summer	125.886	0.136	0.1	1.0	O K
5760 min Summer	125.832	0.082	0.1	0.6	O K
7200 min Summer	125.804	0.054	0.1	0.4	O K
8640 min Summer	125.795	0.045	0.1	0.3	O K
10080 min Summer	125.790	0.040	0.1	0.3	O K
15 min Winter	126.082	0.332	0.1	2.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	130.382	0.0	22
30 min Summer	84.926	0.0	36
60 min Summer	52.662	0.0	64
120 min Summer	31.557	0.0	122
180 min Summer	23.087	0.0	180
240 min Summer	18.392	0.0	216
360 min Summer	13.299	0.0	276
480 min Summer	10.568	0.0	342
600 min Summer	8.836	0.0	410
720 min Summer	7.631	0.0	480
960 min Summer	6.050	0.0	618
1440 min Summer	4.356	0.0	884
2160 min Summer	3.131	0.0	1276
2880 min Summer	2.475	0.0	1648
4320 min Summer	1.775	0.0	2376
5760 min Summer	1.401	0.0	3056
7200 min Summer	1.165	0.0	3680
8640 min Summer	1.002	0.0	4408
10080 min Summer	0.882	0.0	5136
15 min Winter	130.382	0.0	22

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	126.175	0.425	0.1	3.0	O K
60 min Winter	126.260	0.510	0.1	3.6	O K
120 min Winter	126.321	0.571	0.1	4.1	O K
180 min Winter	126.337	0.587	0.1	4.2	O K
240 min Winter	126.334	0.584	0.1	4.2	O K
360 min Winter	126.314	0.564	0.1	4.0	O K
480 min Winter	126.294	0.544	0.1	3.9	O K
600 min Winter	126.271	0.521	0.1	3.7	O K
720 min Winter	126.248	0.498	0.1	3.5	O K
960 min Winter	126.202	0.452	0.1	3.2	O K
1440 min Winter	126.118	0.368	0.1	2.6	O K
2160 min Winter	126.016	0.266	0.1	1.9	O K
2880 min Winter	125.937	0.187	0.1	1.3	O K
4320 min Winter	125.830	0.080	0.1	0.6	O K
5760 min Winter	125.796	0.046	0.1	0.3	O K
7200 min Winter	125.788	0.038	0.1	0.3	O K
8640 min Winter	125.783	0.033	0.1	0.2	O K
10080 min Winter	125.779	0.029	0.0	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.926	0.0	36
60 min Winter	52.662	0.0	64
120 min Winter	31.557	0.0	120
180 min Winter	23.087	0.0	176
240 min Winter	18.392	0.0	230
360 min Winter	13.299	0.0	290
480 min Winter	10.568	0.0	366
600 min Winter	8.836	0.0	444
720 min Winter	7.631	0.0	520
960 min Winter	6.050	0.0	668
1440 min Winter	4.356	0.0	952
2160 min Winter	3.131	0.0	1348
2880 min Winter	2.475	0.0	1732
4320 min Winter	1.775	0.0	2384
5760 min Winter	1.401	0.0	2944
7200 min Winter	1.165	0.0	3672
8640 min Winter	1.002	0.0	4408
10080 min Winter	0.882	0.0	5128

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

Half Drain Time : 330 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	126.079	0.329	0.1	2.8	O K
30 min Summer	126.172	0.422	0.1	3.6	O K
60 min Summer	126.255	0.505	0.2	4.3	O K
120 min Summer	126.316	0.566	0.2	4.8	O K
180 min Summer	126.331	0.581	0.2	5.0	O K
240 min Summer	126.328	0.578	0.2	4.9	O K
360 min Summer	126.313	0.563	0.2	4.8	O K
480 min Summer	126.296	0.546	0.2	4.7	O K
600 min Summer	126.279	0.529	0.2	4.5	O K
720 min Summer	126.262	0.512	0.2	4.4	O K
960 min Summer	126.228	0.478	0.1	4.1	O K
1440 min Summer	126.168	0.418	0.1	3.6	O K
2160 min Summer	126.091	0.341	0.1	2.9	O K
2880 min Summer	126.027	0.277	0.1	2.4	O K
4320 min Summer	125.930	0.180	0.1	1.5	O K
5760 min Summer	125.864	0.114	0.1	1.0	O K
7200 min Summer	125.822	0.072	0.1	0.6	O K
8640 min Summer	125.801	0.051	0.1	0.4	O K
10080 min Summer	125.795	0.045	0.1	0.4	O K
15 min Winter	126.120	0.370	0.1	3.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	130.382	0.0	22
30 min Summer	84.926	0.0	36
60 min Summer	52.662	0.0	66
120 min Summer	31.557	0.0	124
180 min Summer	23.087	0.0	182
240 min Summer	18.392	0.0	232
360 min Summer	13.299	0.0	288
480 min Summer	10.568	0.0	350
600 min Summer	8.836	0.0	420
720 min Summer	7.631	0.0	488
960 min Summer	6.050	0.0	626
1440 min Summer	4.356	0.0	898
2160 min Summer	3.131	0.0	1296
2880 min Summer	2.475	0.0	1672
4320 min Summer	1.775	0.0	2384
5760 min Summer	1.401	0.0	3112
7200 min Summer	1.165	0.0	3752
8640 min Summer	1.002	0.0	4408
10080 min Summer	0.882	0.0	5136
15 min Winter	130.382	0.0	22

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	126.225	0.475	0.1	4.1	O K
60 min Winter	126.321	0.571	0.2	4.9	O K
120 min Winter	126.543	0.793	0.2	5.5	O K
180 min Winter	126.741	0.991	0.2	5.7	Flood Risk
240 min Winter	126.758	1.008	0.2	5.7	Flood Risk
360 min Winter	126.584	0.834	0.2	5.5	Flood Risk
480 min Winter	126.396	0.646	0.2	5.4	O K
600 min Winter	126.355	0.605	0.2	5.2	O K
720 min Winter	126.331	0.581	0.2	5.0	O K
960 min Winter	126.284	0.534	0.2	4.6	O K
1440 min Winter	126.196	0.446	0.1	3.8	O K
2160 min Winter	126.086	0.336	0.1	2.9	O K
2880 min Winter	125.998	0.248	0.1	2.1	O K
4320 min Winter	125.872	0.122	0.1	1.0	O K
5760 min Winter	125.803	0.053	0.1	0.5	O K
7200 min Winter	125.793	0.043	0.1	0.4	O K
8640 min Winter	125.787	0.037	0.1	0.3	O K
10080 min Winter	125.783	0.033	0.1	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.926	0.0	36
60 min Winter	52.662	0.0	64
120 min Winter	31.557	0.0	122
180 min Winter	23.087	0.0	178
240 min Winter	18.392	0.0	234
360 min Winter	13.299	0.0	330
480 min Winter	10.568	0.0	374
600 min Winter	8.836	0.0	450
720 min Winter	7.631	0.0	526
960 min Winter	6.050	0.0	676
1440 min Winter	4.356	0.0	968
2160 min Winter	3.131	0.0	1372
2880 min Winter	2.475	0.0	1760
4320 min Winter	1.775	0.0	2468
5760 min Winter	1.401	0.0	3000
7200 min Winter	1.165	0.0	3672
8640 min Winter	1.002	0.0	4408
10080 min Winter	0.882	0.0	5136

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

Half Drain Time : 697 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	125.931	0.381	0.1	3.8	O K
30 min Summer	126.042	0.492	0.1	4.9	O K
60 min Summer	126.148	0.598	0.1	6.0	O K
120 min Summer	126.239	0.689	0.1	6.9	O K
180 min Summer	126.279	0.729	0.1	7.3	O K
240 min Summer	126.297	0.747	0.1	7.4	O K
360 min Summer	126.304	0.754	0.1	7.5	O K
480 min Summer	126.294	0.744	0.1	7.4	O K
600 min Summer	126.275	0.725	0.1	7.2	O K
720 min Summer	126.257	0.707	0.1	7.1	O K
960 min Summer	126.223	0.673	0.1	6.7	O K
1440 min Summer	126.164	0.614	0.1	6.1	O K
2160 min Summer	126.084	0.534	0.1	5.3	O K
2880 min Summer	126.011	0.461	0.1	4.6	O K
4320 min Summer	125.881	0.331	0.1	3.3	O K
5760 min Summer	125.777	0.227	0.1	2.3	O K
7200 min Summer	125.698	0.148	0.1	1.5	O K
8640 min Summer	125.644	0.094	0.1	0.9	O K
10080 min Summer	125.611	0.061	0.1	0.6	O K
15 min Winter	125.978	0.428	0.1	4.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	130.382	0.0	22
30 min Summer	84.926	0.0	37
60 min Summer	52.662	0.0	66
120 min Summer	31.557	0.0	126
180 min Summer	23.087	0.0	184
240 min Summer	18.392	0.0	244
360 min Summer	13.299	0.0	362
480 min Summer	10.568	0.0	480
600 min Summer	8.836	0.0	560
720 min Summer	7.631	0.0	610
960 min Summer	6.050	0.0	728
1440 min Summer	4.356	0.0	988
2160 min Summer	3.131	0.0	1392
2880 min Summer	2.475	0.0	1792
4320 min Summer	1.775	0.0	2552
5760 min Summer	1.401	0.0	3280
7200 min Summer	1.165	0.0	3960
8640 min Summer	1.002	0.0	4584
10080 min Summer	0.882	0.0	5240
15 min Winter	130.382	0.0	22

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	126.103	0.553	0.1	5.5	O K
60 min Winter	126.224	0.674	0.1	6.7	O K
120 min Winter	126.331	0.781	0.1	7.8	O K
180 min Winter	126.407	0.857	0.1	8.3	O K
240 min Winter	126.666	1.116	0.1	8.5	Flood Risk
360 min Winter	126.834	1.284	0.1	8.7	Flood Risk
480 min Winter	126.812	1.262	0.1	8.7	Flood Risk
600 min Winter	126.677	1.127	0.1	8.5	Flood Risk
720 min Winter	126.476	0.926	0.1	8.3	O K
960 min Winter	126.340	0.790	0.1	7.9	O K
1440 min Winter	126.260	0.710	0.1	7.1	O K
2160 min Winter	126.142	0.592	0.1	5.9	O K
2880 min Winter	126.030	0.480	0.1	4.8	O K
4320 min Winter	125.836	0.286	0.1	2.9	O K
5760 min Winter	125.692	0.142	0.1	1.4	O K
7200 min Winter	125.608	0.058	0.1	0.6	O K
8640 min Winter	125.595	0.045	0.1	0.4	O K
10080 min Winter	125.590	0.040	0.1	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.926	0.0	37
60 min Winter	52.662	0.0	66
120 min Winter	31.557	0.0	124
180 min Winter	23.087	0.0	182
240 min Winter	18.392	0.0	240
360 min Winter	13.299	0.0	354
480 min Winter	10.568	0.0	468
600 min Winter	8.836	0.0	578
720 min Winter	7.631	0.0	684
960 min Winter	6.050	0.0	782
1440 min Winter	4.356	0.0	1080
2160 min Winter	3.131	0.0	1520
2880 min Winter	2.475	0.0	1936
4320 min Winter	1.775	0.0	2688
5760 min Winter	1.401	0.0	3344
7200 min Winter	1.165	0.0	3824
8640 min Winter	1.002	0.0	4408
10080 min Winter	0.882	0.0	5088

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

Half Drain Time : 36 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	125.627	0.177	0.6	1.6	O K
30 min Summer	125.647	0.197	0.7	2.0	O K
60 min Summer	125.657	0.207	0.7	2.2	Flood Risk
120 min Summer	125.655	0.205	0.7	2.2	Flood Risk
180 min Summer	125.647	0.197	0.7	2.0	O K
240 min Summer	125.637	0.187	0.7	1.8	O K
360 min Summer	125.619	0.169	0.6	1.5	O K
480 min Summer	125.604	0.154	0.5	1.2	O K
600 min Summer	125.592	0.142	0.5	1.1	O K
720 min Summer	125.581	0.131	0.5	0.9	O K
960 min Summer	125.564	0.114	0.4	0.7	O K
1440 min Summer	125.540	0.090	0.3	0.4	O K
2160 min Summer	125.519	0.069	0.2	0.3	O K
2880 min Summer	125.506	0.056	0.2	0.2	O K
4320 min Summer	125.495	0.045	0.1	0.1	O K
5760 min Summer	125.490	0.040	0.1	0.1	O K
7200 min Summer	125.486	0.036	0.1	0.1	O K
8640 min Summer	125.484	0.034	0.1	0.1	O K
10080 min Summer	125.482	0.032	0.1	0.1	O K
15 min Winter	125.640	0.190	0.7	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	130.382	0.0	17
30 min Summer	84.926	0.0	28
60 min Summer	52.662	0.0	44
120 min Summer	31.557	0.0	78
180 min Summer	23.087	0.0	112
240 min Summer	18.392	0.0	144
360 min Summer	13.299	0.0	208
480 min Summer	10.568	0.0	268
600 min Summer	8.836	0.0	330
720 min Summer	7.631	0.0	390
960 min Summer	6.050	0.0	510
1440 min Summer	4.356	0.0	750
2160 min Summer	3.131	0.0	1104
2880 min Summer	2.475	0.0	1468
4320 min Summer	1.775	0.0	2196
5760 min Summer	1.401	0.0	2928
7200 min Summer	1.165	0.0	3672
8640 min Summer	1.002	0.0	4376
10080 min Summer	0.882	0.0	5056
15 min Winter	130.382	0.0	17

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	125.662	0.212	0.7	2.4	Flood Risk
60 min Winter	125.670	0.220	0.8	2.5	Flood Risk
120 min Winter	125.664	0.214	0.8	2.4	Flood Risk
180 min Winter	125.651	0.201	0.7	2.1	Flood Risk
240 min Winter	125.637	0.187	0.7	1.8	O K
360 min Winter	125.613	0.163	0.6	1.4	O K
480 min Winter	125.593	0.143	0.5	1.1	O K
600 min Winter	125.578	0.128	0.4	0.9	O K
720 min Winter	125.565	0.115	0.4	0.7	O K
960 min Winter	125.545	0.095	0.3	0.5	O K
1440 min Winter	125.521	0.071	0.2	0.3	O K
2160 min Winter	125.502	0.052	0.2	0.1	O K
2880 min Winter	125.495	0.045	0.1	0.1	O K
4320 min Winter	125.488	0.038	0.1	0.1	O K
5760 min Winter	125.484	0.034	0.1	0.1	O K
7200 min Winter	125.481	0.031	0.1	0.0	O K
8640 min Winter	125.478	0.028	0.1	0.0	O K
10080 min Winter	125.477	0.027	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.926	0.0	29
60 min Winter	52.662	0.0	48
120 min Winter	31.557	0.0	84
180 min Winter	23.087	0.0	120
240 min Winter	18.392	0.0	154
360 min Winter	13.299	0.0	218
480 min Winter	10.568	0.0	280
600 min Winter	8.836	0.0	338
720 min Winter	7.631	0.0	398
960 min Winter	6.050	0.0	518
1440 min Winter	4.356	0.0	750
2160 min Winter	3.131	0.0	1100
2880 min Winter	2.475	0.0	1464
4320 min Winter	1.775	0.0	2160
5760 min Winter	1.401	0.0	2872
7200 min Winter	1.165	0.0	3672
8640 min Winter	1.002	0.0	4368
10080 min Winter	0.882	0.0	5008

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