



**B411 – Teversham Road, Fulbourn, Cambridgeshire**  
**Discharge of Conditions – surface water management**  
**For Castlefield International Ltd**  
**12<sup>th</sup> September 2019**

**Introduction**

This note addresses Condition 8 South Cambridgeshire District Council outline planning permission reference S/0202/17/OL for residential development of land to the east of Teversham Road in Fulbourn.

**Background**

The surface water management proposals for the permitted scheme comprised sub-catchment attenuation facilities for each of the three proposed development parcels (as identified on the approved parameters plan which accompanied the outline application in 2017).

Because of the potential for shallow groundwater at the site, disposal of runoff to infiltration was ruled out. The scheme relied (and relies) on a restricted discharge to the on-site watercourse. The proposed discharge rate was (and remains) the 1 in 1 greenfield rate of 0.3 l/s/ha. As discussed in the flood risk and surface water note which supported the 2017 outline planning application (to which the Flood Risk Assessment referenced in Condition 8 was appended), the attenuation facilities are sized to manage a long duration storm and the commonly quoted drain-down requirement of 24 to 48 hours is not therefore applicable (low runoff rates and short drain-down time being mutually exclusive).

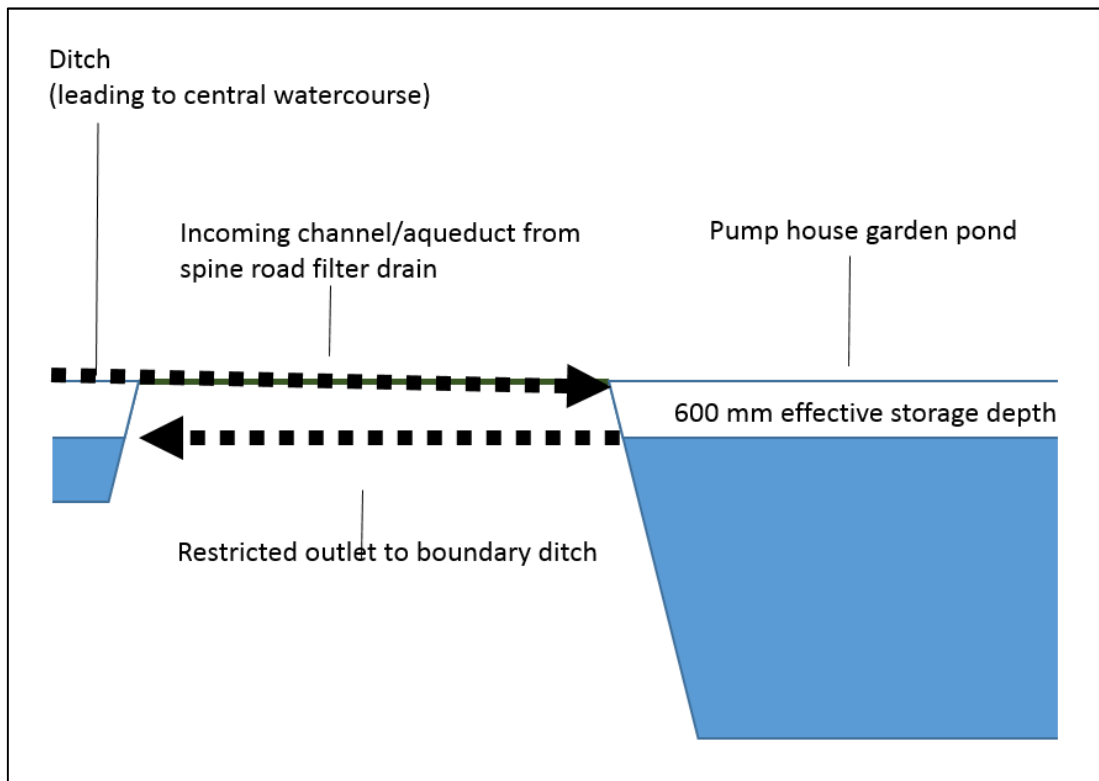
**Surface water management**

The proposed detailed strategy (shown on appended drawings 300 and 301) comprises five sub-catchments (shown on appended drawing 303) managing runoff from the three development parcels. The three attenuation facilities in the eastern part of the site (attenuation facilities B to D) comprise both sub-base replacement crates (beneath permeable paving) and bio-retention basins. The attenuation facilities for the western part of the site differ from the earlier outline strategy in that the bio-retention basin to the south of the development parcel has been removed to retain more of the existing plant life in situ. The residential element of the parcel (housing and shared surface/private roads) now drains to attenuation facility A (crates below permeable paving). Runoff from the spine road will now drain via a grassed filter drain and channel/aqueduct, to the existing pond in the pump house garden.

The invert level of each of the attenuation facilities is based on the highest groundwater levels recorded in one of three groundwater monitoring boreholes (see appended groundwater monitoring report). Further monitoring in additional boreholes may allow invert levels to be reduced at the detailed design stages.

The available storage within the pump house garden pond has been calculated based on the conservative assumption that it is unlined and groundwater fed. The effective storage depth has

therefore been modelled as 600 mm (based on the highest recorded groundwater bgl value in the closest monitoring well). It is worth noting that as well as allowing for more of the existing plant life to be left in situ, increasing the flow of clean water to the pump house garden pond should compliment the proposals to improve the amenity value and interest of the pond and garden.



Sketch showing the proposed pump house garden attenuation arrangement

Each facility includes sufficient surface water attenuation will be provided to manage the 1 in 100 annual probability storm inclusive of 40 % climate change. The appended calculations include a 10 % increase in paved area as an allowance for urban creep. The modelled discharge rate has been set at 'pre-creep' rates to test the facilities.

**Treatment**

Suitable treatment for runoff will be provided by the permeable paving which will accept direct rainfall and some flow from adjacent impermeable surfaces. Spine road runoff in the east of the site will be conveyed to either the bio-retention basins (via slot and/or channel drains running along the private roads). Runoff from the spine road in the west of the site will be treated by the services/filter strip and filter drain arrangement.

Aside from the in-chamber protection (perforated riser tube) the small flow control diameters which are necessary to achieve 0.3 l/s/ha will require upstream filtration to remove debris. Additional debris removal/filtration features (small gabion filter boxes for example) will therefore be provided at outlets/inlets between, above, and below ground storage components.



### **Maintenance**

Currently maintenance of the surface water management will be undertaken by a private management company (details of which will be determined at the appropriate later stages).

### **Appended information**

B411-PL-SK-300 - Surface water management strategy (below ground)

B411-PL-SK-301 - Surface water management strategy (above ground)

B411-PL-SK-302 - Catchment plan

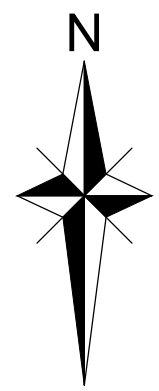
B411-PL-SK-303 - Sections

MicroDrainage simulation results

Groundwater monitoring report

All proposals are subject to detailed design and the approval of relevant parties.





**KEY**

- 1 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
- 2 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
- 3 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
- 4 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
- SW NETWORK
- ORIFICE CONTROL CHAMBER
- HEADWALL
- ROADSIDE FILTER DRAIN
- RILL/CHANNEL DRAIN
- DEBRIS FILTER

**NOTES**

REV	DESCRIPTION	DE	DR	CH	DATE
P01	REVISED TO REFLECT CHANGING LAYOUT LEAP CRATES REVISED		JAM	JOH	SEPT 2019
DESIGNED BY	DRAWN BY	CHECKED BY			
-	DP	-			
SCALE @ A1 SIZE	DATE				
D.N.S.	21/08/2019				

PROJECT TITLE  
**LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE**

DRAWING TITLE  
**DETAILED SURFACE WATER MANAGEMENT STRATEGY**

CLIENT  
**CASTLEFIELD INTERNATIONAL LTD**



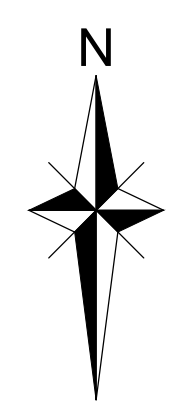
Peck House, 20 Eastcheap London, EC3M 1EB  
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Cambridge House, Lamwades Business Park, Kentford, Newmarket, CB8 7PN  
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DRAWING NUMBER	REV.
B411 - PL - SK - 300	P01

M:\B411 Fulbourn, CAMBS\DRAWINGS\AUTOCAD\CURRENT DRGS\B411 - PL - SK - 300 REV A - SW STRATEGY





**KEY**

- ATTENUATION BASIN
- PERMEABLE PAVING
- ROADSIDE FILTER DRAIN
- RILL/CHANNEL DRAIN
- SW NETWORK
- DEBRIS FILTER
- HEADWALL
- FLOW ROUTES

**NOTES**

P01 REVISED TO REFLECT CHANGING LAYOUT	JAM JOH SEPT 2019
REV DESCRIPTION	DE DR CH DATE
DESIGNED BY	DRAWN BY DP
SCALE @ A1 SIZE	CHECKED BY
D.N.S.	DATE 21/08/2019
PROJECT TITLE	
LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE	
DRAWING TITLE	
DETAILED SURFACE WATER MANAGEMENT STRATEGY (ABOVE GROUND)	
CLIENT	
CASTLEFIELD INTERNATIONAL LTD	

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Highways, Transport & Infrastructure Planning

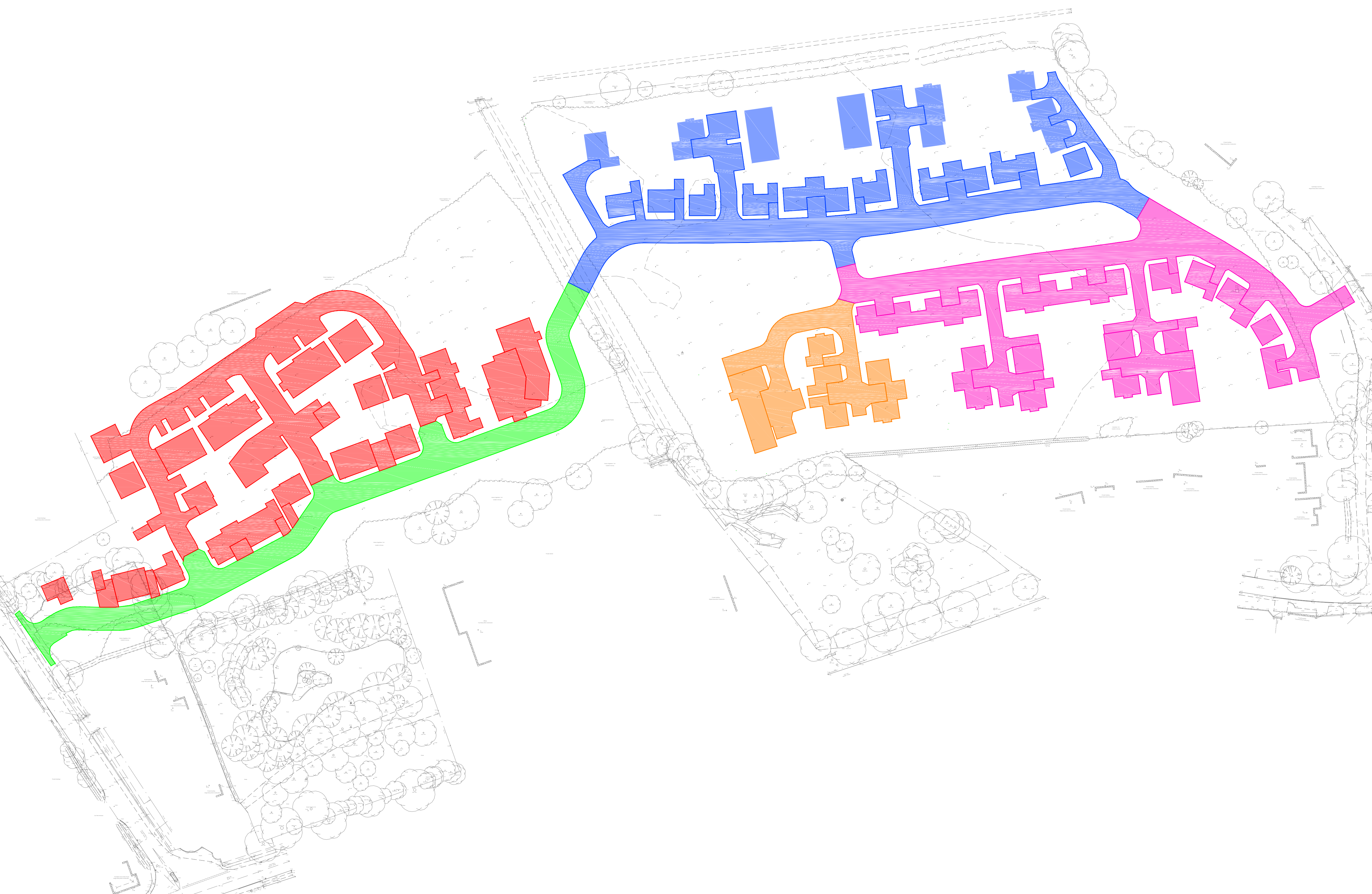
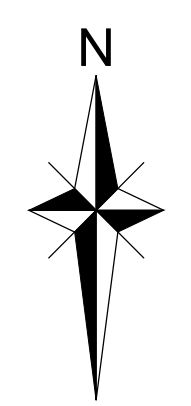
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DRAWING NUMBER	REV.
B411 - PL - SK - 301	P01

M:\B411 Fulbourn, CAMBS\DRAWINGS\AUTOCAD\CURRENT\DRGSS\B411 - PL - SK - 301 REV A - SW STRATEGY ABOVE GROUND





KEY	
<span style="color: red;">■</span>	IMPERMEABLE CATCHMENT AREA DRAINING TO ATTENUATION FACILITY A
<span style="color: green;">■</span>	IMPERMEABLE CATCHMENT AREA DRAINING TO EXISTING POND
<span style="color: blue;">■</span>	IMPERMEABLE CATCHMENT AREA DRAINING TO ATTENUATION FACILITY B
<span style="color: magenta;">■</span>	IMPERMEABLE CATCHMENT AREA DRAINING TO ATTENUATION FACILITY C
<span style="color: orange;">■</span>	IMPERMEABLE CATCHMENT AREA DRAINING TO ATTENUATION FACILITY D

NOTES	

REV	DESCRIPTION	DE	DR	CH	DATE
P01	REVISED TO REFLECT CHANGING LAYOUT		JAM	JOH	SEPT 2019
DESIGNED BY	DRAWN BY	CHECKED BY			
-	DP	-			
SCALE @ A1 SIZE	DATE				
D.N.S.	21/08/2019				

PROJECT TITLE  
**LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE**

DRAWING TITLE  
**CATCHMENT PLAN**

CLIENT  
**CASTLEFIELD INTERNATIONAL LTD**

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 Highways, Transport & Infrastructure Planning

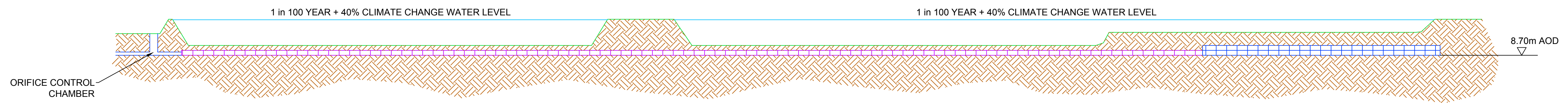
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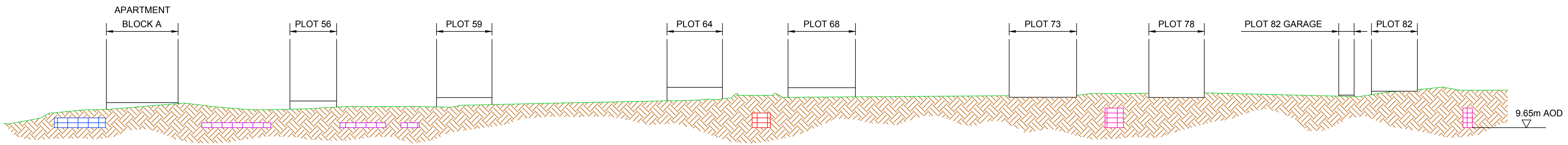
DRAWING NUMBER	REV.
B411 - PL - SK - 302	P01

M:\B411 Fulbourn, CAMBS\DRAWINGS\AUTOCAD\CURRENT\DRG\B411 - PL - SK - 302 REV A - CATCHMENT PLAN



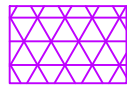





SECTION A-A



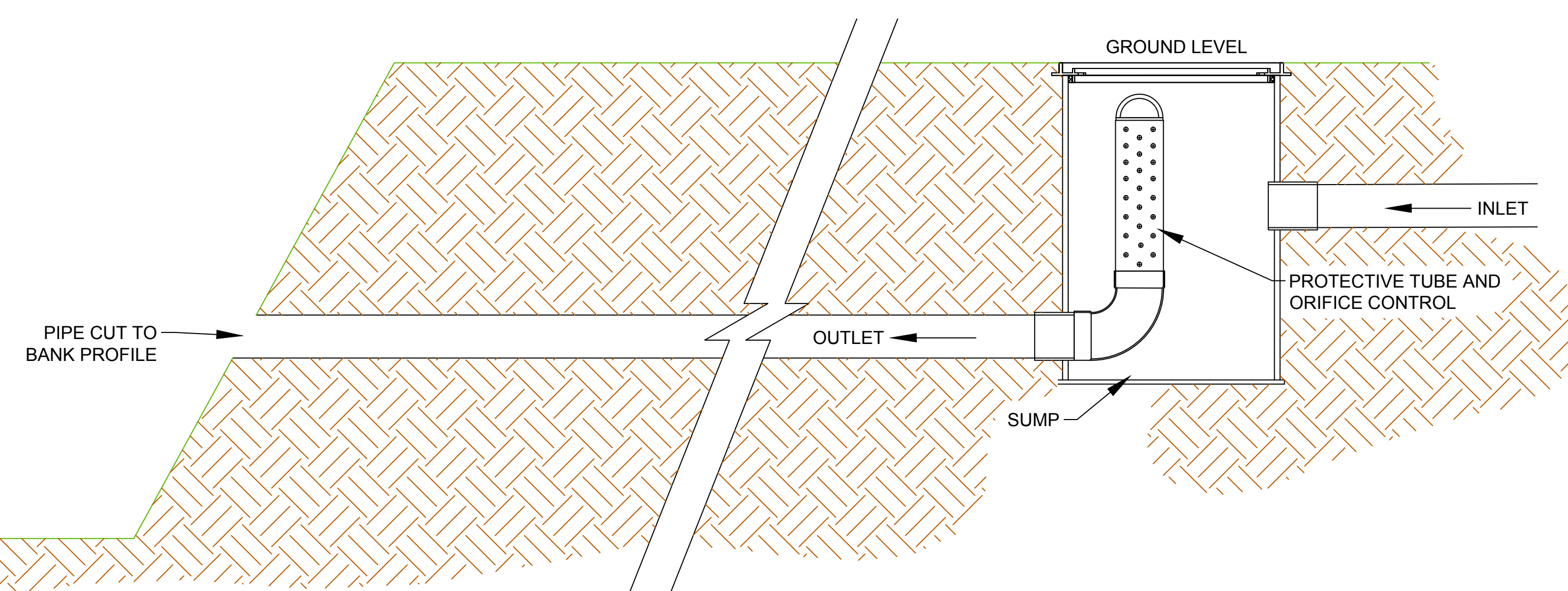
SECTION B-B

**KEY**

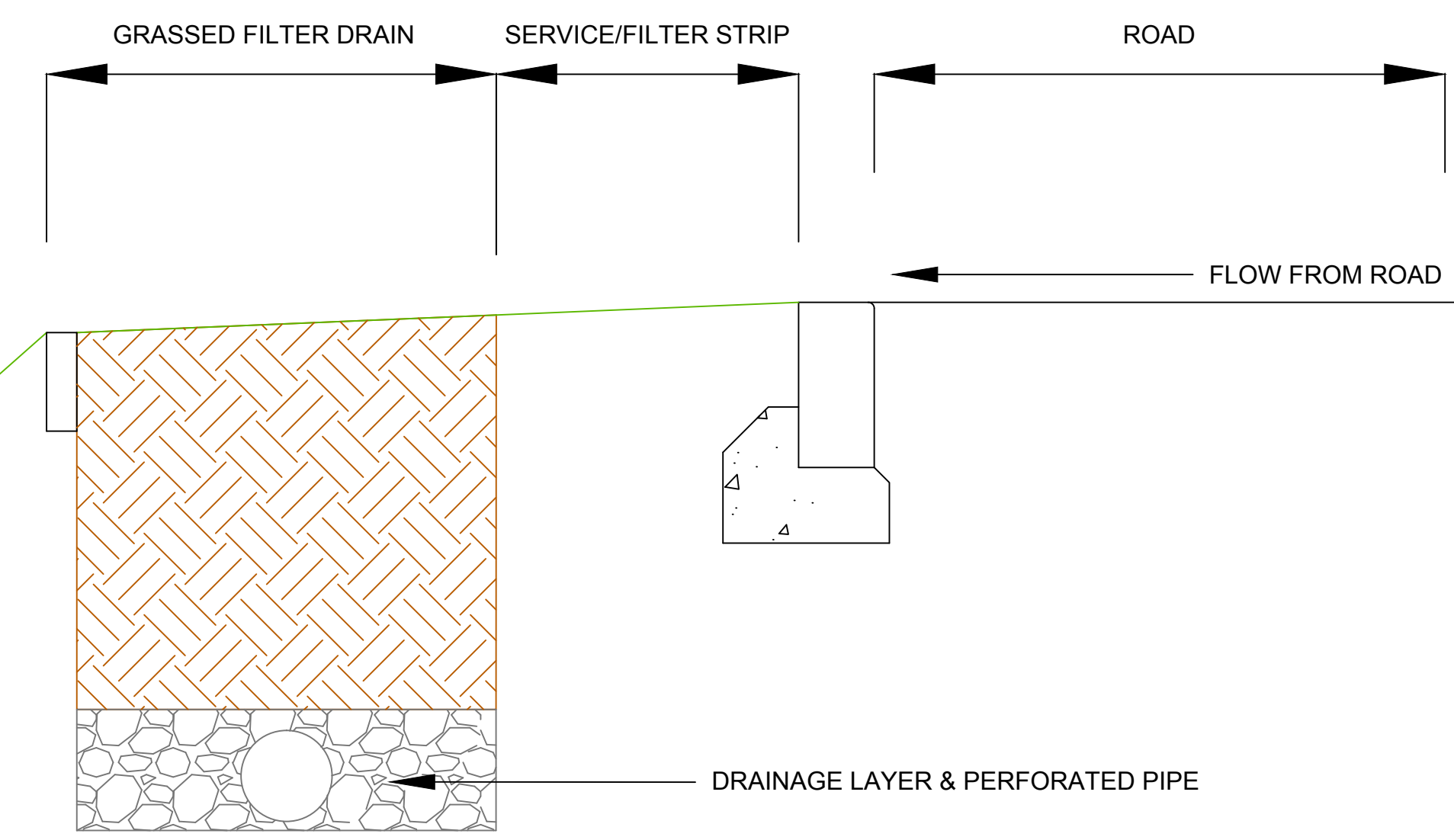
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-  2 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
-  3 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
-  4 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED

**NOTES**


REV	DESCRIPTION	DE	DR	CH	DATE
DESIGNED BY	DRAWN BY	CHECKED BY			
-	DP	-			
SCALE @ A1 SIZE	DATE				
D.N.S.	21/08/2019				
PROJECT TITLE					
LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE					
DRAWING TITLE					
SECTIONS PLAN					
CLIENT					
CASTLEFIELD INTERNATIONAL LTD					




TYPICAL SECTION OF OUTFALL AND ORIFICE CONTROL CHAMBER



TYPICAL SECTION OF GRASSED FILTER DRAIN

DESIGNED BY		DRAWN BY		CHECKED BY	
-		DP		-	
SCALE @ A1 SIZE		DATE			
D.N.S.		21/08/2019			
PROJECT TITLE					
LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE					
DRAWING TITLE					
SECTIONS PLAN					
CLIENT					
CASTLEFIELD INTERNATIONAL LTD					
 <p><b>CANNON</b> CONSULTING ENGINEERS Highways, Transport &amp; Infrastructure Planning</p>					
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DRAWING NUMBER					REV.
B411 - PL - SK - 303					

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Cannon Consulting		Page 1
Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Road Catchment	
Date 23/08/2019 16:26 File B411 - Catchment A Road....	Designed by DJP Checked by	
Micro Drainage	Source Control 2018.1	


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

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	9.586	0.096	0.0	95.6	O K
30 min Summer	9.613	0.123	0.0	123.2	O K
60 min Summer	9.641	0.151	0.0	150.7	O K
120 min Summer	9.681	0.191	0.0	190.8	O K
180 min Summer	9.705	0.215	0.0	215.3	O K
240 min Summer	9.722	0.232	0.0	232.1	O K
360 min Summer	9.744	0.254	0.1	253.6	O K
480 min Summer	9.757	0.267	0.1	266.9	O K
600 min Summer	9.766	0.276	0.1	276.1	O K
720 min Summer	9.773	0.283	0.1	282.8	O K
960 min Summer	9.782	0.292	0.1	292.3	O K
1440 min Summer	9.793	0.303	0.1	303.1	Flood Risk
2160 min Summer	9.804	0.314	0.1	313.5	Flood Risk
2880 min Summer	9.812	0.322	0.1	322.0	Flood Risk
4320 min Summer	9.828	0.338	0.1	338.4	Flood Risk
5760 min Summer	9.844	0.354	0.1	354.3	Flood Risk
7200 min Summer	9.862	0.372	0.1	371.5	Flood Risk
8640 min Summer	9.879	0.389	0.1	389.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	157.360	0.0	2.6	23
30 min Summer	101.360	0.0	3.0	38
60 min Summer	62.020	0.0	6.6	68
120 min Summer	39.270	0.0	7.4	128
180 min Summer	29.549	0.0	7.9	188
240 min Summer	23.905	0.0	8.1	248
360 min Summer	17.430	0.0	8.3	368
480 min Summer	13.768	0.0	8.4	488
600 min Summer	11.401	0.0	8.4	608
720 min Summer	9.742	0.0	8.4	728
960 min Summer	7.561	0.0	8.2	968
1440 min Summer	5.244	0.0	7.8	1448
2160 min Summer	3.633	0.0	16.7	2168
2880 min Summer	2.812	0.0	16.1	2888
4320 min Summer	1.987	0.0	14.6	4328
5760 min Summer	1.574	0.0	33.7	5768
7200 min Summer	1.330	0.0	32.6	7208
8640 min Summer	1.171	0.0	31.5	8648




Cannon Consulting		Page 2
Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Road Catchment	
Date 23/08/2019 16:26 File B411 - Catchment A Road....	Designed by DJP Checked by	
Micro Drainage	Source Control 2018.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
10080 min Summer	9.898	0.408	0.1	408.3	Flood Risk
15 min Winter	9.586	0.096	0.0	95.6	O K
30 min Winter	9.613	0.123	0.0	123.2	O K
60 min Winter	9.641	0.151	0.0	150.7	O K
120 min Winter	9.681	0.191	0.0	190.8	O K
180 min Winter	9.705	0.215	0.0	215.3	O K
240 min Winter	9.722	0.232	0.0	232.1	O K
360 min Winter	9.744	0.254	0.1	253.6	O K
480 min Winter	9.757	0.267	0.1	266.9	O K
600 min Winter	9.766	0.276	0.1	276.1	O K
720 min Winter	9.773	0.283	0.1	282.8	O K
960 min Winter	9.782	0.292	0.1	292.3	O K
1440 min Winter	9.793	0.303	0.1	303.1	Flood Risk
2160 min Winter	9.804	0.314	0.1	313.5	Flood Risk
2880 min Winter	9.812	0.322	0.1	322.0	Flood Risk
4320 min Winter	9.828	0.338	0.1	338.4	Flood Risk
5760 min Winter	9.844	0.354	0.1	354.4	Flood Risk
7200 min Winter	9.862	0.372	0.1	371.7	Flood Risk
8640 min Winter	9.880	0.390	0.1	389.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
10080 min Summer	1.060	0.0	30.3	10088
15 min Winter	157.360	0.0	2.6	23
30 min Winter	101.360	0.0	3.0	38
60 min Winter	62.020	0.0	6.6	68
120 min Winter	39.270	0.0	7.4	128
180 min Winter	29.549	0.0	7.9	188
240 min Winter	23.905	0.0	8.1	248
360 min Winter	17.430	0.0	8.3	366
480 min Winter	13.768	0.0	8.4	486
600 min Winter	11.401	0.0	8.4	606
720 min Winter	9.742	0.0	8.4	726
960 min Winter	7.561	0.0	8.2	964
1440 min Winter	5.244	0.0	7.8	1444
2160 min Winter	3.633	0.0	16.7	2160
2880 min Winter	2.812	0.0	16.1	2880
4320 min Winter	1.987	0.0	14.6	4284
5760 min Winter	1.574	0.0	33.7	5712
7200 min Winter	1.330	0.0	32.6	7136
8640 min Winter	1.171	0.0	31.5	8560




Cannon Consulting		Page 3
Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Road Catchment	
Date 23/08/2019 16:26 File B411 - Catchment A Road....	Designed by DJP Checked by	
Micro Drainage	Source Control 2018.1	

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

<b>Storm Event</b>	<b>Max Level (m)</b>	<b>Max Depth (m)</b>	<b>Max Control (l/s)</b>	<b>Max Volume (m<sup>3</sup>)</b>	<b>Status</b>
10080 min Winter	9.899	0.409	0.1	408.6	Flood Risk

<b>Storm Event</b>	<b>Rain (mm/hr)</b>	<b>Flooded Volume (m<sup>3</sup>)</b>	<b>Discharge Volume (m<sup>3</sup>)</b>	<b>Time-Peak (mins)</b>
10080 min Winter	1.060	0.0	30.3	9984



Cannon Consulting		Page 4
Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Road Catchment	
Date 23/08/2019 16:26 File B411 - Catchment A Road....	Designed by DJP Checked by	
Micro Drainage	Source Control 2018.1	

Rainfall Details


Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.256

Time (mins)		Area	Time (mins)		Area
From:	To:	(ha)	From:	To:	(ha)
0	4	0.156	4	8	0.100



Cannon Consulting		Page 5
Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Road Catchment	
Date 23/08/2019 16:26 File B411 - Catchment A Road....	Designed by DJP Checked by	
Micro Drainage	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.090

Tank or Pond Structure


Invert Level (m) 9.490

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	1000.0	0.600	1000.0

Orifice Outflow Control

Diameter (m) 0.007 Discharge Coefficient 0.600 Invert Level (m) 9.490



Cannon Consulting		Page 1
Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Catchment A	
Date 23/08/2019 16:32 File B411 - Catchment A.srcx	Designed by DJP Checked by	
Micro Drainage	Source Control 2018.1	

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

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max $\Sigma$ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	99.238	0.138	0.0	0.1	0.1	238.7	O K
30 min Summer	99.278	0.178	0.0	0.1	0.1	307.5	O K
60 min Summer	99.318	0.218	0.0	0.1	0.1	376.2	O K
120 min Summer	99.375	0.275	0.0	0.1	0.1	476.3	O K
180 min Summer	99.411	0.311	0.0	0.1	0.1	537.3	O K
240 min Summer	99.435	0.335	0.0	0.1	0.1	579.4	O K
360 min Summer	99.466	0.366	0.0	0.1	0.1	633.1	O K
480 min Summer	99.485	0.385	0.0	0.1	0.1	666.3	O K
600 min Summer	99.499	0.399	0.0	0.1	0.1	689.1	O K
720 min Summer	99.508	0.408	0.0	0.1	0.1	706.1	O K
960 min Summer	99.522	0.422	0.0	0.1	0.1	729.6	O K
1440 min Summer	99.538	0.438	0.0	0.1	0.1	756.7	O K
2160 min Summer	99.553	0.453	0.0	0.1	0.1	782.8	O K
2880 min Summer	99.565	0.465	0.0	0.1	0.1	804.1	O K
4320 min Summer	99.589	0.489	0.0	0.1	0.1	845.1	O K
5760 min Summer	99.612	0.512	0.0	0.1	0.1	885.0	O K
7200 min Summer	99.637	0.537	0.0	0.2	0.2	928.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	157.360	0.0	6.5	27
30 min Summer	101.360	0.0	7.4	42
60 min Summer	62.020	0.0	16.3	72
120 min Summer	39.270	0.0	18.2	132
180 min Summer	29.549	0.0	19.3	192
240 min Summer	23.905	0.0	19.9	252
360 min Summer	17.430	0.0	20.5	372
480 min Summer	13.768	0.0	20.7	492
600 min Summer	11.401	0.0	20.7	612
720 min Summer	9.742	0.0	20.6	732
960 min Summer	7.561	0.0	20.2	972
1440 min Summer	5.244	0.0	19.1	1452
2160 min Summer	3.633	0.0	41.0	2172
2880 min Summer	2.812	0.0	39.4	2892
4320 min Summer	1.987	0.0	35.8	4332
5760 min Summer	1.574	0.0	82.6	5768
7200 min Summer	1.330	0.0	80.0	7208



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
8640 min Summer	99.663	0.563	0.0	0.2	0.2	973.0	O K
10080 min Summer	99.690	0.590	0.0	0.2	0.2	1020.2	O K
15 min Winter	99.238	0.138	0.0	0.1	0.1	238.7	O K
30 min Winter	99.278	0.178	0.0	0.1	0.1	307.5	O K
60 min Winter	99.318	0.218	0.0	0.1	0.1	376.2	O K
120 min Winter	99.375	0.275	0.0	0.1	0.1	476.3	O K
180 min Winter	99.411	0.311	0.0	0.1	0.1	537.3	O K
240 min Winter	99.435	0.335	0.0	0.1	0.1	579.4	O K
360 min Winter	99.466	0.366	0.0	0.1	0.1	633.1	O K
480 min Winter	99.485	0.385	0.0	0.1	0.1	666.3	O K
600 min Winter	99.499	0.399	0.0	0.1	0.1	689.1	O K
720 min Winter	99.508	0.408	0.0	0.1	0.1	706.1	O K
960 min Winter	99.522	0.422	0.0	0.1	0.1	729.6	O K
1440 min Winter	99.538	0.438	0.0	0.1	0.1	756.7	O K
2160 min Winter	99.553	0.453	0.0	0.1	0.1	782.8	O K
2880 min Winter	99.565	0.465	0.0	0.1	0.1	804.1	O K
4320 min Winter	99.589	0.489	0.0	0.1	0.1	845.2	O K
5760 min Winter	99.612	0.512	0.0	0.1	0.1	885.2	O K
7200 min Winter	99.637	0.537	0.0	0.2	0.2	928.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.171	0.0	77.3	8648
10080 min Summer	1.060	0.0	74.2	10088
15 min Winter	157.360	0.0	6.5	27
30 min Winter	101.360	0.0	7.4	42
60 min Winter	62.020	0.0	16.3	72
120 min Winter	39.270	0.0	18.3	132
180 min Winter	29.549	0.0	19.3	192
240 min Winter	23.905	0.0	19.9	250
360 min Winter	17.430	0.0	20.5	370
480 min Winter	13.768	0.0	20.7	490
600 min Winter	11.401	0.0	20.7	610
720 min Winter	9.742	0.0	20.6	730
960 min Winter	7.561	0.0	20.2	968
1440 min Winter	5.244	0.0	19.1	1446
2160 min Winter	3.633	0.0	41.1	2164
2880 min Winter	2.812	0.0	39.4	2880
4320 min Winter	1.987	0.0	35.9	4288
5760 min Winter	1.574	0.0	82.6	5712
7200 min Winter	1.330	0.0	80.1	7136


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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
8640 min Winter	99.663	0.563	0.0	0.2	0.2	973.5	O K
10080 min Winter	99.690	0.590	0.0	0.2	0.2	1020.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.171	0.0	77.3	8560
10080 min Winter	1.060	0.0	74.2	9984



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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.639

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 0.213	4	8 0.213	8	12 0.213

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Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 99.100 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	1820.0	1820.0	0.601	0.0	1922.5
0.600	1820.0	1922.4			

Orifice Outflow Control

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 99.100



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

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

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	9.067	0.367	0.0	0.1	0.1	226.4	O K
30 min Summer	9.146	0.446	0.0	0.1	0.1	291.6	O K
60 min Summer	9.220	0.520	0.0	0.1	0.1	356.7	O K
120 min Summer	9.320	0.620	0.0	0.1	0.1	451.5	O K
180 min Summer	9.378	0.678	0.0	0.1	0.1	509.4	O K
240 min Summer	9.414	0.714	0.0	0.1	0.1	549.2	O K
360 min Summer	9.457	0.757	0.0	0.1	0.1	600.0	O K
480 min Summer	9.482	0.782	0.0	0.1	0.1	631.3	O K
600 min Summer	9.500	0.800	0.0	0.2	0.2	652.8	O K
720 min Summer	9.512	0.812	0.0	0.2	0.2	668.8	Flood Risk
960 min Summer	9.529	0.829	0.0	0.2	0.2	690.8	Flood Risk
1440 min Summer	9.549	0.849	0.0	0.2	0.2	715.9	Flood Risk
2160 min Summer	9.567	0.867	0.0	0.2	0.2	739.9	Flood Risk
2880 min Summer	9.581	0.881	0.0	0.2	0.2	759.3	Flood Risk
4320 min Summer	9.614	0.914	0.0	0.2	0.2	796.6	Flood Risk
5760 min Summer	9.657	0.957	0.0	0.2	0.2	832.9	Flood Risk
7200 min Summer	9.701	1.001	0.0	0.2	0.2	872.1	Flood Risk


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	157.360	0.0	8.7	27
30 min Summer	101.360	0.0	9.5	42
60 min Summer	62.020	0.0	20.5	72
120 min Summer	39.270	0.0	22.3	132
180 min Summer	29.549	0.0	23.2	192
240 min Summer	23.905	0.0	23.6	252
360 min Summer	17.430	0.0	24.0	372
480 min Summer	13.768	0.0	24.0	492
600 min Summer	11.401	0.0	23.9	612
720 min Summer	9.742	0.0	23.7	732
960 min Summer	7.561	0.0	23.2	972
1440 min Summer	5.244	0.0	21.9	1452
2160 min Summer	3.633	0.0	46.7	2172
2880 min Summer	2.812	0.0	44.8	2892
4320 min Summer	1.987	0.0	40.8	4332
5760 min Summer	1.574	0.0	92.7	5768
7200 min Summer	1.330	0.0	90.1	7208

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
8640 min Summer	9.744	1.044	0.0	0.2	0.2	913.1	Flood Risk
10080 min Summer	9.786	1.086	0.0	0.2	0.2	956.1	Flood Risk
15 min Winter	9.067	0.367	0.0	0.1	0.1	226.4	O K
30 min Winter	9.146	0.446	0.0	0.1	0.1	291.6	O K
60 min Winter	9.220	0.520	0.0	0.1	0.1	356.7	O K
120 min Winter	9.320	0.620	0.0	0.1	0.1	451.5	O K
180 min Winter	9.378	0.678	0.0	0.1	0.1	509.3	O K
240 min Winter	9.414	0.714	0.0	0.1	0.1	549.1	O K
360 min Winter	9.457	0.757	0.0	0.1	0.1	600.0	O K
480 min Winter	9.482	0.782	0.0	0.1	0.1	631.3	O K
600 min Winter	9.500	0.800	0.0	0.2	0.2	652.8	O K
720 min Winter	9.512	0.812	0.0	0.2	0.2	668.8	Flood Risk
960 min Winter	9.529	0.829	0.0	0.2	0.2	690.8	Flood Risk
1440 min Winter	9.549	0.849	0.0	0.2	0.2	715.9	Flood Risk
2160 min Winter	9.567	0.867	0.0	0.2	0.2	739.9	Flood Risk
2880 min Winter	9.581	0.881	0.0	0.2	0.2	759.3	Flood Risk
4320 min Winter	9.614	0.914	0.0	0.2	0.2	796.7	Flood Risk
5760 min Winter	9.657	0.957	0.0	0.2	0.2	833.0	Flood Risk
7200 min Winter	9.701	1.001	0.0	0.2	0.2	872.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.171	0.0	87.1	8648
10080 min Summer	1.060	0.0	83.9	10088
15 min Winter	157.360	0.0	8.7	27
30 min Winter	101.360	0.0	9.5	42
60 min Winter	62.020	0.0	20.5	72
120 min Winter	39.270	0.0	22.3	132
180 min Winter	29.549	0.0	23.2	192
240 min Winter	23.905	0.0	23.7	250
360 min Winter	17.430	0.0	24.0	370
480 min Winter	13.768	0.0	24.0	490
600 min Winter	11.401	0.0	23.9	608
720 min Winter	9.742	0.0	23.8	728
960 min Winter	7.561	0.0	23.2	968
1440 min Winter	5.244	0.0	22.0	1446
2160 min Winter	3.633	0.0	46.8	2164
2880 min Winter	2.812	0.0	44.9	2864
4320 min Winter	1.987	0.0	41.0	4288
5760 min Winter	1.574	0.0	92.9	5712
7200 min Winter	1.330	0.0	90.4	7136




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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
8640 min Winter	9.744	1.044	0.0	0.2	0.2	913.4	Flood Risk
10080 min Winter	9.786	1.086	0.0	0.2	0.2	956.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.171	0.0	87.4	8560
10080 min Winter	1.060	0.0	84.2	9984

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Rainfall Details


Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.606

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
	(ha)		(ha)		(ha)
0	4 0.206	4	8 0.200	8	12 0.200



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Model Details

Storage is Online Cover Level (m) 9.800

Complex Structure

Cellular Storage

Invert Level (m) 8.700 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	204.5	204.5	0.301	0.0	221.7
0.300	204.5	221.7			

Cellular Storage

Invert Level (m) 8.700 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	812.0	812.0	0.151	0.0	829.2
0.150	812.0	829.1			

Tank or Pond


Invert Level (m) 9.000

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	123.0	0.800	456.0

Tank or Pond

Invert Level (m) 9.000

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	67.0	0.400	227.0	0.401	321.0	0.800	605.0

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Cellular Storage


Invert Level (m) 9.000 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	598.4	598.4	0.601	0.0	657.2
0.600	598.5	657.1			

Orifice Outflow Control

Diameter (m) 0.009 Discharge Coefficient 0.600 Invert Level (m) 8.700



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

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	9.792	0.142	0.0	0.1	0.1	203.6	O K
30 min Summer	9.833	0.183	0.0	0.1	0.1	262.2	O K
60 min Summer	9.872	0.222	0.0	0.1	0.1	320.8	O K
120 min Summer	9.929	0.279	0.0	0.1	0.1	406.0	O K
180 min Summer	9.963	0.313	0.0	0.1	0.1	458.0	Flood Risk
240 min Summer	9.986	0.336	0.0	0.1	0.1	493.7	Flood Risk
360 min Summer	10.016	0.366	0.0	0.2	0.2	539.4	Flood Risk
480 min Summer	10.034	0.384	0.0	0.2	0.2	567.4	Flood Risk
600 min Summer	10.046	0.396	0.0	0.2	0.2	586.7	Flood Risk
720 min Summer	10.055	0.405	0.0	0.2	0.2	600.9	Flood Risk
960 min Summer	10.068	0.418	0.0	0.2	0.2	620.5	Flood Risk
1440 min Summer	10.082	0.432	0.0	0.2	0.2	642.7	Flood Risk
2160 min Summer	10.095	0.445	0.0	0.2	0.2	663.6	Flood Risk
2880 min Summer	10.107	0.457	0.0	0.2	0.2	680.4	Flood Risk
4320 min Summer	10.132	0.482	0.0	0.2	0.2	712.5	Flood Risk
5760 min Summer	10.156	0.506	0.0	0.2	0.2	743.5	Flood Risk
7200 min Summer	10.181	0.531	0.0	0.2	0.2	777.1	Flood Risk


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	157.360	0.0	7.9	27
30 min Summer	101.360	0.0	9.0	42
60 min Summer	62.020	0.0	19.8	72
120 min Summer	39.270	0.0	22.1	132
180 min Summer	29.549	0.0	23.3	192
240 min Summer	23.905	0.0	24.0	252
360 min Summer	17.430	0.0	24.7	372
480 min Summer	13.768	0.0	24.9	492
600 min Summer	11.401	0.0	24.9	612
720 min Summer	9.742	0.0	24.8	732
960 min Summer	7.561	0.0	24.3	970
1440 min Summer	5.244	0.0	23.0	1450
2160 min Summer	3.633	0.0	49.2	2168
2880 min Summer	2.812	0.0	47.3	2888
4320 min Summer	1.987	0.0	43.2	4328
5760 min Summer	1.574	0.0	98.8	5768
7200 min Summer	1.330	0.0	96.1	7208

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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 (m <sup>3</sup> )	Status
8640 min Summer	10.207	0.557	0.0	0.2	0.2	812.1	Flood Risk
10080 min Summer	10.235	0.585	0.0	0.2	0.2	848.7	Flood Risk
15 min Winter	9.792	0.142	0.0	0.1	0.1	203.6	O K
30 min Winter	9.833	0.183	0.0	0.1	0.1	262.2	O K
60 min Winter	9.872	0.222	0.0	0.1	0.1	320.8	O K
120 min Winter	9.929	0.279	0.0	0.1	0.1	406.0	O K
180 min Winter	9.963	0.313	0.0	0.1	0.1	458.0	Flood Risk
240 min Winter	9.986	0.336	0.0	0.1	0.1	493.7	Flood Risk
360 min Winter	10.016	0.366	0.0	0.2	0.2	539.4	Flood Risk
480 min Winter	10.034	0.384	0.0	0.2	0.2	567.4	Flood Risk
600 min Winter	10.046	0.396	0.0	0.2	0.2	586.7	Flood Risk
720 min Winter	10.055	0.405	0.0	0.2	0.2	600.9	Flood Risk
960 min Winter	10.068	0.418	0.0	0.2	0.2	620.5	Flood Risk
1440 min Winter	10.082	0.432	0.0	0.2	0.2	642.7	Flood Risk
2160 min Winter	10.095	0.445	0.0	0.2	0.2	663.7	Flood Risk
2880 min Winter	10.107	0.457	0.0	0.2	0.2	680.5	Flood Risk
4320 min Winter	10.132	0.482	0.0	0.2	0.2	712.7	Flood Risk
5760 min Winter	10.156	0.506	0.0	0.2	0.2	743.8	Flood Risk
7200 min Winter	10.181	0.531	0.0	0.2	0.2	777.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
8640 min Summer	1.171	0.0	93.0	8648
10080 min Summer	1.060	0.0	89.5	10088
15 min Winter	157.360	0.0	7.9	27
30 min Winter	101.360	0.0	9.0	42
60 min Winter	62.020	0.0	19.8	72
120 min Winter	39.270	0.0	22.1	132
180 min Winter	29.549	0.0	23.3	190
240 min Winter	23.905	0.0	24.0	250
360 min Winter	17.430	0.0	24.7	368
480 min Winter	13.768	0.0	24.9	488
600 min Winter	11.401	0.0	24.9	606
720 min Winter	9.742	0.0	24.8	726
960 min Winter	7.561	0.0	24.3	964
1440 min Winter	5.244	0.0	23.0	1442
2160 min Winter	3.633	0.0	49.2	2160
2880 min Winter	2.812	0.0	47.3	2860
4320 min Winter	1.987	0.0	43.2	4284
5760 min Winter	1.574	0.0	98.8	5712
7200 min Winter	1.330	0.0	96.1	7128


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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m <sup>3</sup> )	Status
8640 min Winter	10.208	0.558	0.0	0.2	0.2	812.7	Flood Risk
10080 min Winter	10.235	0.585	0.0	0.2	0.2	849.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
8640 min Winter	1.171	0.0	93.0	8552
10080 min Winter	1.060	0.0	89.5	9976



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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.545

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 0.330	4	8 0.115	8	12 0.100

Cannon Consulting		Page 5
Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Catchment C	
Date 23/08/2019 16:33 File B411 - Catchment C.srcx	Designed by DJP Checked by	
Micro Drainage	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.250

Complex Structure

Cellular Storage

Invert Level (m) 9.650 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	1041.7	1041.7	0.600	1041.7	1119.2

Tank or Pond

Invert Level (m) 9.650

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	62.0	0.600	228.0

Cellular Storage

Invert Level (m) 9.650 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	332.8	332.8	0.451	0.0	365.7
0.450	332.8	365.6			


Tank or Pond

Invert Level (m) 9.650

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	38.0	0.600	146.0

Orifice Outflow Control

Diameter (m) 0.011 Discharge Coefficient 0.600 Invert Level (m) 9.650

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Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Catchment D	
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Micro Drainage		Source Control 2018.1

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


Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.727	0.077	0.0	0.0	0.0	69.1	O K
30 min Summer	9.748	0.098	0.0	0.0	0.0	89.0	O K
60 min Summer	9.770	0.120	0.0	0.0	0.0	108.9	O K
120 min Summer	9.801	0.151	0.0	0.0	0.0	137.9	O K
180 min Summer	9.833	0.183	0.0	0.0	0.0	155.5	O K
240 min Summer	9.854	0.204	0.0	0.0	0.0	167.7	O K
360 min Summer	9.880	0.230	0.0	0.0	0.0	183.2	Flood Risk
480 min Summer	9.896	0.246	0.0	0.1	0.1	192.7	Flood Risk
600 min Summer	9.907	0.257	0.0	0.1	0.1	199.3	Flood Risk
720 min Summer	9.915	0.265	0.0	0.1	0.1	204.1	Flood Risk
960 min Summer	9.926	0.276	0.0	0.1	0.1	210.8	Flood Risk
1440 min Summer	9.939	0.289	0.0	0.1	0.1	218.4	Flood Risk
2160 min Summer	9.950	0.300	0.0	0.1	0.1	225.6	Flood Risk
2880 min Summer	9.970	0.320	0.0	0.1	0.1	231.4	Flood Risk
4320 min Summer	10.007	0.357	0.0	0.1	0.1	242.4	Flood Risk
5760 min Summer	10.041	0.391	0.0	0.1	0.1	252.9	Flood Risk
7200 min Summer	10.075	0.425	0.0	0.1	0.1	264.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	157.360	0.0	2.4	19
30 min Summer	101.360	0.0	2.7	34
60 min Summer	62.020	0.0	5.9	64
120 min Summer	39.270	0.0	6.6	124
180 min Summer	29.549	0.0	7.2	184
240 min Summer	23.905	0.0	7.5	244
360 min Summer	17.430	0.0	7.9	364
480 min Summer	13.768	0.0	8.0	484
600 min Summer	11.401	0.0	8.1	604
720 min Summer	9.742	0.0	8.0	724
960 min Summer	7.561	0.0	7.9	964
1440 min Summer	5.244	0.0	7.5	1444
2160 min Summer	3.633	0.0	16.1	2164
2880 min Summer	2.812	0.0	15.5	2884
4320 min Summer	1.987	0.0	14.3	4324
5760 min Summer	1.574	0.0	33.6	5768
7200 min Summer	1.330	0.0	33.1	7208




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Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Catchment D	
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Micro Drainage	Source Control 2018.1	

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
8640 min Summer	10.108	0.458	0.0	0.1	0.1	275.8	Flood Risk
10080 min Summer	10.142	0.492	0.0	0.1	0.1	287.9	Flood Risk
15 min Winter	9.727	0.077	0.0	0.0	0.0	69.1	O K
30 min Winter	9.748	0.098	0.0	0.0	0.0	89.0	O K
60 min Winter	9.770	0.120	0.0	0.0	0.0	108.9	O K
120 min Winter	9.801	0.151	0.0	0.0	0.0	137.9	O K
180 min Winter	9.833	0.183	0.0	0.0	0.0	155.5	O K
240 min Winter	9.854	0.204	0.0	0.0	0.0	167.7	O K
360 min Winter	9.880	0.230	0.0	0.0	0.0	183.2	Flood Risk
480 min Winter	9.896	0.246	0.0	0.1	0.1	192.7	Flood Risk
600 min Winter	9.907	0.257	0.0	0.1	0.1	199.3	Flood Risk
720 min Winter	9.915	0.265	0.0	0.1	0.1	204.1	Flood Risk
960 min Winter	9.926	0.276	0.0	0.1	0.1	210.8	Flood Risk
1440 min Winter	9.939	0.289	0.0	0.1	0.1	218.4	Flood Risk
2160 min Winter	9.950	0.300	0.0	0.1	0.1	225.6	Flood Risk
2880 min Winter	9.971	0.321	0.0	0.1	0.1	231.4	Flood Risk
4320 min Winter	10.008	0.358	0.0	0.1	0.1	242.4	Flood Risk
5760 min Winter	10.041	0.391	0.0	0.1	0.1	253.0	Flood Risk
7200 min Winter	10.076	0.426	0.0	0.1	0.1	264.4	Flood Risk


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.171	0.0	32.2	8648
10080 min Summer	1.060	0.0	31.1	10088
15 min Winter	157.360	0.0	2.4	19
30 min Winter	101.360	0.0	2.7	34
60 min Winter	62.020	0.0	5.9	64
120 min Winter	39.270	0.0	6.6	124
180 min Winter	29.549	0.0	7.2	184
240 min Winter	23.905	0.0	7.5	244
360 min Winter	17.430	0.0	7.9	364
480 min Winter	13.768	0.0	8.0	484
600 min Winter	11.401	0.0	8.1	602
720 min Winter	9.742	0.0	8.0	722
960 min Winter	7.561	0.0	7.9	962
1440 min Winter	5.244	0.0	7.5	1442
2160 min Winter	3.633	0.0	16.1	2160
2880 min Winter	2.812	0.0	15.5	2856
4320 min Winter	1.987	0.0	14.3	4280
5760 min Winter	1.574	0.0	33.6	5704
7200 min Winter	1.330	0.0	33.1	7128

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Micro Drainage	Source Control 2018.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m <sup>3</sup> )	Status
8640 min Winter	10.109	0.459	0.0	0.1	0.1	276.1	Flood Risk
10080 min Winter	10.143	0.493	0.0	0.1	0.1	288.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
8640 min Winter	1.171	0.0	32.2	8552
10080 min Winter	1.060	0.0	31.0	9888

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Micro Drainage	Source Control 2018.1	

Rainfall Details


Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.185

Time (mins)		Area
From:	To:	(ha)
0	4	0.185



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Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Catchment D	
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Micro Drainage	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.160

Complex Structure

Cellular Storage

Invert Level (m) 9.650 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	356.6	393.0	0.301	0.0	416.8
0.300	356.6	416.8			

Cellular Storage

Invert Level (m) 9.650 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	399.5	399.5	0.151	0.0	411.5
0.150	399.5	411.5			

Tank or Pond


Invert Level (m) 9.650

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	94.0	0.600	355.0

Cellular Storage

Invert Level (m) 9.650 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	81.2	81.2	0.600	81.2	102.8

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Cambridge House Lanwades Business Park Kentford	B411 Fulbourn Catchment D	
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Micro Drainage	Source Control 2018.1	

Orifice Outflow Control

Diameter (m) 0.007 Discharge Coefficient 0.600 Invert Level (m) 9.650

Our Ref 1630,MO/Ltr01/JG,JD,PD/21-06-16/V1  
Your Ref

Date 21 June 2016

T: 01603 298 076 F: 01603 298 075  
E: [info@geosphere-environmental.co.uk](mailto:info@geosphere-environmental.co.uk)  
W: [www.geosphere-environmental.co.uk](http://www.geosphere-environmental.co.uk)

Castlefield International Ltd c/o Cannon Consulting Engineers  
Cambridge House  
Lanwades Business Park  
Kennett  
Newmarket  
Suffolk  
CB8 7PN

**For the attention of James Howard**

By Email  
- [james.howard@cannonce.co.uk](mailto:james.howard@cannonce.co.uk)

Dear Mr Howard

## **GROUNDWATER MONITORING AT TEVERSHAM ROAD, FULBOURNE, CAMBRIDGESHIRE, CB21 5HE**

### **1. Introduction**

This factual letter report has been prepared for the Client, Castlefield International Ltd c/o Cannon Consulting Engineers.

Geosphere Environmental was commissioned to undertake additional groundwater monitoring visits at the subject site, outlined by and located by Drawing reference 1630,MO/001, attached.

This was to be achieved by:

- Undertaking monthly monitoring of the groundwater levels over a period of six months to assess the changes in groundwater.

This is a continuation of monitoring groundwater levels with the previous data included below.

### **2. Groundwater Level Monitoring**

The groundwater level monitoring involved multiple visits to the site over six months, and using a dipmeter to determine the depth to groundwater below the surrounding ground level. The monitoring points were WS1a and WS3a, as illustrated by the attached Exploratory Hole Location Plan, Drawing ref. 1630,MO 001/Rev 0.

Another monitoring point, WS6a, was available during previous phases of groundwater monitoring, but could not be located during any of the recent monitoring visits, despite numerous additional visits by Geosphere Environmental personnel to search for the monitoring pipe.



## 2.1 Groundwater Monitoring Data Summary

Groundwater was measured within the locatable monitoring wells on six occasions, within this phase of works and this is summarised below. In addition to which, the data from the previous phases, (report or project reference 1058,CO), are displayed below to assist assessment:

Summary of groundwater depth results			
Date of visit	WS1a (mbgl)	WS3a (mbgl)	WS6a (mbgl)
05/02/2015	0.65	0.92	0.63
16/02/2015	0.75	1.00	0.66
13/03/2015	0.74	1.03	0.67
28/04/2015	0.79	n/m	0.60
28/05/2015	0.81	1.14	0.59
05/06/2015	0.88	1.08	0.66
16/11/2016	0.80	1.10	n/m
18/01/2016	1.03	0.68	n/m
24/02/2016	0.71	1.00	n/m
23/03/2016	0.98	0.78	n/m
19/04/2016	0.68	0.99	n/m
20/05/2016	1.00	1.25	n/m

The stream running through the site was observed however the best access point was obstructed by a fallen tree. Where the stream was observable it was flowing northwards, with clear water and at a moderate rate.

The results are provided as an attachment. Our standard report conditions and limitations apply to this letter report and these are available upon request.

We trust the above is clear and acceptable, however if you have any comments or queries please do not hesitate to contact us.

Yours sincerely



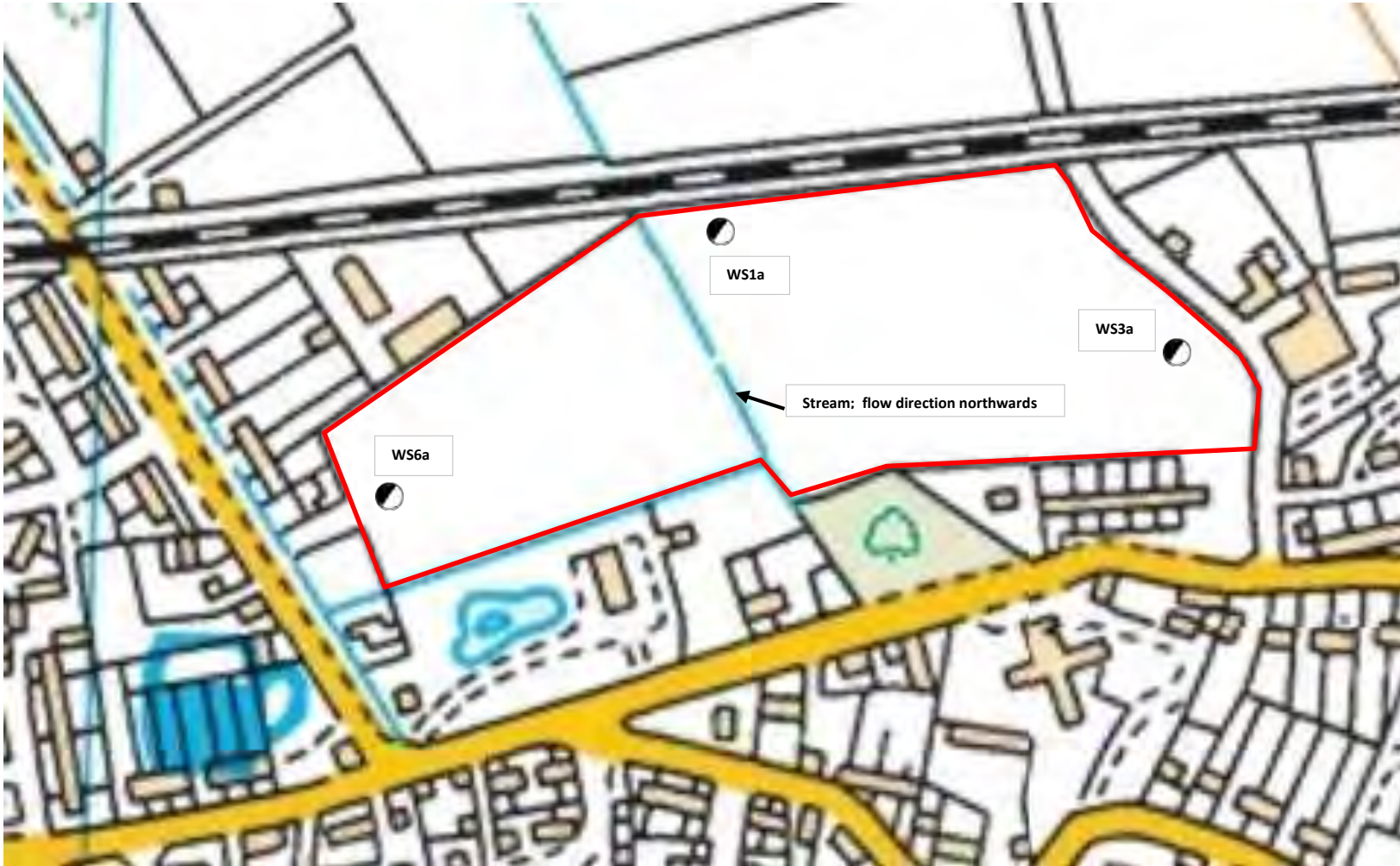
**Jim Dawson**  
**Principal Geoenvironmental Consultant**  
**Geosphere Environmental Ltd**

### Enclosures/Attachments:

Exploratory Hole Location Plan - Drawing 1630,MO/001 (June 2016)

Groundwater monitoring data, project 1630,MO

Groundwater monitoring data, project 1058,CO



**LEGEND:**

Site boundary



Monitoring well locations



Approximate site boundary



geosphere environmental ltd

Brightwell Barn, Ipswich Road,  
Brightwell, Suffolk, IP10 0BJ  
T 01603 298 076 F 01603 289 075  
E info@geosphere-environmental.co.uk

**SITE**

Teversham Road, Fulbourne, Cambridgeshire,  
CB21 5HE

**TITLE**

Exploratory Hole Location Plan

**CLIENT**

Castlefield International Ltd c/o Cannon Consulting  
Engineers.

**REPORT NO.**

1630, MO

**DRAWN BY**

JG

**DRAWING NO.**

001.

**CHECKED**

LF, JD

**DATE**

June2016

**SCALE**

Not to scale

Exploratory Hole Location										
WS1a										
Return Visit #	Monitoring Date	Atmospheric Pressure (mb)	Methane Content (% v/v)   (% LEL)		Carbon Dioxide (% v/v)	Oxygen (% v/v)	Flow Rate (l/hr)	Water Level (mbgl)	Comments	
1st visit	16/11/2015							0.80	Cool, cloudy, dry, calm	
2nd visit	18/01/2016							1.03	Cold, overcast, damp, breezy	
3rd visit	24/02/2016							0.71	Cool, sunny, damp, calm	
4th visit	23/03/2016							0.98	Cool, cloudy, damp, calm	
5th visit	19/04/2016							0.68	Sunny, cool, dry, still	
6th visit	20/05/2016							1.00	Cool, overcast, damp, calm	
<b>Instrument Used:</b>		Dipmeter				<b>NOTE:</b>		n/a	Not applicable	
<b>REMARKS:</b>		WS1 located approximately 10m from rail line at NW corner of Cox Drove field						nm	Not measured	

**KEY:**

- Methane (% v/v)
- Carbon Dioxide (% v/v)
- Oxygen (% v/v)

**Monitoring Visit**

**KEY:**

- Series1

<b>SITE</b> Land off Teversham Road, Fulbourn, Cambridgeshire	<b>REPORT</b> 1630,MO	<b>DATE</b> 20 June 2016
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Exploratory Hole Location										
WS3a										
Return Visit #	Monitoring Date	Atmospheric Pressure (mb)	Methane Content (% v/v)   (% LEL)		Carbon Dioxide (% v/v)	Oxygen (% v/v)	Flow Rate (l/hr)	Water Level (mbgl)	Comments	
1st visit	16/11/2015							1.10	Cool, cloudy, dry, calm	
2nd visit	18/01/2016							0.68	Cold, overcast, damp, breezy	
3rd visit	24/02/2016							1.00	Cool, sunny, damp, calm	
4th visit	23/03/2016							0.78	Cool, cloudy, damp, calm	
5th visit	19/04/2016							0.99	Sunny, cool, dry, still	
6th visit	20/05/2016							1.25	Cool, overcast, damp, calm	
<b>Instrument Used:</b>		Dipmeter				<b>NOTE:</b>		n/a	Not applicable	
<b>REMARKS:</b>		WS3 located approx approx 25m from Cox Drove access point						nm	Not measured	

**KEY:**

- Methane (% v/v)
- Carbon Dioxide (% v/v)
- Oxygen (% v/v)

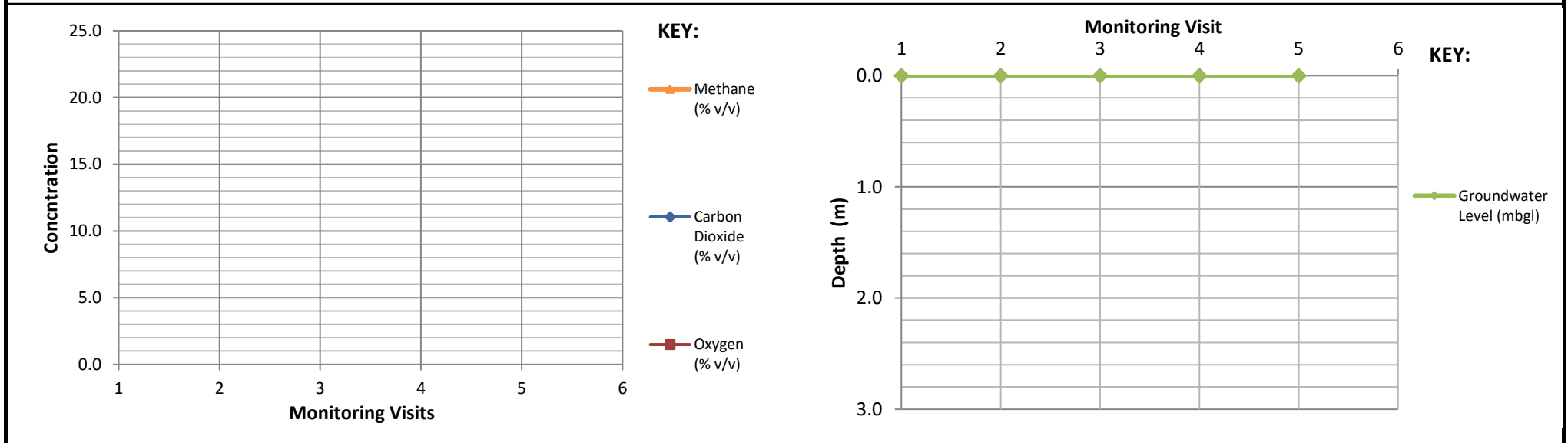
**KEY:**

- Series1

<b>SITE</b> Land off Teversham Road, Fulbourn, Cambridgeshire	<b>REPORT</b> 1630,MO	<b>DATE</b> 20 June 2016
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Exploratory Hole Location		WS6A							
Return Visit #	Monitoring Date	Atmospheric Pressure (mb)	Methane Content (% v/v)   (% LEL)		Carbon Dioxide (% v/v)	Oxygen (% v/v)	Flow Rate (l/hr)	Water Level (mbgl)	Comments
1st visit								n/m	Not located during this phase of monitoring; searched-for by at least three consultants, with previous experience of the site on separate occasions.
2nd visit								n/m	
3rd visit								n/m	
4th visit								n/m	
5th visit								n/m	
6th visit								n/m	



**SITE**  
 Land off Teversham Road, Fulbourn, Cambridgeshire

<b>Exploratory Hole Location</b>		<b>WS1a</b>		<b>Date of Installation</b>		04/02/2015															
Return Visit #	Monitoring Date	Depth of Monitoring Well (mbgl)	Water Level (mbgl)	Comments																	
1st visit	05/02/2015	2.70	0.65	Cool, overcast, damp and breezy																	
2nd visit	16/02/2015	2.70	0.75	Cool, cloudy, damp and calm																	
3rd visit	13/03/2015	2.70	0.74	Cool, overcast, dry and calm																	
4th visit	28/04/2015	2.70	0.79	Cool, cloudy, dry and breezy																	
5th visit	28/05/2015	2.70	0.81	Warm, cloudy, dry and breezy																	
6th visit	05/06/2015	2.70	0.88	Hot, overcast, damp and calm																	
<b>Instrument Used:</b>		GA2000 gas analyser	n/a	Not applicable																	
<b>REMARKS:</b>			nm	Not measured																	
<p><b>Monitoring Visit</b></p> <table border="1"> <caption>Groundwater Level Data</caption> <thead> <tr> <th>Monitoring Visit</th> <th>Water Level (mbgl)</th> </tr> </thead> <tbody> <tr><td>1</td><td>0.65</td></tr> <tr><td>2</td><td>0.75</td></tr> <tr><td>3</td><td>0.74</td></tr> <tr><td>4</td><td>0.79</td></tr> <tr><td>5</td><td>0.81</td></tr> <tr><td>6</td><td>0.88</td></tr> </tbody> </table>								Monitoring Visit	Water Level (mbgl)	1	0.65	2	0.75	3	0.74	4	0.79	5	0.81	6	0.88
Monitoring Visit	Water Level (mbgl)																				
1	0.65																				
2	0.75																				
3	0.74																				
4	0.79																				
5	0.81																				
6	0.88																				
<b>SITE</b>			<b>REPORT</b>		<b>DATE</b>																
Teversham Road, Fulbourn			1058,CO		10 November 2015																

<b>Exploratory Hole Location</b>		<b>WS3a</b>		<b>Date of Installation</b>		04/02/2015															
Return Visit #	Monitoring Date	Depth of Monitoring Well (mbgl)	Water Level (mbgl)	Comments																	
1st visit	05/02/2015	2.00	0.92	Cool, overcast, damp and breezy																	
2nd visit	16/02/2015	2.00	1.00	Cool, cloudy, damp and calm																	
3rd visit	13/03/2015	2.00	1.03	Cool, overcast, dry and calm																	
4th visit	28/04/2015	2.00	n/m	Cool, cloudy, dry and breezy																	
5th visit	28/05/2015	2.00	1.14	Warm, cloudy, dry and breezy																	
6th visit	05/06/2015	2.00	1.08	Hot, overcast, damp and calm																	
<b>Instrument Used:</b>		GA2000 gas analyser	n/a	Not applicable																	
<b>REMARKS:</b>			nm	Not measured																	
<p><b>Monitoring Visit</b></p> <table border="1"> <caption>Groundwater Level Data</caption> <thead> <tr> <th>Monitoring Visit</th> <th>Water Level (mbgl)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.92</td> </tr> <tr> <td>2</td> <td>1.00</td> </tr> <tr> <td>3</td> <td>1.03</td> </tr> <tr> <td>4</td> <td>n/m</td> </tr> <tr> <td>5</td> <td>1.14</td> </tr> <tr> <td>6</td> <td>1.08</td> </tr> </tbody> </table> <p><b>KEY:</b> —◆— Groundwater Level (mbgl)</p>								Monitoring Visit	Water Level (mbgl)	1	0.92	2	1.00	3	1.03	4	n/m	5	1.14	6	1.08
Monitoring Visit	Water Level (mbgl)																				
1	0.92																				
2	1.00																				
3	1.03																				
4	n/m																				
5	1.14																				
6	1.08																				
<b>SITE</b>			<b>REPORT</b>		<b>DATE</b>																
Teversham Road, Fulbourn			1058,CO		10 November 2015																

<b>Exploratory Hole Location</b>		<b>WS6a</b>		<b>Date of Installation</b>	04/02/2015
Return Visit #	Monitoring Date	Depth of Monitoring Well (mbgl)	Water Level (mbgl)	Comments	
1st visit	05/02/2015	2.60	0.63	Cool, overcast, damp and breezy	
2nd visit	16/02/2015	2.60	0.66	Cool, cloudy, damp and calm	
3rd visit	13/03/2015	2.60	0.67	Cool, overcast, dry and calm	
4th visit	28/04/2015	2.60	0.60	Cool, cloudy, dry and breezy	
5th visit	28/05/2015	2.60	0.59	Warm, cloudy, dry and breezy	
6th visit	05/06/2015	2.60	0.66	Hot, overcast, damp and calm	
<b>Instrument Used:</b>		GA2000 gas analyser	n/a	Not applicable	
<b>REMARKS:</b>			nm	Not measured	
<p style="text-align: center;"><b>Monitoring Visit</b></p> <p style="text-align: right;"><b>KEY:</b></p> <p style="text-align: right;">◆ Groundwater Level (mbgl)</p>					
<b>SITE</b>			<b>REPORT</b>	<b>DATE</b>	
Teversham Road, Fulbourn			1058,CO	10 November 2015	





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