

16th December 2016

Our reference: 132739.L04

Your reference: SWM/2016/0731

Planning reference: 16/02377/FUL

Ms Sarah Reghif
The Flood and Water Management Team
Hampshire County Council
EII Court West, 1st Floor
Winchester
Hampshire
SO23 8UJ

RESPONSE TO COMMENTS RE: DEMOLITION OF THE EXISTING STABLE BUILDING, ARENA, FLOODLIGHTS AND HARDSTANDING, AND THE ERECTION OF 30 RESIDENTIAL DWELLINGS, WITH ASSOCIATED ACCESS, LANDSCAPING, AND CAR PARKING ARRANGEMENTS.

Dear Sarah,

We write with respect to your comments (dated 14th November 2016) regarding the site at Broden Stables in Crondall. This letter addresses points raised within your comments, including groundwater flooding issues, infiltration and surface water discharge rates.

Surface water runoff rates

Pre-application correspondence with Hampshire County Council (HCC) stated that 5l/s would be a suitable discharge rate for the site, given the calculated low Greenfield runoff rate of 0.6l/s. In light of the comments received by HCC during the application consultation period, the Greenfield surface water runoff calculations have been revised to better represent the site specific sub-surface and near-surface geology and hydrogeology. Original calculations were submitted with a SOIL value of 0.150, representing free-draining, permeable soils. Calculations have been revised to instead use HOST class 10 – soils seasonally waterlogged by fluctuating groundwater, and with relatively rapid lateral saturated conductivity. This better represents the underlying hydrogeology and position of the site close to the base of the river valley. Calculations were undertaken using the Greenfield Runoff Estimation for Sites tool on www.uksuds.com. Outputs of these calculations and the parameters used are contained within **Appendix A** of this letter. The revised Qbar runoff rate for the site has been calculated as 3.9l/s. As previously stated in the FRA, HCC advised that an outfall of 5l/s should be used when Greenfield runoff rates are below this to prevent increasing flood risk arising from blockages. In this case, due to the sensitivity of the catchment further downstream, it is proposed to restrict the off-site discharge rate to 4.0l/s (as close as practicable to a rate of 3.9l/s). This will ensure that there is no net increase in off-site discharge for events in excess of the Qbar storm event. Runoff rates are summarised in Table 1 below.

Table 1: Revised Greenfield runoff rates

Return period	Peak flow (l/s)
QBar	3.9
1 in 1 year	3.3
1 in 30 year	9.0
1 in 100 year	12.4

Groundwater and Infiltration

The site-specific infiltration report is contained within **Appendix B** of this report. This report supports the infiltration rate used within the submitted FRA. HCC comments reference a depth to groundwater of between 2-3m below ground level (mBGL), based on information contained with the desk-based PRA submitted with the application. Information contained within the infiltration report indicates that groundwater was not struck to a depth of 3.2mBGL in the location of the basin the northern corner of the site. Based on the available information, infiltration is considered suitable in this location, with a basin depth of 1.5mBGL.

Based on the request for further information within the Hart District Council (HDC) comments for groundwater levels monitored through a winter period and/or mitigation measures to prevent internal flooding and impact on below ground infrastructure, it is not considered appropriate in this instance undertake long-term groundwater monitoring, particularly as the recommended surface water drainage system has a high level outfall which will be designed to function if underlying conditions prevented natural infiltration. It is therefore recommended that finished floor levels of residential dwellings are raised by a minimum of 150mm in respect of immediate surrounding ground levels (upslope) to prevent the ingress of any groundwater flows into properties. With respect to minimising the impact on below ground infrastructure, it is recommended that best practice is followed to ensure that foul and surface water drainage are sealed systems in order to prevent the ingress of groundwater into the drainage systems. Non-return valves could also be fitted to prevent flooding within properties. It is also recommended that drainage networks be laid as shallow as possible to reduce the potential for groundwater ingress.

We look forward to hearing your response on the above comments.

Yours sincerely,

For RSK LDE Limited

Mason Durant
Hydrologist



Appendix A: Revised Greenfield runoff calculations

Appendix B: Site-specific infiltration report



APPENDIX A

Revised Greenfield runoff calculations

Site name:

Site location:

Site coordinates

Latitude:

Longitude:

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Reference:

Date:

Site characteristics

Total site area	1.4	ha
Significant public open space	0	ha
Area positively drained	1.4	ha

Methodology

Greenfield runoff method	IH124
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from dominant HOST
SOIL type	4
HOST class	10
SPR	0.35

Hydrological characteristics

	Default	Edited	
SAAR	739	753	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.85	0.85	
Hydrological region	6	6	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Greenfield runoff rates

	Default	Edited	
Qbar	7.22	3.89	l/s
1 in 1 year	6.14	3.31	l/s
1 in 30 years	16.61	8.96	l/s
1 in 100 years	23.04	12.42	l/s

Please note that a minimum flow of 5 l/s applies to any site

Site name:

Site location:

Site coordinates

Latitude:

Longitude:

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Reference:

Date:

Site characteristics

Total site area	1.4	ha
Significant public open space	0	ha
Area positively drained	1.4	ha

Methodology

Greenfield runoff method	FEH	
Qmed estimation method	Calculate from BFI and SAAR	
BFI and SPR estimation method	Calculate from dominant HOST	
HOST class	10	
BFI / BFIHOST	0.52	
Qmed	4.672	l/s
Qbar / Qmed Conversion Factor	1.136	

Hydrological characteristics

	Default	Edited	
SAAR	739	753	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.85	0.85	
Hydrological region	6	6	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Greenfield runoff rates

	Default	Edited	
Qbar	5.06	5.31	l/s
1 in 1 year	4.30	4.51	l/s
1 in 30 years	11.65	12.21	l/s
1 in 100 years	16.15	16.93	l/s

Please note that a minimum flow of 5 l/s applies to any site



APPENDIX B

Site-specific infiltration report

Our ref: 28582-02R
24th May 2016

Mr William Edgerley
Cron dall Developments Ltd,

Dear William,

Broden Stables, Cron dall – Trial Pit Infiltration Testing

1. Introduction

On the instructions of Cron dall Developments Ltd (the 'client') RSK Environment Ltd (RSK) has attended the above mentioned site in order to complete trial pit infiltration testing across the site area.

2. Site Works

RSK attended site on the 19th May 2016 and undertook a total of three separate trial pit infiltration tests with the locations prescribed by RSK Land Development Engineering, to infirm the design of an appropriate drainage strategy. Exploratory hole locations are shown on **Figure 1**.

Infiltration tests were carried out in general accordance with BRE365, albeit with only one test being conducted in each trial pit location. Owing to variable ground conditions, pits were excavated to varying depths, ranging between 1.60m and 3.20mbgl, with a response zone for each test targeted towards granular strata, where possible.

3. Ground Conditions

The exploratory holes encountered a variable covering of topsoil extending to depths ranging between 0.15m and 0.4mbgl overlying variable granular and cohesive River Terrace Deposits to the full depth of investigation at a depth of 3.20mbgl.

The River Terrace deposits were variable in composition typically comprising of an upper cohesive horizon overlying granular materials at depth. Cohesive materials, typically comprising of a sandy gravelly clay with variable flint gravels, were encountered in all three trial pits at depths ranging between 0.15m and 0.40mbgl extending to depths ranging between 0.80m and 2.40mbgl. TP1 terminated within cohesive deposits at a depth of 1.60mbgl.





Beneath the cohesive deposits a clayey sand was encountered at depths of 0.8mbgl and 2.40mbgl in TP2 and TP3 respectively, extending to the base of each exploratory hole.

With the exception of a slight groundwater seepage at a depth of 1.60mbgl in TP1, significant groundwater ingress was not noted in any of the trial pits. However, owing to the progression of infiltration testing, exploratory holes were not left open for any considerable period of time to allow groundwater levels to equilibrate.

4. Results of Infiltration Testing

Infiltration rates derived from the individual tests are reproduced in **Table 1**. Owing to the slow nature of the infiltration, associated rates have not been derived between the 75th and 25th percentiles (based upon the maximum fill level, as prescribed in BRE365) with variable percentiles utilised for each test as outlined in the table.

Table 1: Derived infiltration rates

Location	Test depth (mbgl)	Strata targeted	Percentiles used for calculated infiltration rate	Unfactored Infiltration rate (m/s)
TP101	0.53m to 1.60m	River Terrace Deposits – upper cohesive elements	50% to 90%	9.57×10^{-6}
TP102	1.19m to 2.30m	River Terrace Deposits – granular horizon	75% to 95%	3.72×10^{-6}
TP103	1.95m to 3.20m	River Terrace Deposits – granular horizon	70% to 90%	6.86×10^{-6}

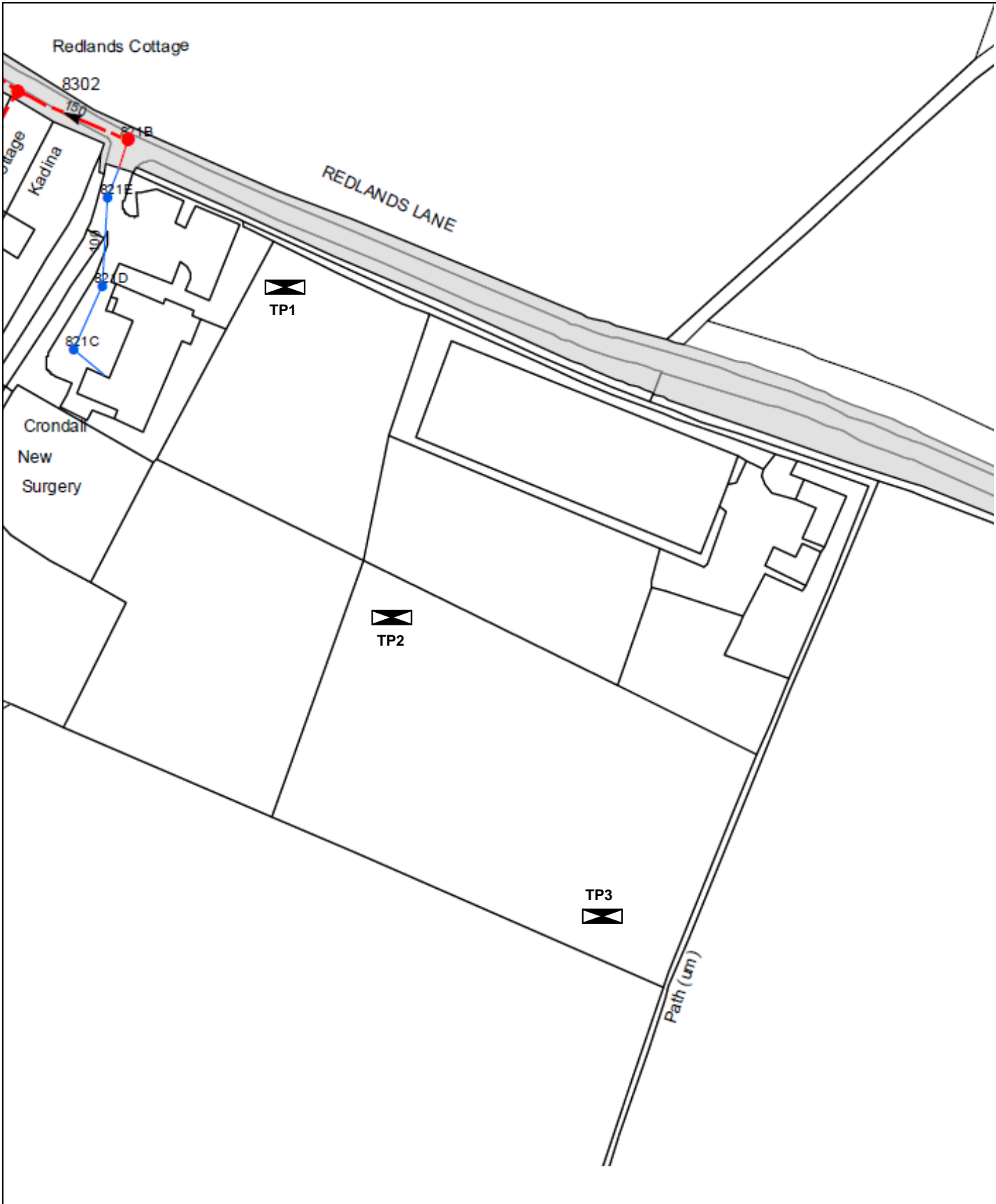
We trust the above is suitable for your present needs. Please do not hesitate to get in contact with the undersigned if you have any queries or require clarification on any of the above.

Yours sincerely
For RSK Environment Ltd

Andrew Kent
Associate Director, Geosciences

Encl. Figures
Appendix A – Exploratory Hole Records
Appendix B – Soakage Testing Results

Figures



**Exploratory Hole
Location Plan**

Client: Crondall Developments Ltd

Figure No: 1

Site: Broden Stables, Crondall

Job No: 28582-02

Scale: NTS

Source: -



Appendix A
Exploratory Hole Records

Contract: Broden Stables		Client: Crondall Developments Ltd		Trial Pit: TP1
Contract Ref: 28582	Start: 19.05.16 End: 19.05.16	Ground Level: ---	Co-ordinates: ---	Sheet: 1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.20	1	D			Grass over dark brown sandy slightly gravelly CLAY with occasional roots. Gravel is subrounded to subangular fine to coarse of flint. (TOPSOIL)	(0.40)		
0.20	2	ES				Firm orangish brown slightly sandy very gravelly CLAY. Gravel is subrounded to subangular fine to coarse with rare cobbles of flint. (RIVER TERRACE DEPOSITS)		0.40
1.00-1.60	4	B			Trial pit terminated at 1.60m depth.	(1.20)		
1.20	3	D				1.60		

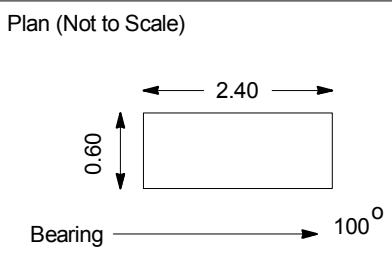
GINT_LIBRARY_V8_06.GLB LibVersion: v8_06 - Core+Logs - 001 | Log TRIAL PIT LOG - A4P | 28582_BRODEN STABLES.GPJ - v8_06.
 RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk | 24/05/16 - 14:10 | CB1 |

Plan (Not to Scale) 		General Remarks 1. Seepage at 1.60m depth. 2. No groundwater encountered. 3. Trial pit backfilled with arisings upon completion.	
All dimensions in metres		Scale: 1:25	
Method Used: Machine dug	Plant Used: JCB-3CX	Logged By: JTownsend	Checked By:

Contract: Broden Stables		Client: Crondall Developments Ltd		Trial Pit: TP2	
Contract Ref: 28582		Start: 19.05.16	Ground Level: ---	Co-ordinates: ---	Sheet: 1 of 1
End: 19.05.16					

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.10	1	D			Dark brown slightly sandy gravelly CLAY with occasional roots. Gravel is subangular fine to coarse of flint and subangular fine to medium of chalk. (TOPSOIL)	0.15	[Symbol]	
0.10	2	ES				Firm orangish brown with greyish brown mottled slightly sandy very gravelly CLAY. Gravel is subangular fine to coarse with occasional cobbles of flint. (RIVER TERRACE DEPOSITS)		(0.65)
0.60	3	D			Orangish brown clayey fine to medium SAND with occasional pockets of orangish brown firm clay. (RIVER TERRACE DEPOSITS)	0.80	[Symbol]	
1.00	4	D				(1.50)		
1.30-2.30	5	B				2.30	[Symbol]	
Trial pit terminated at 2.30m depth.								

GINT_LIBRARY_V8_06.GLB LibVersion: v8_06 - Core+Logs - 001 | Log TRIAL PIT LOG - A4P | 28582_BRODEN STABLES.GPJ - v8_06.
 RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk | 24/05/16 - 14:10 | CB1 |



General Remarks

- Slight collapse from 1.20m depth.
- No groundwater encountered.
- Trial pit backfilled with arisings upon completion.

All dimensions in metres		Scale: 1:25	
Method Used: Machine dug	Plant Used: JCB-3CX	Logged By: JTownsend	Checked By: [Signature]



Contract: Broden Stables		Client: Crondall Developments Ltd		Trial Pit: TP3
Contract Ref: 28582	Start: 19.05.16 End: 19.05.16	Ground Level: ---	Co-ordinates: ---	Sheet: 1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend		
Depth	No	Type	Results							
0.20	1	D				Grass over dark brown slightly sandy slightly gravelly CLAY with occasional roots. Gravel is subangular fine to coarse of flint with subangular fine chalk. (TOPSOIL)	(0.30)			
0.20	2	ES				Soft to firm orangish brown mottled greyish brown slightly sandy very gravelly CLAY with occasional roots. Gravel is subrounded to subangular fine to coarse of quartzite and flint and rare pockets of sand. (RIVER TERRACE DEPOSITS)	0.30			
0.60	3	D						(0.75)		
								1.05		
1.50	4	D				Firm to stiff light blue with orangish brown mottling slightly sandy CLAY with occasional pockets of sand. (RIVER TERRACE DEPOSITS)		(0.95)		
2.20	5	D					Soft greyish brown clayey slightly sandy SILT with occasional pockets of clay. (RIVER TERRACE DEPOSITS)		(0.40)	
2.40-3.20	6	B					Orangish brown slightly silty fine to medium SAND with occasional pockets of clay. (RIVER TERRACE DEPOSITS)		2.40	
2.60	7	D						(0.80)		
								3.20		
Trial pit terminated at 3.20m depth.										

GINT_LIBRARY_V8_06.GLB LibVersion: v8_06_010 PriVersion: v8_06 - Core+Logs - 001 | Log TRIAL PIT LOG - A4P | 28582_BRODEN STABLES.GPJ - v8_06.
 RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk | 24/05/16 - 14:10 | CB1 |

Plan (Not to Scale) 		General Remarks 1. Pit walls remained stable throughout. 2. No groundwater encountered. 3. Trial pit backfilled with arisings upon completion.		
All dimensions in metres		Scale: 1:25		
Method Used: Machine dug	Plant Used: JCB-3CX	Logged By: JTownsend	Checked By:	



Appendix B
Infiltration Testing Results

