AMENDED

ROY LOBLEY CONSULTING
Specialists in Flood Risk Management

FLOOD RISK ASSESSMENT & OUTLINE SUSTAINABLE DRAINAGE STRATEGY

Residential Development
Main Street, Sturton

Qudos Property
March 2022

DOCUMENT ISSUE RECORD

Document Reference	RLC/0850/FRA+OSDS01

Revision		Date of Issue
1	Issued	13/12/2021
2	Layout revised	07/03/2022

Author

Roy Lobley
07847 482244
Roy.Lobley@outlook.com

Limitations

The conclusions drawn by Roy Lobley Consulting are based on information supplied and could differ if the information is found to be inaccurate or misleading. In which case Roy Lobley Consulting accepts no liability should additional information exist or becomes available with respect to this project.

The information in this report is based on statistical data and qualitative analysis which are for guidance purposes only. This study provides no guarantee against flooding or of the absolute accuracy of water levels, flows and associated probabilities.

This report has been prepared for the sole use of Qudos Property and no other third parties may rely upon or reproduce the contents of this report without the written permission of Roy Lobley Consulting.

EXECUTIVE SUMMARY

This Flood Risk Assessment is compliant with the requirements set out in the National Planning Policy Framework, and the associated online Planning Practice Guidance. It has been produced on behalf of Qudos Property. This report demonstrates that the proposed development is not at significant flood risk, and will not increase flood risk to others, subject to the recommended flood mitigation strategies being implemented.

Policy

Development Type	Flood Zone	Vulnerability	Sequential Test
Dwelling Houses	1	More Vulnerable	Not Required

Climate Change Allowance

Peak Rainfall Intensity

Allowance Category	Percentage Increase
Upper End	40
Central	20

Flood Risk and Mitigation

Flood Risk Source	Level of Risk Without Mitigation	Proposed Mitigation
Fluvial Groundwater Sewers	Low	Non required
Tidal Pluvial Reservoir Canal/Artificial	None	
Development Foul & Surface Water	To wider catchment	Surface water via infiltration Foul water to AW sewer

CONTENTS PAGE

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 This Flood Risk Assessment, (FRA), is compliant with the requirements set out in the National Planning Policy Framework, (NPPF), and the associated online Planning Practice Guidance.

1.2 The FRA has been produced on behalf of Qudos Property in respect of a planning application for a residential development at Main Street, Sturton.

Data Used

1.3 This FRA is based on the following information:

- Proposed Plans
- British Geological Survey Drift & Geology Maps
- Environment Agency Data
- British Geological Survey Hydrogeology Data
- Anglian Water Sewer Records

Existing Site

1.4 The site is located at grid reference SE9696404471 as shown in **Figure 1.1** below and covers an area of approximately 1.1ha.

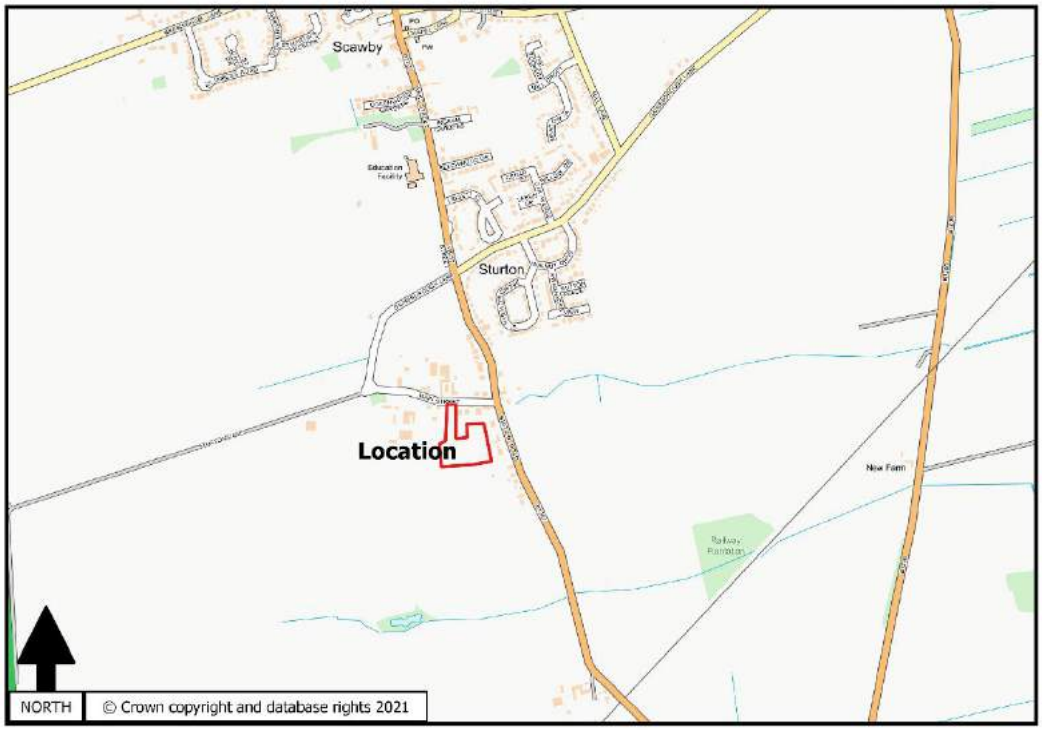


Figure 1.1 Site Location

1.5 The online British Geological Survey maps indicates that the site is located on a bedrock of mudstone and limestone.

Proposed Development

1.6 The proposed development consists of a residential development as shown on the extract of the proposed plan below in **Figure 1.2**

Figure 1.2 Proposed Plan

2.0 FLOOD RISK PLANNING POLICY

National Planning Policy Framework

2.1 The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. A supporting web-based Planning Practice Guidance is also available.

2.2 The guidance uses four Flood Zones to characterise flood risk which refer to the probability of river and sea flooding, ignoring the presence of defences.

Sequential Test

2.3 The NPPF requires the application of a Sequential Test to ensure that new development is in areas with the lowest probability of flooding and the Flood Zones provide the basis for applying the Test.

Flood Zone Definition

Flood Zone 1	Low probability (1 in 1000 annual probability of river or sea flooding (<0.1%)).
Flood Zone 2	Medium probability (between 1 in 100 and 1 in 1000 annual probability of river flooding (1.0%.-.0.1%) or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%.-.0.1%) in any given year).
Flood Zone 3a	High probability (1 in 100 or great annual probability of river flooding (>1.0%) or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).
Flood Zone 3b	This zone comprises land where water must flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5.0%), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

2.4 The Flood Zones do not consider the projected effects of climate change and may not represent potential flooding from smaller watercourses.

2.5 The aim is to steer new development to Flood Zone 1 and where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should consider the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required.

2.6 Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, considering the flood risk vulnerability of land uses and applying the Exception Test if required.

2.7 The guidance also sets out the vulnerability to flooding of different land uses and some of these are detailed below.

Flood Risk Vulnerability Classification

Essential Infrastructure	Transport Infrastructure; Utility Infrastructure; Wind Turbines.
Water Compatible	Flood Control Infrastructure; Water and Sewage Infrastructure; Navigation Facilities.
Highly Vulnerable	Emergency Services (which are required in times of flood); Basement Dwellings; Caravans, Mobile Homes and Park Homes, (intended for permanent residential use); Installations requiring Hazardous Substances Consent.
More Vulnerable	Hospitals and other Health Services; Residential Institutions; Dwelling Houses, Drinking Establishments; Nightclubs; Hotels; Non-residential uses for Health Services; Nurseries; Educational Establishments; Landfill and Hazardous Waste Management Facilities; Sites used for Holiday or short-let Caravan and Camping sites, (subject to a specific warning and evacuation plan).
Less Vulnerable	Commercial Establishments; Emergency Services not required in times of flood; Land and Buildings used for Agriculture and Forestry. Waste Treatment; Minerals Working; Water Treatment Works; Sewage Treatment Works.

Appropriate Development

2.8 Based on the vulnerability of a development the guidance states what Flood Zone(s) the development is appropriate within. The flood risk compatibility is summarised below.

Flood Zone 1	Appropriate Development – All.
Flood Zone 2	Exception Test - Highly vulnerable. Appropriate Development - Essential Infrastructure; More vulnerable; Less vulnerable and Water Compatible.
Flood Zone 3a	Should not be permitted – Highly vulnerable. Exception Test – Essential Infrastructure, More vulnerable. Appropriate Development – Less vulnerable; Water compatible.
Flood Zone 3b	Should not be permitted – Highly vulnerable; More vulnerable; Less vulnerable. Exception Test – Essential Infrastructure. Appropriate Development –Water compatible.

2.9 The Planning Practice Guidance also states that all sources of flooding should be considered when preparing a FRA.

Exception Test

2.10 The Exception Test is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

2.11 The first part of the Exception Test is to show that the proposed development will provide wider sustainability benefits to the community that outweigh flood risk. The second part is the requirement for a FRA to demonstrate that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

Development Proposals

2.12 The proposed development consists of Dwelling Houses.

Flood Zones

2.13 The Flood Zones are shown on **Figure 2.1** below which shows the site to be in Flood Zone 1.

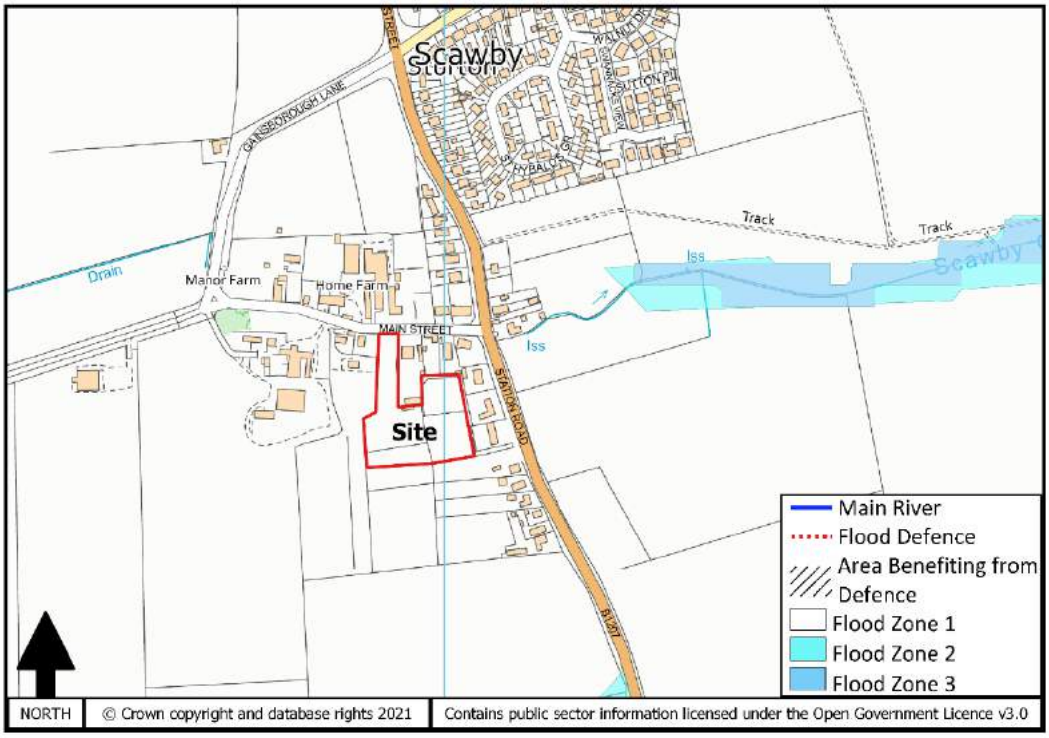


Figure 2.1 Flood Zones

Development Vulnerability

2.14 Dwelling Houses are More Vulnerable and therefore appropriate in Flood Zone 1.

Exception Test

2.15 Whilst the development is considered appropriate a FRA is required to ensure the development will remain safe over its lifetime from all sources of flooding and not increase flood risk elsewhere.

3.0 CLIMATE CHANGE

3.1 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change.

3.2 As the Government's expert on flood risk on 19th February 2016 the Environment Agency, (EA), published revised climate change allowances to support the NPPF. The sea level rise allowances were revised on the 17th December 2019 and the peak river flows revised on the 20th July 2021.

3.3 The climate change allowances are based on projections and different scenarios of carbon dioxide (CO2) emissions to the atmosphere and provide predictions of anticipated change for:

- peak river flow by river Management Catchment;
- peak rainfall intensity;
- sea level rise;
- offshore wind speed and extreme wave height.

Peak River Flow Allowances

3.4 The peak river flow allowances show the anticipated changes to peak flow by Management Catchment, which are sub-catchments of River Basin Districts, with three allowances; central; higher central and upper end.

3.5 However, this proposed development is in Flood Zone 1 and therefore peak river flow allowances do not apply.

Peak Rainfall Intensity Allowance

3.6 Increased rainfall affects river levels and land and urban drainage and should be applied to surface water drainage systems.

3.7 Theses allowances are uniform across England and change over three periods of time over the next century. The appropriate period should be chosen based on the expected lifetime of the development and for residential that is 100 years

3.8 Surface water drainage strategies and detailed designs need to assess both the central and upper end allowances to understand the range of impact. The following climate change allowances in peak rainfall intensity therefore need to be applied:

Allowance Category	Percentage Increase
Upper End	40
Central	20

Table 3.1 Climate Change Allowances for Peak Rainfall Intensity

Sea Level Allowances

3.9 There is a range of allowances for each region and epoch or time frame for sea level rise. However, this site is not affected from tidal sources, see section 4.

4.0 FLOOD RISK SOURCES

4.1 The following flood risk sources have been identified and where mitigation is required to reduce the flood risk this is discussed in **Section 5**.

Fluvial

Main River

4.2 The nearest EA Main River to the site is approximately 1.00km to the east.

Ordinary Watercourses

4.3 The site does not lie within any Internal Drainage Board District.

4.4 The risk of flooding from fluvial sources is low.

Tidal

4.5 The site is not at risk from tidal sources.

Pluvial

4.6 The EA have produced maps showing flooding when rainwater lies or flows over the ground. The surface water flooding extents are shown below in **Figure 4.1**. Unlike the fluvial mapping, which is based on a detailed hydraulic model, this mapping is based purely on applying rainfall to a digital terrain model. As such this mapping serves to represent a worst-case scenario which may well overstate the actual probability of flooding in this area.

4.7 There is a caveat, as to the use of these maps and that they are not to be used to identify that an individual property will flood. Because of the way they have been produced and the fact that they are indicative these maps are not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

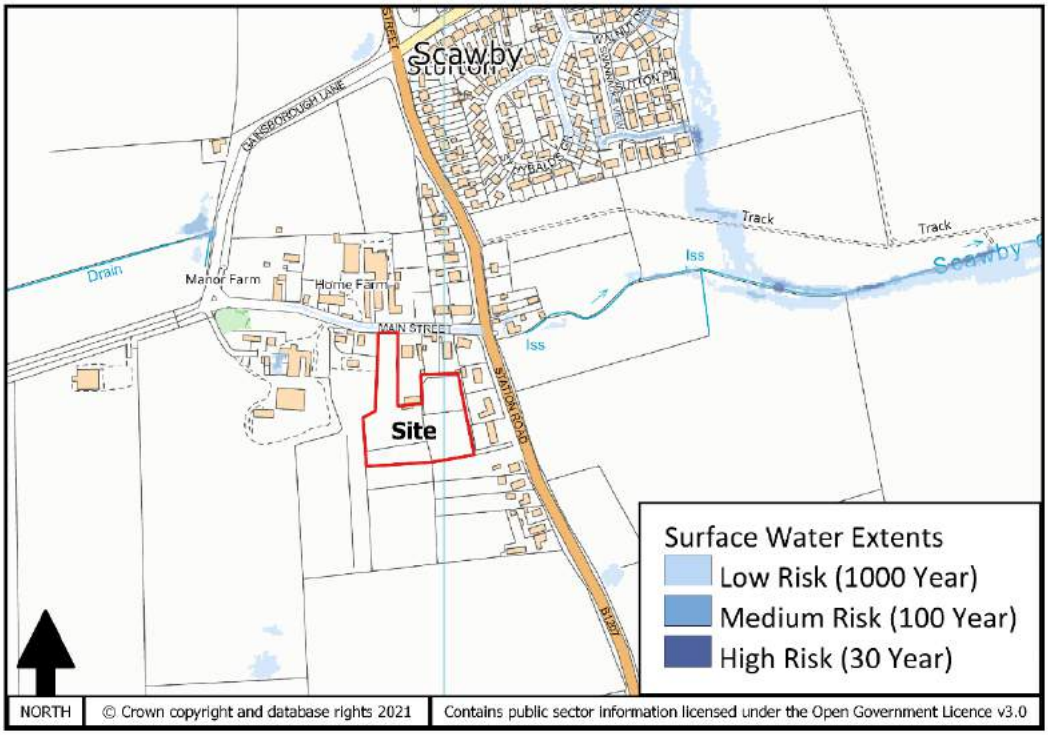


Figure 4.1 Surface Water Flooding Extents

4.8 The site is not at risk of flooding from pluvial sources.

Groundwater

4.9 The site is located on a highly productive aquifer and there are no known instances of groundwater flooding in the area.

4.10 A spring is noted to originate at the interface between the Kirton Cementstone Formation (Interbedded Limestone and Mudstone) and the Kirton Cementstone Formation (Limestone) with the resulting stream flowing in an easterly direction away from the Site towards the River Ancholme and area of lower elevation.

4.11 The risk of flooding from groundwater is low.

Sewers

4.12 Public maintained sewers run adjacent to the site but are unlikely to pose a significant flood risk as they are well maintained.

4.13 The risk of flooding from existing sewers is low.

Reservoirs

4.14 The EA has prepared reservoir failure flood risk mapping to show the largest area that might be flooded if a reservoir were to fail and release the water it holds. The mapping displays two scenarios as follows:

- Dry this is the extent when the river levels are normal,
- Wet this is the extent when there is also flooding from rivers.

4.15 The mapping displays a worst-case scenario and is only intended as a guide.

4.16 The site is not at risk of flooding from reservoirs.

Canals and Artificial Water Bodies

4.17 The site is not at risk of flooding from canals.

Development Foul & Surface Water

4.18 The proposed development will require the disposal of foul and surface water which could impact on existing systems and developments.

5.0 MITIGATION

5.1 Section 4.0 has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA sets out the mitigation measures which are to be incorporated within the proposed development to address and reduce the risk of flooding to within acceptable levels.

Site Layout

5.2 The proposed development is only at a low risk of flooding from fluvial, groundwater and existing sewers and therefore the standard raising of finished floor levels a minimum 150mm above the surrounding ground levels will be sufficient mitigation.

Development Surface and Foul Water Drainage

5.3 The following **Section 6**, and **Section 7**, identifies the proposed mitigation for the developments surface and foul water disposal.

6.0 SURFACE WATER DRAINAGE

6.1 When rain falls on a natural landscape it soaks into the ground, evaporates, is taken up by plants and some of it eventually finds its way into streams and rivers.

6.2 These stages of the water cycle can be impeded when land is developed and there tends to be less permeable ground available for infiltration and less vegetation for evapotranspiration. When rain falls on impermeable surfaces much more of it turns to surface water runoff, which can cause flooding, pollution and erosion problems.

6.3 Sustainable drainage systems, (SuDS), are designed to maximise the opportunities and benefits that can be secured from surface water management.

Hierarchy of Surface Water Drainage

6.4 The recommended surface water drainage hierarchy is to utilise soakaway, or infiltration as the preferred option, followed by discharging to an appropriate watercourse or if this is not available the final option is to an existing public sewer.

6.5 Ground investigation in the form of percolation tests undertaken to BRE Digest 365 across the site has identified that soakaways would be suitable and the test results are included as **Appendix 1** with a summary below in **Table 6.1.**

Test Location	Infiltration Rate (m/sec)
SA01	0.00000087
SA02	0.00065
SA03	0.00017

Table 6.1 Infiltration Test Results

6.6 The majority of the site is covered by SA02 and SA03 with an average infiltration rate of 0.00041m/sec.

6.7 The test holes were terminated at 1.50m BGL and 1.60m BGL into the Kirton Limestone and the geology beneath these depths is considered to be consistent to significant depths below surface level given the wider areas consistent Limestone geology associated with the formation from shallow sea deposits and typical of this area of Lincolnshire.

Surface Water Discharge via Infiltration

6.8 The sizing of soakaways has been undertaken using a software tool developed by HR Wallingford based on the method provided in CIRIA report 156 and a summary is included below with the full results included in **Appendix 2.**

Porosity of Fill Material

6.9 Typical values for the porosity of fill materials are:

- High Void Structure 0.90 - 0.95
- Single Size Clean Stones 0.30 - 0.40
- Graded Sand/Gravel 0.20 - 0.30

6.10 In this instance it is proposed to use;

- plastic soakaway crates with a high void structure of 0.95 for the rear roof soakaways,
- the gravel sub base with a void ratio of 0.30 for the roads and private parking areas,
- where possible, the gravel sub base with a void ratio of 0.30 for the front roof soakaways.

Soakaways Size

6.11 A factor of safety of 1.5 has been chosen based on the table below.

	CONSEQUENCE OF FAILURE		
Total Area to be Drained	**No damage or inconvenience**	**Minor Inconvenience e.g. SW on Car Park**	**Damage to Buildings or Major Inconvenience e.g. SW on Roads**
<100m^2	1.5	2.0	10.0
100m^2 to 1000m^2	1.5	3.0	10.0
>1000m^2	1.5	5.0	10.0

Table 6.2 Infiltration Factor of Safety

6.12 The size of soakaways has been calculated for the 1:100 year return period, (although Building Regulations Part H3 only requires a 1:10 year return period), with a 40% climate change allowances in peak rainfall intensity.

Rectangular Soakaway 1

6.13 50m^2 of roof area will require a soakaway 1.0m x 2.0m x 0.5m deep.

Rectangular Soakaway 2

6.14 The depth of sub base under the permeable road and parking areas on the majority of the site is minimal.

Rectangular Soakaway 3

6.15 Where the gravel sub base can be used for the front roof soakaways 50m^2 of roof will require 6m^2 of gravel to a depth of 230mm.

Rectangular Soakaway 4

6.16 At the entrance where the SA01 infiltration rate was 0.00000087 the sub base will need to be 0.23m thick.

7.0 FOUL WATER DRAINAGE

7.1 The foul water from the proposed development will be discharge to the Anglian Water foul sewer as shown in **Figure 7.1** below.

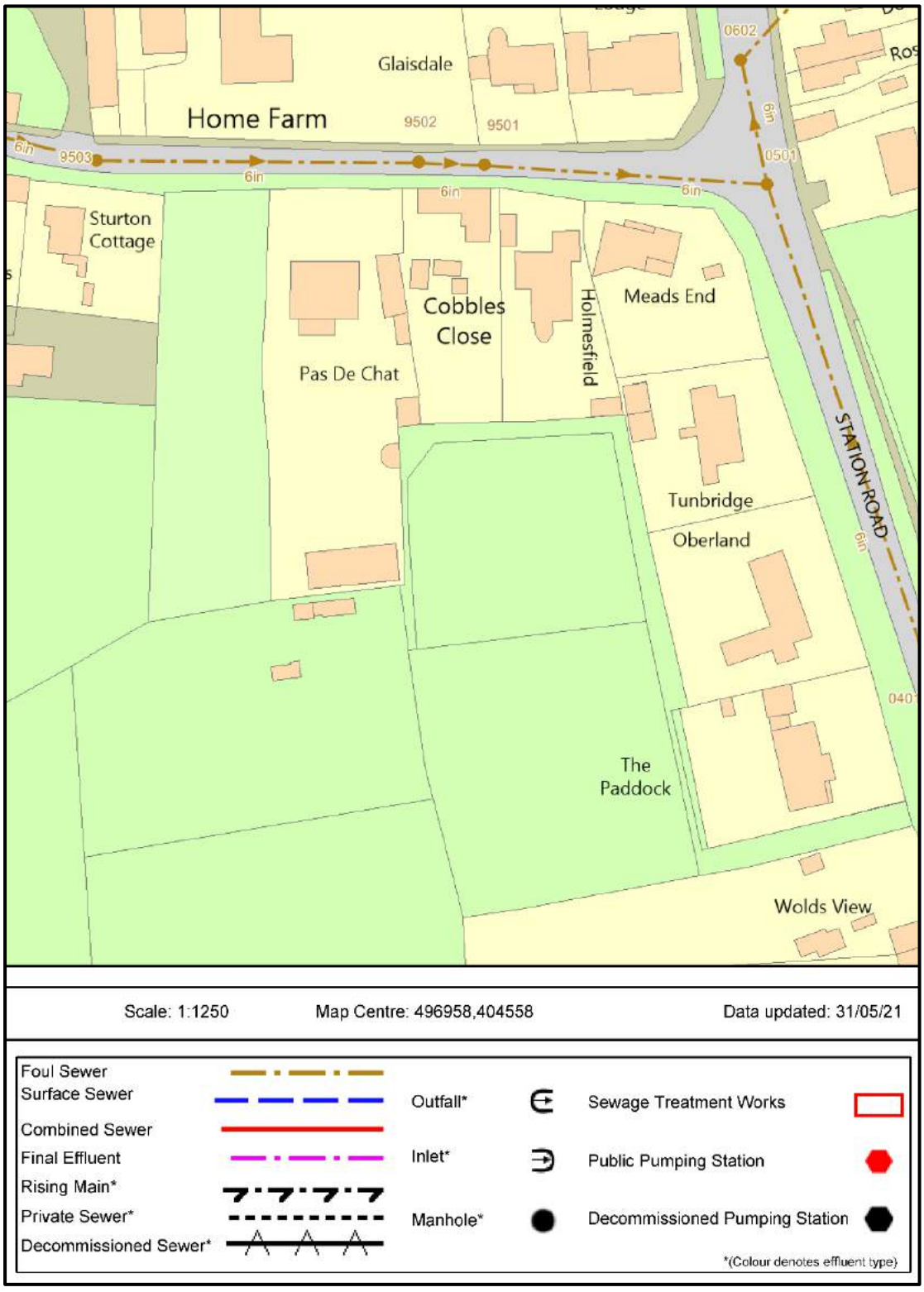


Figure 7.1 Foul Water Sewers

8.0 CONCLUSIONS

8.1 This FRA is compliant with the requirements set out in the NPPF and the associated online Planning Practice Guidance.

8.2 The FRA has been produced on behalf of Qudos Property.

8.3 This report demonstrates that the proposed development is not at significant flood risk, and will not increase flood risk to others, subject to the recommended flood mitigation strategies being implemented.

8.4 The identified risks and mitigation measures are summarised below;

Flood Risk Source	Level of Risk Without Mitigation	Proposed Mitigation
Fluvial Groundwater Sewers	Low	Non required
Tidal Pluvial Reservoir Canal/Artificial	None	
Development Foul & Surface Water	To wider catchment	Surface water via infiltration Foul water to AW sewer

Table 8.1 Summary of Risk and Mitigation

Appendix 1
Infiltration Test Results

Delta-Simons Environmental Consultants
3 Henley Office Park, Doddington Road, Lincoln LN6 3QR
www.deltasimons.com

Limited Factual Soakaway Infiltration Report

Main Street, Sturton, North Lincolnshire

Presented to **Qudos Property**

Issued: 8th December 2021

Delta-Simons Project Number: 21-0813.01

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
2	Final	08/12/2021	Updated to reflect Local Authority Comments	[redacted]	[redacted]	[redacted]
				James Brown Technician	Paul Huteson Associate	Paul Huteson Associate

1.0 Context and Purpose

Delta-Simons Environmental Consultants Limited (Delta-Simons) has been requested by Qudos Property (the "Client") to undertake three (3 no.) BRE365 compliant infiltration tests in order to obtain information to assist in the design of the surface water drainage strategy associated with the proposed residential development at Main Street, Sturton, North Lincolnshire, DN20 9DL (hereafter referred to as the "Site"). A Site Location Map is included as Figure 1 and a current Topographical Survey of the Site is shown as Drawing 1.

The location of the infiltration tests are shown on Figure 2 and the Proposed Development Plan is included as Drawing 2.

2.0 Limitations

Delta-Simons standard limitations are included as Appendix A.

In addition, specific limitations identified during the investigation works included refusal of all trial pits at depths between 18.79 m AOD and 19.72 m AOD on Limestone bedrock.

3.0 Scope of Works

Site works included the monitoring of and the supervision of the construction of three (3 no.) soakaways (SA101 to SA103) at locations and depths provided by Delta Simons. The depths and locations were chosen to provide a good example of the overall ground conditions across the Site and from what was encountered on Site during the investigation.

4.0 Mapped Ground Conditions and Site Setting

From online British Geological Survey mapping, the Site is indicated as being directly underlain by bedrock of the Kirton Cementstone Formation (Mudstone and Limestone interbedded). No superficial deposits are mapped, however Alluvial deposits are mapped approximately 160 m east associated with a small stream and possible spring. The spring is noted to originate at the interface between the Kirton Cementstone Formation (Interbedded Limestone and Mudstone) and the Kirton Cementstone Formation (Limestone) with the resulting stream flowing in an easterly direction away from the Site towards the River Ancholme and area of lower elevation. A further unnamed water course is noted approximately 260 m south however given the distance from the Site is not considered to be significant.

It is considered that the Site would be underlain by interbeded limestone to depth. Groundwater is expected to be at depth within the Limestone Aquifer.

The natural soil was generally representative of the published geology for the Site. Groundwater was not encountered during the investigation.

Trial pit logs are included as Appendix B.

5.0 Soakage Testing

Soakage testing was undertaken in general accordance with BRE Digest 365: Soakaway Design [Ref. 1], between the 12th and 13th April 2021.

The soakage testing comprised of excavating trial pits to depths of approximately 1 no. to 1.0m bgl, 1 no. 1.5m bgl and 1 no. to 1.6m bgl. The geology at each trial pit location was logged as seen in Appendix B. A gravel pack and monitoring pipes were then installed in the trial pits and the remaining void was backfilled with arisings. The remaining spoil was graded back to original ground level where possible. Any remaining spoil was left for the client to remove.

The gravel pack in each test location was then filled with water to the top of the installed gravel pack and the depth to water from ground level recorded at intervals over a period of up to 24 hours, where required.

The soakage test data was recorded and used to calculate the soil infiltration rate for each location.

Test results are provided in Appendix C and summarised below. The approximate locations of the soakage tests are shown in Figure 2.

Summary of Testing in General Accordance with BRE 365

Test Location	Test Depth Range (m bgl)	Recommended Soil Infiltration Rate (m/s)	Geology
SA101	0.7 – 1.0	8.7×10^{-07}	Slightly clayey sandy fine to coarse limestone gravel (Weathered Kirton Cementstone Formation)
SA102	0.7 – 1.5	6.5×10^{-04}	Slightly clayey sandy medium to cobble limestone gravel (Weathered Kirton Cementstone Formation)
SA103	0.9 – 1.6	1.7×10^{-04}	Slightly clayey sandy medium to cobble limestone gravel Weathered Kirton Cementstone Formation)

6.0 Summary

In summary, the geology beneath the Site was consistent with the mapped strata comprising weathered Kirton Cementstone until refusal at shallow depths. Geology beneath these depths is considered to be consistent to significant depths below surface level given the wider areas consistent Limestone geology associated with the formation from shallow sea deposits and typical of this area of Lincolnshire. The identified possible spring associated with the interface between limestone geologies, although noted, is not considered to represent a on-going or future risk to the Site given this flows in an easterly direction away from the Site.

No groundwater was identified during investigation. On this basis it is considered that there would be a very low risk of shallow groundwater issues at the Site and subject to the drainage engineer design, infiltration to land at this location is considered suitable and no further investigation is warranted.

7.0 References

Ref 1: BRE Digest 365: Soakaway Design, BRE 2016.

Enclosed:

Drawings

Drawing 1 Topographical Survey

Drawing 2 Proposed Development Plan

Figures

Figure 1 Location Map

Figure 2 Approximate Intrusive Location Plan

Appendices

Appendix A Limitations

Appendix B Trial Pit Logs

Appendix C Soakaway Test Results

Drawing 1 – Topographical Survey

Notes

1. Surveyed June 2021
2. Survey related to Ordnance Survey "OS Net" at control point STN01, using realtime correction received via Trimble Navigations "VRS Now" service. Survey plotted to flat plane metric grid with no local scale factor applied, i.e. LSF 1.00.
3. Levels related to GPS Orthometric height, converted to MSL (Newlyn) by OSGM15.

Control

STN	East	North	Level	Type
STN01	496926.028	404589.852	19.663	Nail
STN02	496934.461	404537.074	20.146	Peg

General

- Every effort is made to identify all visible above ground features. However, please bear in mind that at the time of the survey, some surface features may have been obscured.
- Visible features in the vicinity of the site extents, as detailed on this survey, may not represent the legally conveyed ownership boundaries.

Legend

Top / Bottom of Bank
Building / Overhead Canopy
Wall
Solid Surface Feature / Road Edge
Hard / Soft Surface Change
Kerb / Dropped Kerb
Back Edge of Kerb / Dropped Kerb
Combined Kerb & Drainage System
Drainage Channel
Road Traffic Sensors
Fence Line -

BW	Barbed Wire	HR	Hand Rail	PR	Post & Rail
CB	Close Boarded	IR	Iron Railings	SB	Safety Barrier
ChNut	Chestnut	Mtl PR	Metal Post & Rail	SF	Security Fence
CL	Chain Link	OB	Open Boarded	TF	Temporary Fence
CP	Concrete Panel	PA	Paling Fence	WM	Wire Mesh
(D)	Dilapidated	PC	Post & Chain		

Hedge Line
Tree / Scrub Canopy Line
O/H Telephone / Electric Cable(s)
Rock Face
Pipe Line (Above Ground)
Bush
Tree-Deciduous
Tree-Evergreen

T.PIT 22.5 Trial Pit (with level)
BH 26.5 Borehole (with level)
Survey Station
10.1 Spot Level
Woodland Area (Deciduous)
Gate
Level Datum
Woodland Area (Coniferous)
Electric Pylon
Marsh Land

Feature Abbreviations

ACU	Air Conditioning Unit	FH	Fire Hydrant	NP	Name Plate	SVP	Soil Vent Pipe
BB	Belisha Beacon	FP	Fence Post	PB	Post Box	TAP	Stand Pipe
BO	Bollard	FL	Flood Light	PM	Parking Meter	TCB	Telephone Box
BO(L)	Bollard (Lit)	G	Gully (with Level)	RBB	Rodent Bait Box	TEL	Telecom's Cover
BP	Boundary Post	GP	Gate Post	RE	Rodding Eye	TL	Traffic Light
BS	Bus Stop	GAS	Gas Cover	RS	Road Sign	TP	Telephone Pole
CATV	Cable TV Cover	KO	Kerb Offlet	RS(L)	Road Sign (Lit)	TS	Traffic Signal Cover
CCTV	Close Circuit TV	LB	Lighting Beacon	RWP	Rain Water Pipe	VP	Vent Pipe
COL	Column	LBIN	Litter Bin	SNR	Sensor	WM	Water Meter
CP	Concrete Post	LP	Lamp Post	SP	Sign Post	WO	Wash Out
DWB	Dog Waste Bin	ME	Meter	SP(L)	Sign Post (Lit)	WV	Water Valve
EL	Electric Cover	MH	Manhole	SPDC	Speed Camera	UC?	Unknown Cover
EP	Electricity Pole	MP	Marker Post	STAY	Cable Stay	UTL	Unable to Lift
ER	Earth Rod	MEP	Metal Post	SV	Stop Valve	Ø	Diameter

Description Abbreviations

Asmd Rt	Assumed Route	Flw Bd	Flower Bed	O/H	Overhead
BkDrp	Back Drop	FW	Foul Water	OSBM	Ordnance Survey Bench Mark
Bk	Brick	GTrp	Grease Trap		
BusStKb	Bus Stop Kerb	Ht	Height	RetWall	Retaining Wall
Bldg	Building	Hg	Hedge	Rd Edg	Road Edge
CDrnKbS	Combined Drainage & Kerb System	Intcpr	Interceptor	Spd Rtr	Speed Retarder
		Lvl	Level	St	Stone
Conc	Concrete	m	Metres	STN	Station
CPit	Catch Pit	mm	Millimetres	SW	Surface Water
DrpKB	Drop Kerb	MSL	Mean Sea Level	Tac	Tactile Paving
Drn Chnl	Drainage Channel	No.	Number	Tmc	Tarmac

Level Prefix

AL	Arch Level	RL	Roof / Ridge Level	ToS	Top of Steel Level	FFL	Finished Floor Level
CL	Cover Level	SL	Soffit Level	ToW	Top of Wall Level	1st.FFL	1st Finished Floor Level
DPC	Damp Proof Course	SprL	Springing Level	SILL	Sill Level		
EL	Eaves Level	TL	Threshold Level	WL	Water Level (inc.date & Time)		
IL	Invert Level	ToC	Top of Concrete Level				
PL	Parapet Level	ToP	Top of Pipe Level				

Do Not Scale - If In Doubt Ask!

Digital File 0376_10_2D.dwg Original Size A0

No.	Description	Date	Signed

Revisions

Drawing Status FINAL

Surveyed GE	Date 04.06.21	Scale 1:200
Drawn GE	Sheet 1 of 1	Approved CS

Client **Qudos Property**

Title Topographical Survey

Project **Land off Main Street Sturton North Lincolnshire**

Drawing No. 0376/10/001 Rev. -

CLS Survey

CLS Survey
Atherton Way
BRIGG
North Lincolnshire
DN20 8AR

Tel: 01652 658417
Fax: 01652658183
Survey@CLSCivilEngineering.co.uk
www.clscivilengineering.co.uk

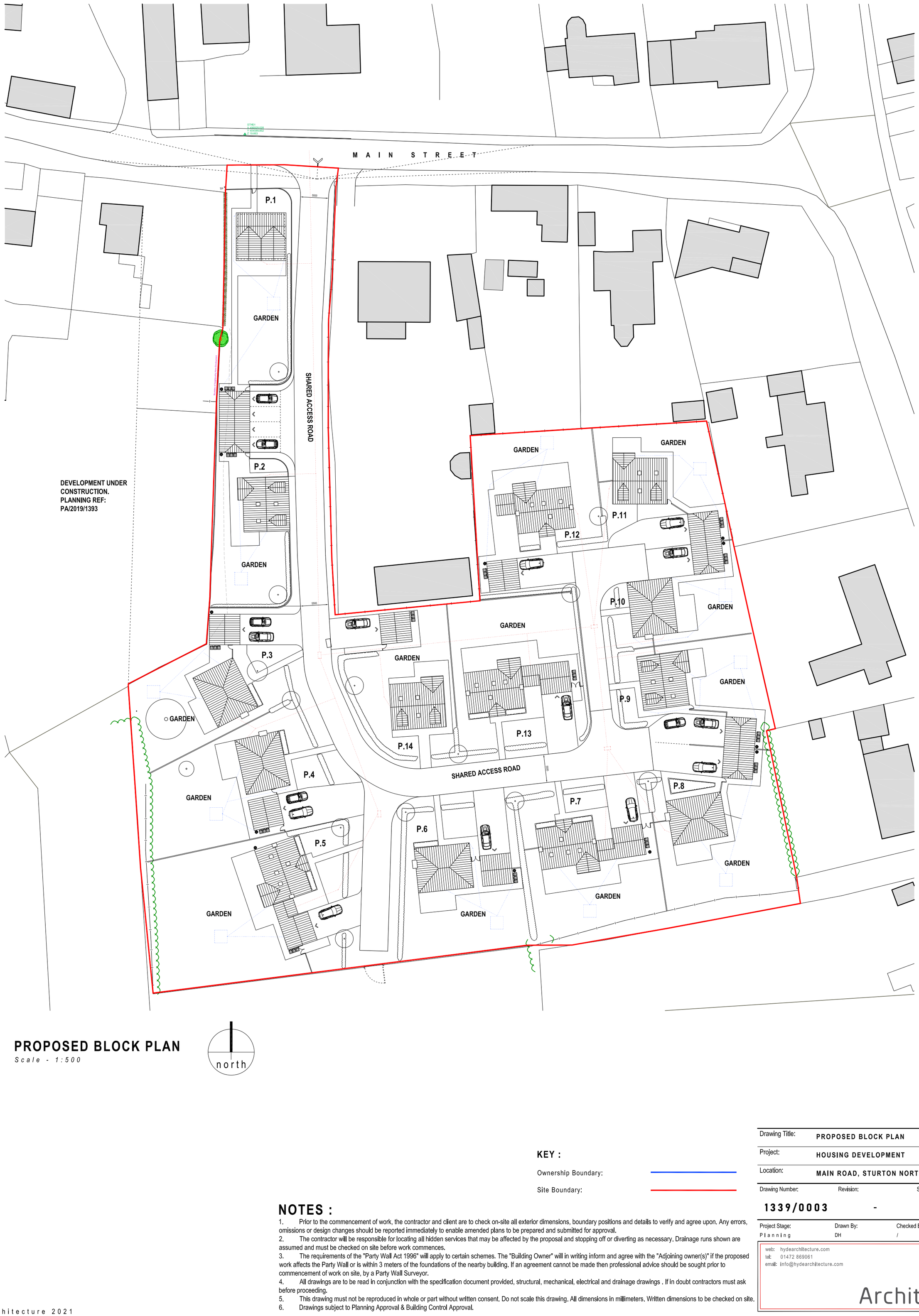
CLS Survey
Topographical - Measured Building - Revit - Cad Services - Engineering

Director: C.L.Salmon, B.Sc., C.Eng., M.I.C.E., M.I.D.E.
Registered Office: Atherton Way, Brigg, North Lincolnshire, DN20 8AR
Company Registration Number: 04425283

nqa. ISO 9001 Registered

Drawing 2 – Proposed Development Plan

Rev:	Drawn By:	Description:	Date:
-	-	-	--.--.--



PROPOSED BLOCK PLAN

Scale - 1:500

north

KEY :

Ownership Boundary:

Site Boundary:

NOTES :

1. Prior to the commencement of work, the contractor and client are to check on-site all exterior dimensions, boundary positions and details to verify and agree upon. Any errors, omissions or design changes should be reported immediately to enable amended plans to be prepared and submitted for approval.
2. The contractor will be responsible for locating all hidden services that may be affected by the proposal and stopping off or diverting as necessary. Drainage runs shown are assumed and must be checked on site before work commences.
3. The requirements of the "Party Wall Act 1996" will apply to certain schemes. The "Building Owner" will in writing inform and agree with the "Adjoining owner(s)" if the proposed work affects the Party Wall or is within 3 meters of the foundations of the nearby building. If an agreement cannot be made then professional advice should be sought prior to commencement of work on site, by a Party Wall Surveyor.
4. All drawings are to be read in conjunction with the specification document provided, structural, mechanical, electrical and drainage drawings . If in doubt contractors must ask before proceeding.
5. This drawing must not be reproduced in whole or part without written consent. Do not scale this drawing. All dimensions in millimeters. Written dimensions to be checked on site.
6. Drawings subject to Planning Approval & Building Control Approval.

Drawing Title:	PROPOSED BLOCK PLAN
Project:	HOUSING DEVELOPMENT
Location:	MAIN ROAD, STURTON NORTH LINCS

Drawing Number:	Revision:	Scale / Size:
1339/0003	-	1:50 / A2

Project Stage:	Drawn By:	Checked By:	Date:
Planning	DH	/	20.06.2021

web: hydearchitecture.com
tel: 01472 869061
email: info@hydearchitecture.com

Hyde Architecture

Figure 1 – Location Map

Scale: 1 / 500,000 @ A4

LEGEND

Site Boundary

Scawby

Sturton

Railway Plantation

Scale: 1 / 5,000 @ A4

deltasimons
Environment - Health & Safety - Sustainability

TITLE:
Site Location Map
Main Street
Sturton, Scawby

DRAWN BY: NW	SCALE: To Scale@A4
CHECKED BY: JB	REVISION: 1
DATE: 14 April 2021	

PROJECT NO: 21-0813

FIGURE NO: 1

Figure 2 – Approximate Intrusive Location Plan

LEGEND

Site Boundary

1:500 @ A2

Hyde Architecture

Site Plan Provided by Client

deltasimons
Environment - Health & Safety - Sustainability

TITLE:
Approximate Intrusive Location Plan
Main Street
Sturton, Scawby

DRAWN BY: NW	SCALE: Not to Scale	PROJECT NO: 21-0813.01	
CHECKED BY: JB	REVISION: 1	FIGURE NO: 2	
DATE: 14 April 2021			

Appendix A – Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

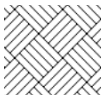
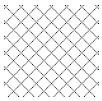
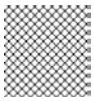
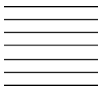
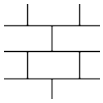
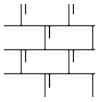
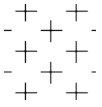
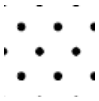
Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

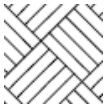
Appendix B – Trial Pit Logs

KEY TO BOREHOLE AND TRIAL PIT LOGS

MATERIAL LEGENDS

	Topsoil		Made Ground		Bituminous Material
	Concrete		Clay		Silt
	Sand		Gravel		Peat
	Cobbles		Boulders		Mudstone
	Siltstone		Sandstone		Limestone
	Chalk		Coal		Breccia
	Conglomerate		Igneous		Metamorphic
	Pyroclastic (volcanic ash)		Gypsum		Shale
	Ironstone		Bedrock (Unidentified)		Void

INSTALLATION/BACKFILL LEGENDS

	Sand		Gravel		Bentonite/Grout
	Arisings		Concrete		Plain Pipe
	Slotted Pipe				

Legend symbols in general accordance with BS 5930:1999+A2:2010 and standard industry practice.

KEY TO BOREHOLE AND TRIAL PIT LOGS

SAMPLE TYPES

ACM	Asbestos Containing Material Sample
B	Bulk Disturbed Sample
BLK	Block Sample
C	Core Sample
CBR	Undisturbed Sample for California Bearing Ratio Test – 154mm diameter
D	Disturbed Sample - Tub
ES	Soil Sample for Environmental Testing
EW	Water Sample for Environmental Testing
G	Gas Sample
U	Undisturbed Driven Tube Sample – 70/102mm diameter, 450mm long
W	Water Sample

TEST TYPES

CPT	Cone Penetrometer Test (kN/m^2)
FID	Flame Ionisation Detector Test (ppm)
HV	In-Situ Hand Shear Vane Test (kN/m^2)
PID	Photoionisation Detector Test (ppm)
SPT (S)	Standard Penetration Test – Split Spoon Sampler
SPT (C)	Standard Penetration Test – Solid 60 Degree Cone

CORE DETAILS

If	Fracture Spacing (mm) – Minimum, Average, Maximum
NI	Non-Intact where >25 fracture spacings per metre
TCR	Total Core Recovery (%)
SCR	Solid Core Recovery (%)
RQD	Rock Quality Designation (%)
AF	Air Flush Return (%)
WF	Water Flush Return (%)

WATER COLUMN DETAILS

	Water Strike
	Water Level

deltasimons
Environment - Health & Safety - Sustainability

Head Office
3 Henley Way, Doddington Road
Lincoln, LN6 3QR
Tel: +44 (0) 1522 882555
Email: info@deltasimons.com

Project No: 21-0813.01 | Hole ID: SA101 | Page: 1 of 1

Project: Main st, Sturton, Scawby.

Trial Pit Log

Date: 12/04/2021 | Client: Qudos Property

Description of Strata	Legend	Strata Depth (m)	Reduced Level (mAOD)	Water Strike (m)	Sample Details: Depth (m)	Sample Details: Type & Ref	Test Details: Depth (m)	Test Details: Results
TOPSOIL: Dark brown slightly clayey slightly gravelly fine SAND with roots. Gravel is fine angular limestone.		0.30	19.39					
Black slightly clayey gravelly fine SAND. Gravel is fine to cobble subrounded limestone.(SUBSOIL)		0.70	18.99					
Orange and grey mottled clayey sandy fine to cobble subrounded limestone GRAVEL. Sand is fine. (WEATHERED KIRTON CEMENTSTONE)		0.90	18.79					
Very hard yellow to cream LIMESTONE. (KIRTON CEMENTSTONE)		1.00	18.69					
Trial pit complete at 1.00 m bgl.								

Dimensions and Orientation:

Length = 2.00 m

Width = 0.70 m

Orientation: 80°

Inclination:

Remarks:
1. Engineer verified logged in general accordance to BS 5930:2015 +A1:2020. 2. Services during the excavation are the responsibility of the client. 3. Trial pit remained dry upon completion. 4. Backfilled with gravel to 0.7m bgl and completed with arisings. 5. Excavation refused on Kirton Cementstone Bedrock. 6. Levels take from Client provided topographical survey.

Coordinates:	Elevation (mAOD):	Excavated By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
E496935.00 N404564.00	19.69	Qudos Property	Kubota 360	JB	PH	PH	1:30

deltasimons
Environment - Health & Safety - Sustainability

Head Office
3 Henley Way, Doddington Road
Lincoln, LN6 3QR
Tel: +44 (0) 1522 882555
Email: info@deltasimons.com

Project No:	Hole ID:	Page:
21-0813.01	SA102	1 of 1

Project: **Main st, Sturton, Scawby.**

Trial Pit Log

Date: **12/04/2021** | Client: **Qudos Property**

Description of Strata	Legend	Strata Depth (m)	Reduced Level (mAOD)	Water Strike (m)	Sample Details: Depth (m)	Sample Details: Type & Ref	Test Details: Depth (m)	Test Details: Results
TOPSOIL: Dark brown slightly clayey slightly gravelly fine SAND with roots. Gravel is fine angular limestone.		0.30	20.07					
Soft orangeish brown sandy gravelly CLAY. Sand is medium. Gravel is fine to coarse subangular limestone. (WEATHERED KIRTON CEMENTSTONE)		0.70	19.67					
Cream to brown slightly clayey sandy medium to cobble subangular limestone GRAVEL. Sand is medium. (WEATHERED KIRTON CEMENTSTONE)		1.40	18.97					
Very hard yellow to cream LIMESTONE.(KIRTON CEMENTSTONE)		1.50	18.87					
Trial pit complete at 1.50 m bgl.								

Dimensions and Orientation:

Length = 1.60 m

Width = 0.60 m

Orientation: **348°**

Inclination:

Remarks:
1. Engineer verified logged in general accordance to BS 5930:2015 +A1:2020. 2. Services during the excavation are the responsibility of the client. 3. Trial pit remained dry upon completion. 4. Backfilled with gravel to 0.9m bgl and completed with arisings. 5. Excavation refused on the Kirton Cementstone Bedrock. 6. Levels take from Client provided topographical survey.

Coordinates:	Elevation (mAOD):	Excavated By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
E496993.00 N404507.00	20.37	Qudos Property	Kubota 360	JB	PH	PH	1:30

deltasimons
Environment - Health & Safety - Sustainability

Head Office
3 Henley Way, Doddington Road
Lincoln, LN6 3QR
Tel: +44 (0) 1522 882555
Email: info@deltasimons.com

Project No:	Hole ID:	Page:
21-0813.01	SA103	1 of 1

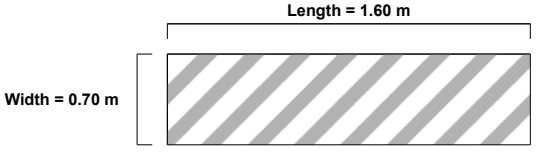
Project: **Main st, Sturton, Scawby.**

Trial Pit Log

Date: **12/04/2021** | Client: **Qudos Property**

Description of Strata	Legend	Strata Depth (m)	Reduced Level (mAOD)	Water Strike (m)	Sample Details: Depth (m)	Sample Details: Type & Ref	Test Details: Depth (m)	Test Details: Results
TOPSOIL: Dark brown slightly clayey slightly gravelly fine SAND with roots. Gravel is fine angular limestone.		0.20	21.02					
Soft orangeish brown sandy gravelly CLAY. Sand is medium. Gravel is fine to coarse subangular limestone. (WEATHERED KIRTON CEMENTSTONE)		0.50	20.72					
Firm cream to brown mottled sandy gravelly CLAY. Sand is medium. Gravel is fine to coarse subangular limestone. (WEATHERED KIRTON CEMENTSTONE)		0.80	20.42					
Cream to brown slightly clayey sandy medium to cobble subangular limestone GRAVEL. Sand is medium. (WEATHERED KIRTON CEMENTSTONE)		1.50	19.72					
Very hard yellow to cream LIMESTONE.(KIRTON CEMENTSTONE)		1.60	19.62					
Trial pit complete at 1.60 m bgl.								

Dimensions and Orientation:



Orientation: **346°**

Inclination:

Remarks:
1. Engineer verified logged in general accordance to BS 5930:2015 +A1:2020. 2. Services during the excavation are the responsibility of the client. 3. Trial pit remained dry upon completion. 4. Backfilled with gravel to 0.7m bgl and completed with arisings. 5. Excavation refused on the Kirton Cementstone Bedrock. 6. Levels take from Client provided topographical survey.

Coordinates:	Elevation (mAOD):	Excavated By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
E496931.00 N404457.00	21.22	Qudos Property	Kubota 360	JB	PH	PH	1:30

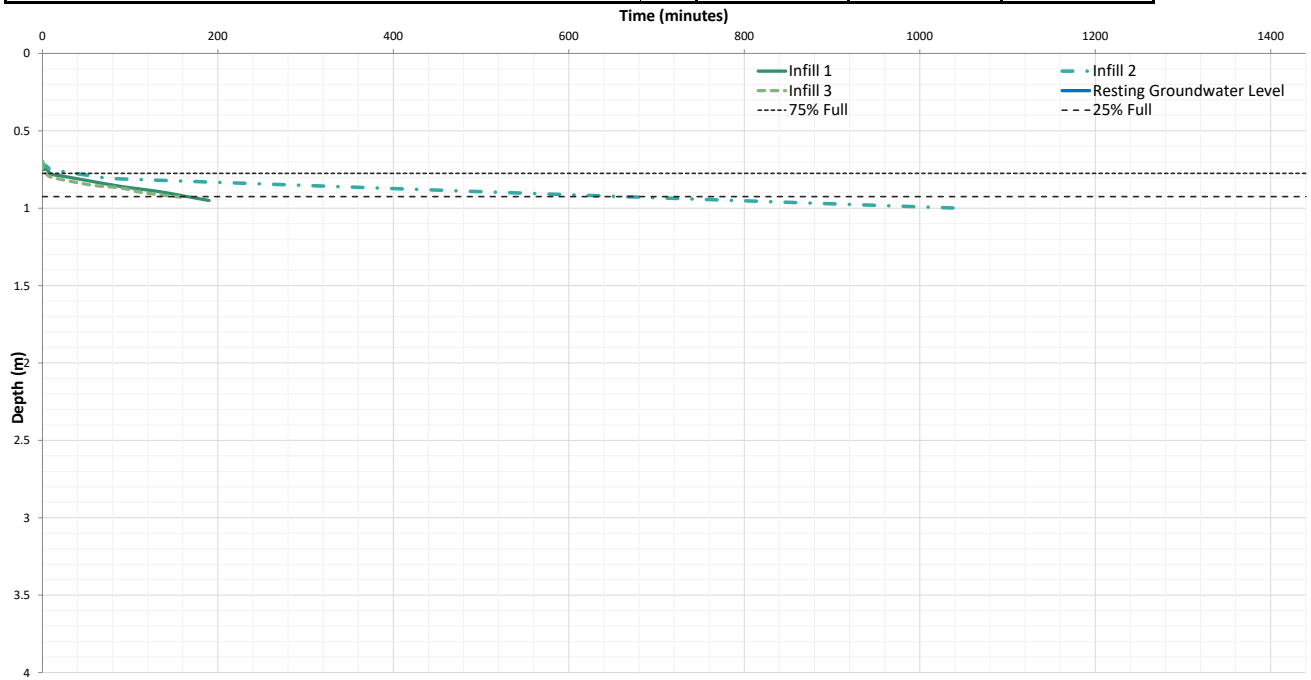
Appendix C – BRE365 Infiltration Test Results

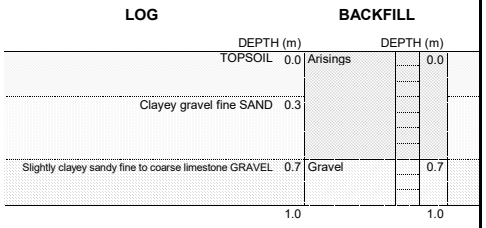
	units	Infill 1	Infill 2	Infill 3
Length	m		2.00	
Width	m		0.60	
Depth	m		1.00	
Gravel type			Standard	
Voids ratio			0.35	
Resting groundwater level at time of testing	m		5.00	
Depth of first reading	m	0.70	0.70	0.70
Depth of final reading	m	0.95	1.00	0.93
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		No	Yes	No
Depth at 75% full/effective depth	m	0.76	0.78	0.76
Depth at 25% full/effective depth	m	0.89	0.93	0.87
Time at 75% full/effective depth	mins	7.08	38.12	1.37
Time at 25% full/effective depth	mins	126.67	666.05	92.08
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m^3	0.05	0.06	0.05
Mean surface area for outflow (50% full/effective depth)	m^2	1.85	1.98	1.80
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	119.58	627.93	90.71
Soil infiltration rate, f =	m/s	0.00000396	0.00000084	0.00000494
or	m/s	4.0E-06	8.4E-07	4.9E-06

Recommended soil infiltration rate

8.4E-07	m/s

Note:
Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.





deltasimons

TITLE: Soakaway Test Results
Main st, Sturton, Scawby
Qudos Property

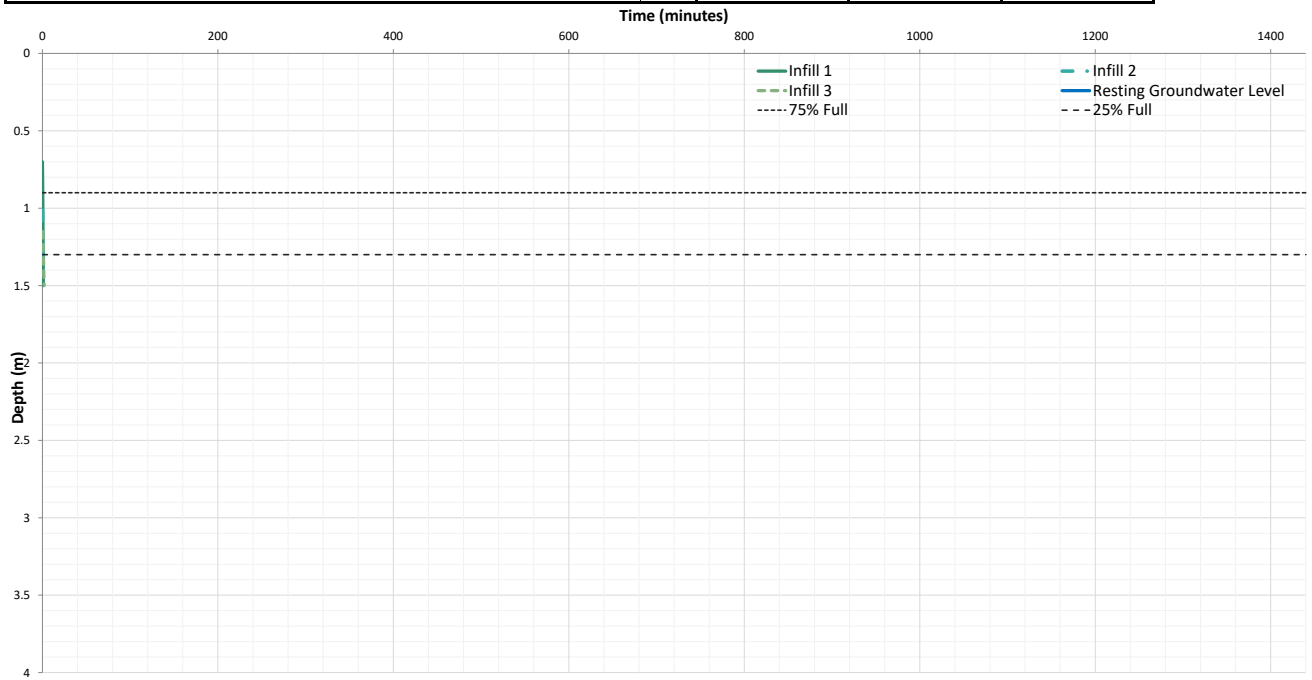
In accordance with BRE Digest 365 (2016)

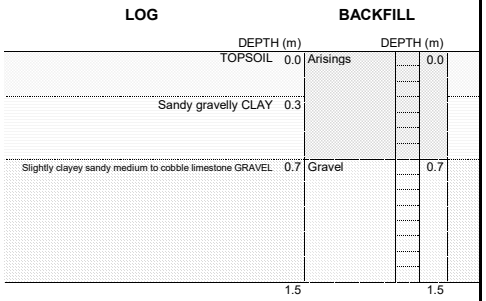
DRAWN BY: CB	SCALE: Not to Scale	PROJECT NUMBER: 21-0813.01
CHECKED BY: SS	REVISION: 1	SOAKAWAY NUMBER: SA101
DATE: 12/04/2021		

	units	Infill 1	Infill 2	Infill 3
Length	m		1.60	
Width	m		0.60	
Depth	m		1.50	
Gravel type			Standard	
Voids ratio			0.35	
Resting groundwater level at time of testing	m		5.00	
Depth of first reading	m	0.70	1.01	1.15
Depth of final reading	m	1.50	1.50	1.50
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	0.90	1.13	1.24
Depth at 25% full/effective depth	m	1.30	1.38	1.41
Time at 75% full/effective depth	mins	0.33	0.25	0.69
Time at 25% full/effective depth	mins	0.80	0.75	1.56
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m^3	0.13	0.08	0.06
Mean surface area for outflow (50% full/effective depth)	m^2	2.72	2.04	1.73
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	0.47	0.50	0.88
Soil infiltration rate, f =	m/s	0.00176471	0.00134642	0.00064740
or	m/s	1.8E-03	1.3E-03	6.5E-04

Recommended soil infiltration rate	
6.5E-04	m/s

Note:
Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.





deltasimons

TITLE: Soakaway Test Results
Main St, Sturton, Scawby
Qudos Property

In accordance with BRE Digest 365 (2016)

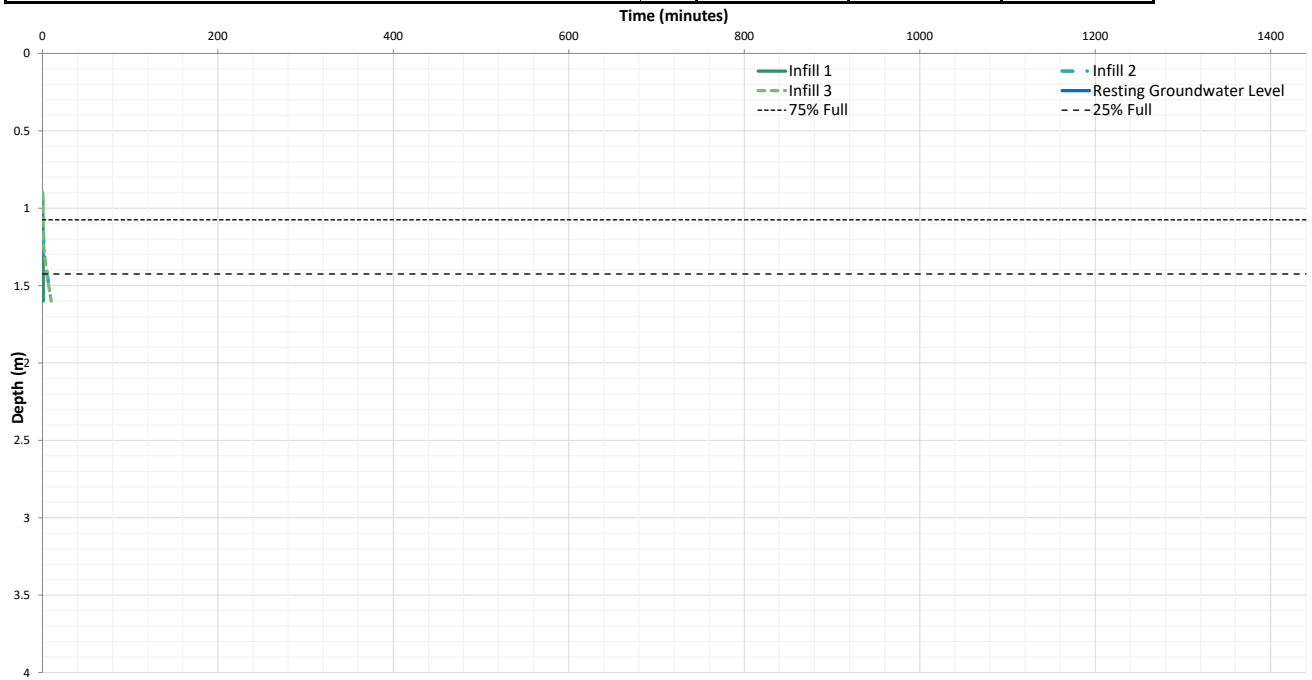
DRAWN BY: CB	SCALE: Not to Scale	PROJECT NUMBER: 21-0813.01
CHECKED BY: SS	REVISION: 1	SOAKAWAY NUMBER: SA102
DATE: 12/04/2021		

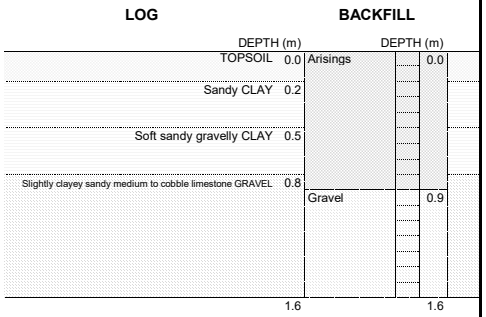
	units	Infill 1	Infill 2	Infill 3
Length	m		1.60	
Width	m		0.70	
Depth	m		1.60	
Gravel type			Standard	
Voids ratio			0.35	
Resting groundwater level at time of testing	m		5.00	
Depth of first reading	m	0.90	0.90	0.90
Depth of final reading	m	1.60	1.60	1.60
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	1.08	1.08	1.08
Depth at 25% full/effective depth	m	1.43	1.43	1.43
Time at 75% full/effective depth	mins	0.56	0.44	0.35
Time at 25% full/effective depth	mins	0.85	5.39	5.14
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m^3	0.14	0.14	0.14
Mean surface area for outflow (50% full/effective depth)	m^2	2.73	2.73	2.73
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	0.29	4.96	4.79
Soil infiltration rate, f =	m/s	0.00287179	0.00016897	0.00017491
or	m/s	2.9E-03	1.7E-04	1.7E-04

Recommended soil infiltration rate

1.7E-04	m/s

Note:
Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.





deltasimons

TITLE: Soakaway Test Results
Main St, Sturton, Scawby
Qudos Property

In accordance with BRE Digest 365 (2016)

DRAWN BY: CB	SCALE: Not to Scale	PROJECT NUMBER: 21-0813.01
CHECKED BY: SS	REVISION: 1	SOAKAWAY NUMBER: SA103
DATE: 12/04/2021		

Appendix 2
Soakaway Size

GEOMETRY

Rectangular soakaway 1		Rectangular soakaway 2		Rectangular soakaway 3		Rectangular soakaway 4	
Width (m)	1	Width (m)	1	Width (m)	2	Width (m)	1
Length (m)	2	Length (m)	1	Length (m)	3	Length (m)	1
Diameter (m)							
Soakaway base area (m2)	2	Soakaway base area (m2)	1	Soakaway base area (m2)	6	Soakaway base area (m2)	1

PARAMETERS

Porosity	0.95	Porosity	0.3	Porosity	0.3	Porosity	0.3
Effective porosity							
Infiltration coefficient (m/h)	1.476	Infiltration coefficient (m/h)	1.476	Infiltration coefficient (m/h)	1.476	Infiltration coefficient (m/h)	0.003132
Factor of safety	1.5	Factor of safety	1.5	Factor of safety	1.5	Factor of safety	1.5

AREA TO BE DRAINED

Contributing area		**Contributing area**		**Contributing area**		**Contributing area**	
Roof	50	Road	1	Roof	50	Road	1
Total area (m2)	50	**Total area (m2)**	1	**Total area (m2)**	50	**Total area (m2)**	1

DESIGN RAINFALL

M5-60 rainfall depth (mm)	20	M5-60 rainfall depth (mm)	20	M5-60 rainfall depth (mm)	20	M5-60 rainfall depth (mm)	20
Rainfall ratio r	0.4	Rainfall ratio r	0.4	Rainfall ratio r	0.4	Rainfall ratio r	0.4
Climate change factor	1.4	Climate change factor	1.4	Climate change factor	1.4	Climate change factor	1.4
FEH factor	1	FEH factor	1	FEH factor	1	FEH factor	1
Return period (years)	100	Return period (years)	100	Return period (years)	100	Return period (years)	100

Rainfall Duration (h)	Intensity (mm/h)	Rainfall Duration (h)	Intensity (mm/h)	Rainfall Duration (h)	Intensity (mm/h)	Rainfall Duration (h)	Intensity (mm/h)
0.083333333	240.66	0.083333333	240.66	0.083333333	240.66	0.083333333	240.66
0.166666667	168.462	0.166666667	168.462	0.166666667	168.462	0.166666667	168.462
0.25	141.306	0.25	141.306	0.25	141.306	0.25	141.306
0.5	89.598	0.5	89.598	0.5	89.598	0.5	89.598
1	56.84	1	56.84	1	56.84	1	56.84
2	33.909	2	33.909	2	33.909	2	33.909
4	19.83	4	19.83	4	19.83	4	19.83
6	14.663	6	14.663	6	14.663	6	14.663
10	9.504	10	9.504	10	9.504	10	9.504
24	4.935	24	4.935	24	4.935	24	4.935

RESULTS

Maximum water depth (m)	0.47	**Maximum water depth (m)**	0	**Maximum water depth (m)**	0.23	**Maximum water depth (m)**	0.23
Time for half-emptying (h)	0.11	**Time for half-emptying (h)**	0	**Time for half-emptying (h)**	0.03	**Time for half-emptying (h)**	9.84

ROY LOBLEY CONSULTING

Roy.Lobley@outlook.com
07847482244
www.roylobleyconsulting.com