FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

Proposed Residential Development,

Jacktrees, Cleator Moor

Reference	RWO/FRADS/22087
Date	December 22
Client Name	Gleeson Regeneration
Version	1

Yorkshire Office
4 Park Place
Leeds
LS1 2RU
Tel: +44 (0)113 532 3500
info@rwo.group
www.rwo.group

North East Office
19-20 Brenkley Way
Seaton Burn
Newcastle upon Tyne
Tyne & Wear
NE13 6DS
Tel: +44 (0)191 258 5632

CONTENTS

APPENDICES

CONFIDENTIALITY STATEMENT

This report is addressed to and may be relied upon by the following:

Gleeson Regeneration

This report has been prepared for the sole use and reliance of the above-named parties. This report shall not be relied upon or transferred to any other parties without the express written authorisation of RWO Group. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

DOCUMENT HISTORY

VERSION	PURPOSE/DESCRIPTION	DATE
1	First Issue	20.12.2022

1.0 EXECUTIVE SUMMARY

This assessment has looked at the implications of a proposed residential development in relation to drainage and flood risk.

The sites under consideration are located within Flood Zone 1 on the latest version of the Indicative Floodplain Maps produced by the Environment Agency (EA) a copy of the flood map is provided in Appendix D.

NPPF Technical Guidance advises the following;

Flood Zone 1 is defined as a low risk area, which comprises land assessed as having assessed as having less than 1 in 1,000 annual probability of river or sea flooding (0.1%).

Flood Zone 2 is defined as a medium-risk area, which comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1-0.1%), or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5-01%) in any year.

Flood Zone 3 is defined as a high-risk area, which comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of sea flooding (>0.5%) in any year.

As such the site is located in an area of low-risk of flooding from River and/or Sea.

Other sources of flooding have been assessed and the risk of flooding from these sources is considered to be low and/or manageable with mitigation.

Surface water from the proposed development will discharge to the surface water public sewers subject to relevant consents and approvals, with onsite attenuation provided accordingly. The surface water flows will be restricted to greenfield rates of runoff, which has been calculated at 20l/s.

2.0 INTRODUCTION

RWO Associates (RWO) has been instructed by Gleeson Regeneration to prepare a Flood Risk Assessment and Drainage Strategy to support a planning application for a proposed residential development at Cleator Moor.

3.0 THE SITE

The proposed development site forms a roughly triangular shaped piece of land, with boundaries roughly facing north east, west and south, located to the east of Jacktrees Road. The site is located approximately 5.5km to the southeast of Whitehaven, with a site area of approximately 2Ha.

The site currently comprises pasture land, divided into three fields by post and wire fences. Mature trees and hedgerows are located on the western boundary along Jacktrees Road and across the southern boundary. The eastern half of the site slopes down at a gradient of up to 1 in 10 to the southwest from around 84mAOD within the north-eastern proximately 74.5mAOD within the central area. The western half of the site is more flat lying at levels between 73mAOD and 74.5m AOD. The southwestern area adjacent to Jacktrees Road, roughly 35m x 25m in extent, is occupied by farm shed buildings with concrete hardstanding's. The site is currently accessed via a metal sheet gate on Jacktrees Road used as access to the farm buildings on site.

The site-centred ordnance survey reference is NY 01744 14567. A site location plan is provided in Appendix A and an aerial photograph is presented as Figure 1 below.

Figure 1 – Site location (Red marker indicates the approximate centre of site)

A topographical survey is included in Appendix B.

4.0 PROPOSED DEVELOPMENT

It is proposed to develop the site for residential purposes which will consist of 68 dwellings, along with associated roads, drainage and site infrastructure.

A proposed site layout plan is included in Appendix C.

5.0 EXISTING DRAINAGE

Public sewer records obtained from United Utilities are provided in Appendix D which identifies the following public sewers in the vicinity of the site.

- A 75mm public foul water rising main is recorded on the northeastern portion of the site.
- Various public sewers are located offsite to the east, north and west including foul, surface and combined.
- There are surface water drains to the east and west of the development site.

The River Keekle and River Ehen are located southwest and south east, approximately 450-500m offsite.

6.0 FLOOD RISK

The sites under consideration are located within Flood Zone 1 on the latest version of the Indicative Floodplain Maps produced by the Environment Agency (EA) a copy of the flood map is provided in Appendix E. Based on the site being located in Flood Zone 1, it is at low risk of flooding from River and/or Sea.

NPPF Technical Guidance advises the following;

Flood Zone 1 is defined as a [low/medium/high] - risk area, which comprises land assessed as having assessed as having less than 1 in 1,000 annual probability of river or sea flooding (0.1%).

Flood Zone 2 is defined as a [low/medium/high] - risk area, which comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1-0.1%), or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5-01%) in any year.

Flood Zone 3 is defined as a [low/medium/high] - risk area, which comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of sea flooding (>0.5%) in any year.

The proposed site usage falls within the more vulnerable category as identified in the NPPF Table 2: Flood Risk Vulnerably Classification. As such the exception test, will not need considering for any development within Flood Zone 3a, based on NPPF Table 3: Flood risk vulnerability and flood zone 'compatibility'.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Table 1 – 'NPPF Table 3: Flood risk Vulnerability Classification'

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind Turbines.
Highly Vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunication installations required to be operational during flooding. • Emergency disposal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure").
More vulnerable • Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for **dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, *subject to a specific warning and evacuation plan.*
Less vulnerable • Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agricultural and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals workings and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewerage treatment works (if adequate measures to control pollution and manage sewerage during flooding events are in place).
Water-compatible development • Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of defence installations. • Ship building, repairing, dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water based recreation (excluding sleeping accommodation). • Lifeguard and coastal stations. • Amenity open space, nature conversation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, *subject to specific warning and evacuation plan.*

Table 2 – 'NPPF Table 2: Flood Risk Vulnerability Classification'

Surface Water (Pluvial) Flooding

The Environment Agency Surface Water (Pluvial) Flood Map provided below indicates the site is at a low risk of flooding. When reviewing the overland flood routes against the topographical survey these are flows leaving the site and as such the development will capture and convey these flows to the new drainage system once development. This will in turn reduce the risk of flooding offsite.

The risk of flooding from this source is therefore considered low.

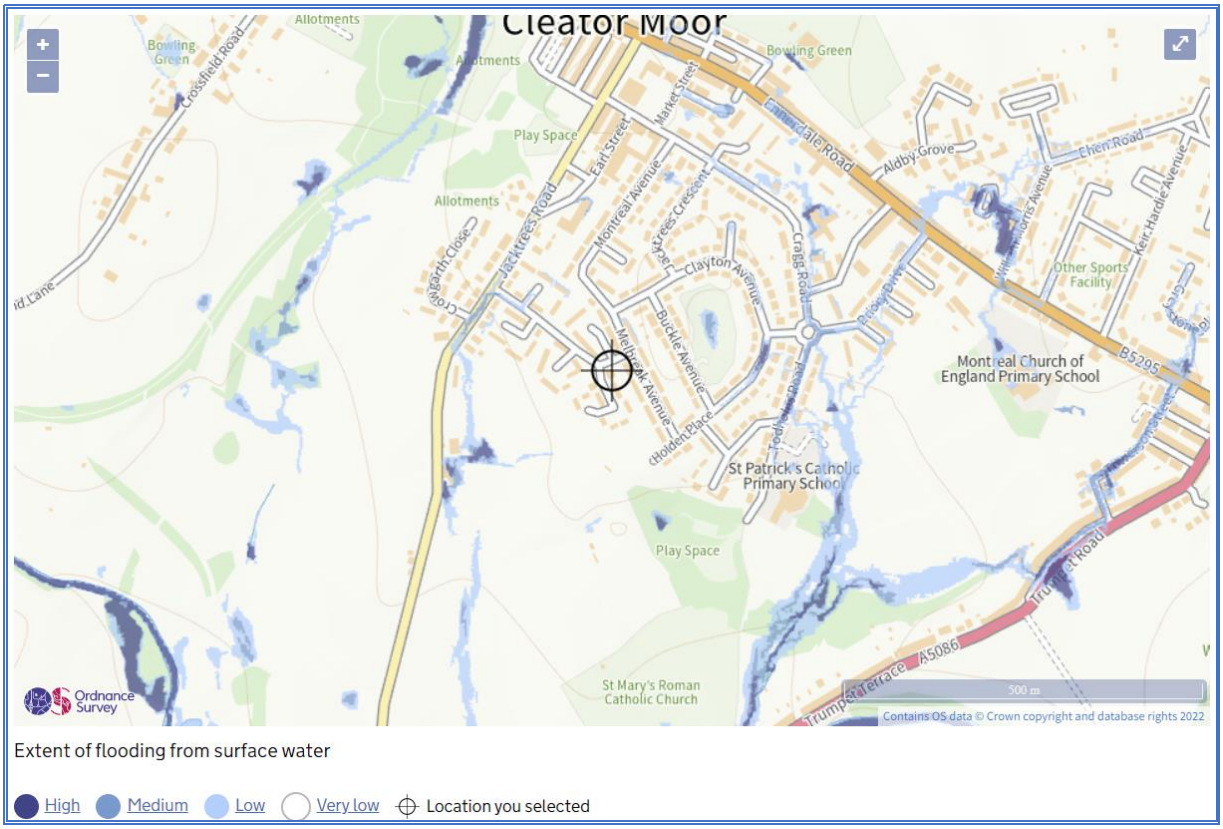

Figure 2 – Surface Water (Pluvial) Flood Map

Groundwater Flooding

The intrusive Geotechnical site investigation undertaken by GVR Geo report reference, G-22-055, this indicates the majority of groundwater is at depths of 3.6m and below. Although two number monitoring points had ground water as shallow as 0.33m, this is most likely surface water runoff entering the monitoring point given the depths noted in the other monitoring points.

Based on the groundwater monitoring undertaken groundwater is deemed a low and/or manageable risk.

6.2 Groundwater

Groundwater strikes were not encountered in any of the trial pits during excavation.

The boreholes recorded groundwater strikes within the bedrock at varying depths of between 3.6m and 25.7m bgl during drilling. Borehole RH06 also recorded a groundwater strike in the infilled mine workings at a depth of 29.5m bgl.

Monitoring wells were installed in all boreholes with the base of screens extending from 4.1-5.0m depth. Six monitoring visits were undertaken between August and October 2018. The monitoring recorded groundwater levels fluctuating between depths of 0.33m and 4.39m in boreholes RH02 and RH04. Borehole RH05 was not monitored.

These results are likely to represent perched discontinuous groundwaters within the granular Glacial Till soils, with the main groundwater table at depth within the bedrock.

Extract 1 – Groundwater Flood Map

Flooding from Sewers

The sewers near the site are public sewers owned by United Utilities and will be subject to regular maintenance and inspection, therefore blockage of these sewers is unlikely.

The risk of flooding from sewers is low.

The measures to mitigate the risks of flooding from new drainage are as detailed in Section 7.0.

Flooding from Reservoirs, Canals and Other Artificial Sources

The site is not located in an area identified as being at potential risk in the event of a reservoir failure or canal breach when reviewing the online Environment Agency Flood maps.

7.0 SURFACE AND FOUL WATER DRAINAGE

The proposed site drainage will comprise of a separate foul and surface water draiage system.

The following summarises the requirements for the discharge of surface and foul water from the site.

Sustainable Urban Drainage Systems (SUDS)

As noted above in section 6.0, an instruisve site investigaiotn has been undertaken and this has considered the potential use of soil inifltraiotn as a menas to dispose of surface water. The majority of the site is underlain with till clays, some small areas have localised bands of sands and gravels but given potential leaching issues adjacent the use of infiltration has been excluded.

Drainage	The ground conditions may be locally suitable for soakaway drainage systems. However, consideration should be given to the potential for surface water infiltration to permeate to the adjacent infilled opencast and the potential to generate contaminated leachates.

Figure 4 – Soil Types (Soilscapes)

Infiltration drainage has been excluded following an intrusive site investigation.

Whilst the disposal of surface water by infiltration methods is not feasible Sustainable Urban Drainage System (SUDS) may be used in conjunction with conventional drainage systems to improve water quality as well as manage surface water discharge.

The following audit has been carried out relating to suitability of SUD's systems:

Drainage Method	Description/Suitability	Proposal/Feasibility
1. Infiltration.	An intrusive site investigation has variable ground and potential leaching issues.	Not Applicable.
2. Ponds and wetlands.	Suitable subject to land being made available.	Applicable.
3. Infiltration Basins.	An intrusive site investigation has variable ground and potential leaching issues.	Not Applicable.
4. Detention Basins.	Suitable subject to land being made available.	Applicable.
5. Swale.	May be utilised convey water/improve water quality.	Applicable.
6. French/Filter drain.	May be utilised convey water/improve water quality.	Applicable.
7. Pervious/Permeable Pavement.	A tanked permeable paving system may be utilised.	Applicable. (As noted only)
8. Geocellular Systems/Tank systems.	May be used as surface water attenuation.	Applicable.
9. Oversized pipes.	May be used as surface water attenuation.	Applicable.
10. Box culverts.	May be used as surface water attenuation.	Applicable.
11. Purpose designed tanks.	May be used as surface water attenuation.	Applicable.

Surface Water Drainage

The disposal of surface water shall be in accordance with the Requirement H3 of Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway/infiltration system, watercourse and public sewer in that priority order.

As noted in the SUDS sections, the discharge of surface water drainage via infiltration methods is not feasible.

There are no identifiable watercourses on the site or near the boundary.

It is therefore proposed to discharge surface water to the public sewer, subject to United Utilities approval.

The site will discharge on a greenfield discharge rate basis which has been calculated utilising the IH124 methodology, giving a proposed discharge rate of 20l/s, subject to relevant approvals. The IH124 calculation is included in Appendix F.

As surface water discharge from the sites will be restricted, on site surface water attenuation will be required. The following provides an initial calculation of the approximate volumes of attenuation using the 'Quick Storage Estimate' element of Windes Microdrainage:

Attenuation Volumes

Storage Design Parameters

- M5-60 = 16.200
- Ratio R = 0.259

Site

- Restricted discharge rate = 20 litres/second.
- Proposed Impermeable area = 1.035 Ha (50% of site area)
- 1:100 Year Return Period (+45% cc) = 457.2m^3

A copy of the storage estimate is included in Appendix G.

The proposed on site drainage system shall be designed in accordance with the requirements of Sewers for Adoption and shall demonstrate that:

- No surcharge of pipes occurs in the 1 in 2-year rainfall event.
- No surface flooding occurs in 1 in 30-year rainfall event.
- No flooding to buildings and adjacent properties occurs in 1 in 100-year rainfall event (including an allowance of 45% for the effects of future climate change), as defined in NPPF Technical Guidance.

Foul Water Drainage

Foul water will discharge to the public sewer, subject to United Utilities approval.

8.0 CONCLUSIONS

This assessment has looked at the implications of a proposed residential development in relation to drainage and flood risk.

The sites under consideration are located within Flood Zone 1 on the latest version of the Indicative Floodplain Maps produced by the Environment Agency (EA] a copy of the flood map is provided in Appendix D.

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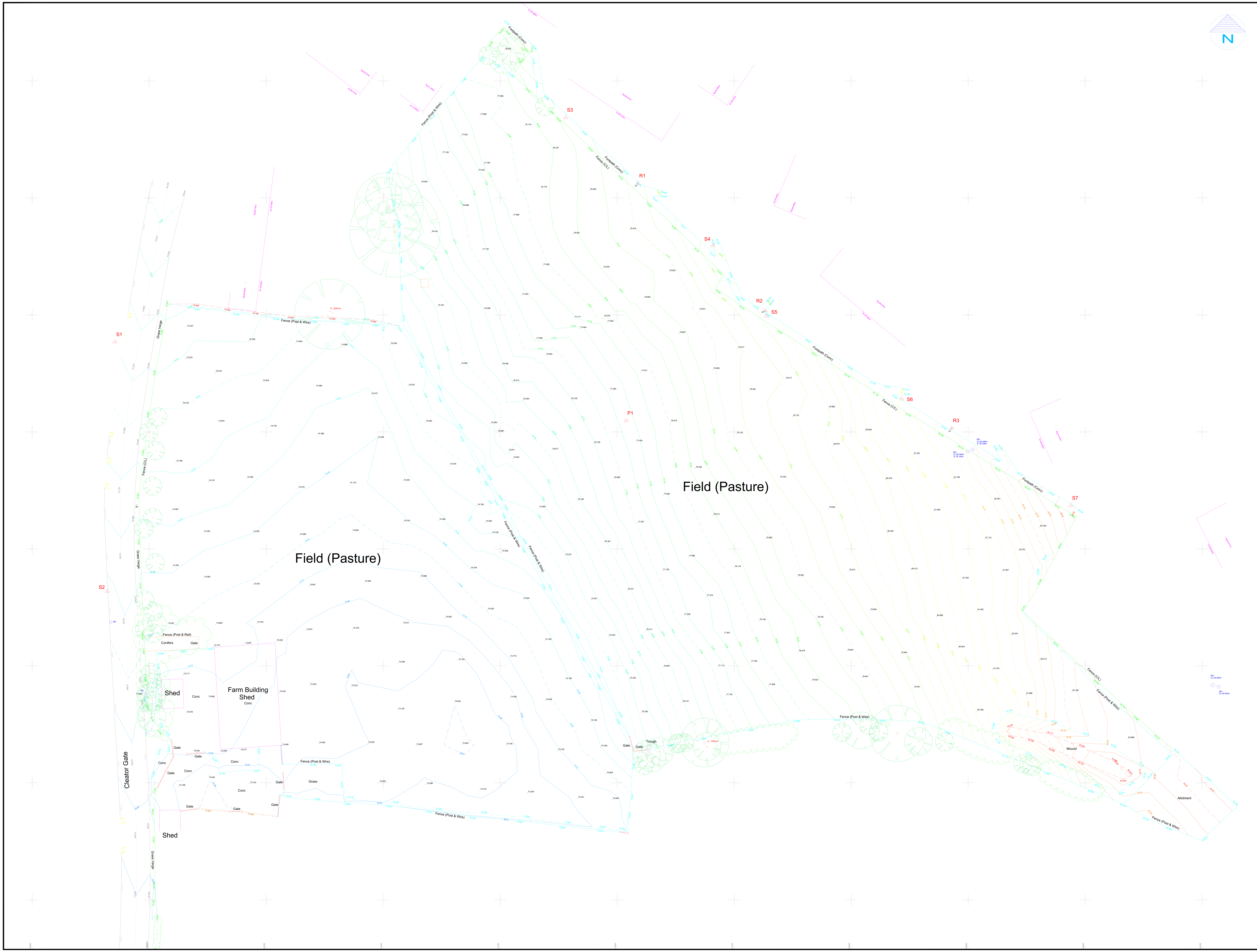
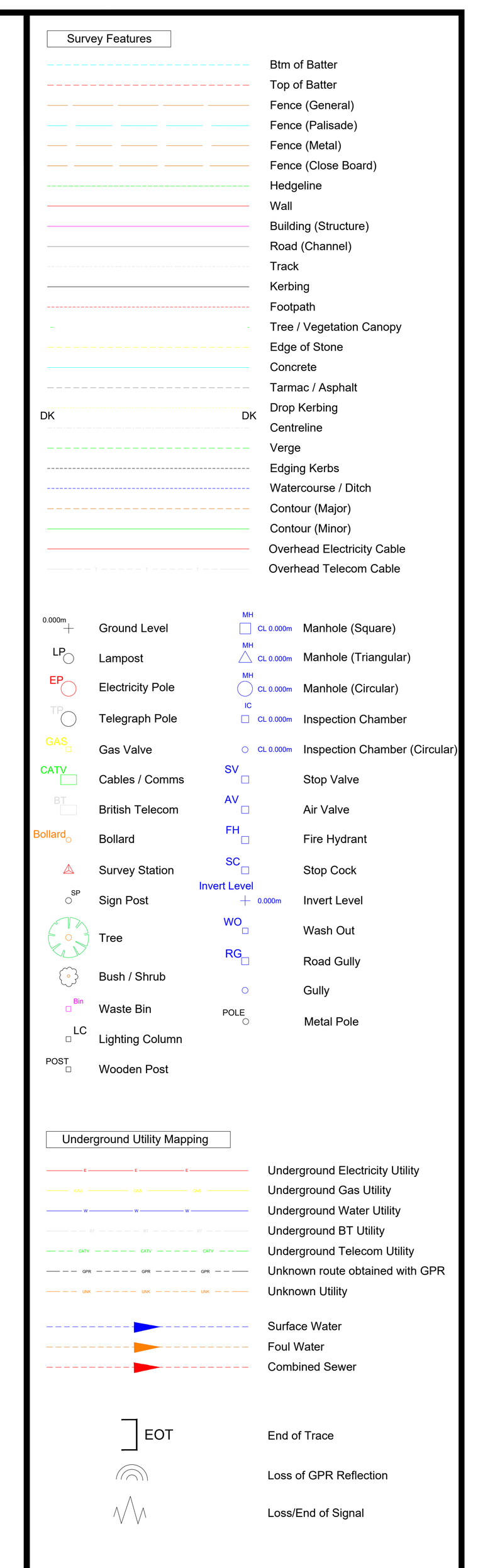
RWO Group
December 2022

Appendix A Site Location Plan

Location Map	
Site	Jacktrees, Cleator
Client	Gleeson Regeneration
Job Number	22087
Scale	NTS

Appendix B Topographic Survey





Notes :-

DO NOT SCALE FROM DRAWING
DIMENSIONS TO BE TAKEN ON SITE

Site Grid

Ordnance Survey Grid & Datum
(Trimble GPS System OSTN15 Transformation)
RTK Network

SURVEY STATIONS

Name	Easting	Northing	Height	Remark
P1	301751.925	514577.400	77.356	
R1	301754.459	514628.131	81.388	
R2	301781.612	514600.877	82.047	
R3	301821.484	514575.822	84.452	
S1	301642.706	514594.226	75.344	
S2	301641.064	514540.954	74.268	
S3	301739.025	514642.206	78.588	
S4	301770.432	514614.808	80.117	
S5	301781.856	514599.748	79.838	
S6	301810.754	514582.077	81.616	
S7	301846.963	514559.272	83.888	

REV	AMENDMENT	DRAWN	DATE

Jacktrees
Road
Cleator Moor
JOB TITLE

Gleeson Homes
CLIENT

Topographical
Survey
DRAWING TITLE

1:250 @ A0 SCALE | J D Gibson DRAWN

15/04/2019 DATE | J D Gibson APPROVED

GSM
GIBSON SURVEYING & MAPPING

Gibson Surveying and Mapping Ltd

21 West View,
Crook,
County Durham.
DL159EY.

Mob. 07896698645
Tel. 01388 764106

email : info@gsmsurvey.co.uk
www.gsmsurvey.co.uk

PROJECT No. | DRG No. GH/JR/TS01 | REV

Appendix C Propsed Site Layout

Proposed Residential Development @ Jacktrees Road.

Knapton & Knapton Ltd

MJGleeson
the urban regeneration specialist

D143 • Dr Mill • Dean Clough Mills • Halifax • HX3 5AX • +44 1422 380047 • www.knaptonandknapton.co.uk

Notes.

- Existing tree retained.
- Red line submission boundary.
- Existing tree removed.
- Indicative planting.
- Grass to front garden
- Paving slab access to level threshold for principle entrance. Gradient not to exceed 1:12 for maximum 5m length.
- Private drives first 1.5m to be tarmac. Single drives 2.6m wide plus min 0.6m wide path. Min 3.2m overall.
- 1.8m high screen wall. to detail
- 1.8m high screen fence. to detail
- 600mm high plot division fence. to detail.
- House type code reference and plot number.
- Parking bays.
- Bin collection area for private drives only.

Rural elevation style.

R — Forterra Abbey Red multi facing brick.
Forterra Ashwell Yellow multi feature brick.
With flat grey roof tile.

Schedule.

TYPE	OCCUPANCY	ARRANGEMENT	No	GROSS INTERNAL FLOOR AREA (GIA) SQFT	GROSS INTERNAL FLOOR AREA (GIA) SQM	GIA TOTALS PER TYPE SQFT	GIA TOTALS PER TYPE SQM	Mix %	Mix%	Brief Mix
201	2B	semi/town	8	651	60.48	5,208	483.82	12%	12%	
301	3B	semi/town	15	759	70.51	11,385	1057.67	22%		
340	3B	semi/town	3	839	77.94	2,517	233.83	4%	26%	
304	3B	detached	4	772	71.72	3,088	286.88	6%		
354	3B	detached	7	904	83.98	6,328	587.87	10%		
359	3B	detached	12	984	91.41	11,808	1096.96	18%	34%	
435	4B	detached	7	1221	113.43	8,547	794.02	10%		
401	4B	detached	8	1066	99.03	8,528	792.25	12%		
454	4B	detached	4	1149	106.74	4,596	426.97	6%	28%	
			68			62,005	5760.26	100%	100%	0%

Gross Site Area	5.12	acres	Red Line Boundary	2,288.13	sqm
POS Area	0.31	acres			
Tree Belt	0.00				
Nett Site Area	4.81	acres	Nett Site Area	2,149.59	sqm
Density	12,890.85	sqft/acre			
Density	1,197.56	sqm/acre			
Density	14.14	units/acre			

Scale:

0 5 10 20 50

Scale • 1:500 @ A1
Date • 15/11/22
Drg No • PL-02

North

pm am noon

Client • Gleeson Homes Ltd.
Site • Jacktrees Road
Plan • Planning Layout 1:500.

Designers of the Built Environment

Knapton & Knapton Ltd

Appendix D United Utilities Records

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
0102	68.18	CO	66.02	750			CO	80.33933	1 in 55
0607		CO		100			VC	11.5178	
0606		CO		100			VC	19.68478	
0203	69.79	CO	67.35	750			CO	63.3255	1 in 48
0202		CO	0	150			VC	41.57358	
9802		CO		100			VC	14.46346	
9801	0	CO		100			VC	5.900954	
9803		CO		100			VC	3.529799	
0811		CO		100			VC	1.880929	
0810		CO		150			VC	25.04586	
9703		CO		100			VC	12.35325	
9702		CO		100			VC	19.39373	
8704		CO		100			VC	6.088665	
8705		CO		100			VC	9.568464	
8702		CO		100			VC	22.7904	
9701		CO		100			VC	9.521439	
9709		CO		100			VC	11.30497	
8709		CO		100			VC	2.395478	
9711		CO		100			VC	10.97669	
9712		CO		100			VC	20.00584	
9713		CO		100			VC	13.07764	
9804		CO		100			VC	13.3601	
0701		CO		100			VC	1.979912	
0201		CO	0	150			VC	40.99232	
9301	77.63	CO	75.98	150			VC	56.29554	
0501		CO		150			VC	14.70363	
8505		CO		100			VC	15.12924	
8616		CO		100			VC	23.95278	
8615		CO		100			VC	8.384974	
8604		CO		100			VC	7.136553	
8603		CO		100			VC	23.81545	
8601		CO		150			VC	8.729019	
8706		CO		150			VC	14.20747	
8713		CO		150			VC	10.38795	
8712		CO		100			VC	10.0584	
9716		CO		100			VC	9.876478	
8707		CO		100			VC	9.96316	
9705		CO		100			VC	3.208701	
8506		CO		100			VC	13.75258	
8504		CO		100			VC	23.39228	
0504		CO		100			VC	11.60524	
9603		CO		150			VC	4.32893	
6701	76.23	FO	74.92	225			VC	22.18728	1 in 50
6708	76.73	SW	75.25	225			VC	18.99012	1 in 50
6702	76.72	FO	75.33	225			VC	13.94659	1 in 36
6703	77.58	FO	75.81	150			VC	33.57718	1 in 73
6716	77.48	SW	75.8	150			VC	30.86674	1 in 58
7615		FO		150			VC	23.89895	
7605		FO		100			VC	11.4628	
8606		FO		100			VC	17.60753	
8607		FO		100			VC	6.70976	
8608		FO		100			VC	4.979555	
8609		FO		100			VC	3.32999	
8605		CO		100			VC	8.703774	
6603		FO		100			VC	2.780894	
7607		SW		100			VC	3.630443	
7602		FO		100			VC	5.432907	
7610		FO		100			VC	7.540497	
7609		FO		100			VC	10.86758	
7706		CO		150			VC	18.6132	
7614		FO		150			VC	26.83336	
7616		FO		150			VC	13.35994	
7606		FO		150			VC	10.52693	
7707		CO		150			VC	17.99121	
7702		CO		100			PF	30.45983	
8715		CO		100			VC	2.326643	
8714		CO		100			VC	11.73406	
7704		CO		100			VC	10.70084	
7708		CO		100			VC	5.345768	
7710		CO		100			PF	8.681736	
6714	77.43	FO	76.13	150			VC	24.1752	1 in 38
6719		FO		100			VC	5.810091	
6720		FO		100			VC	2.68111	
6715	79.6	SW	77.97	150			VC	44.1872	1 in 21
6704	79.8	FO	78.15	150			VC	42.4134	1 in 18
6801	82.68	FO	80.82	150			VC	34.43325	1 in 13
6802	82.81	SW	80.92	150			VC	40.6319	1 in 14
6710	79.64	FO	78.41	100			VC	18.60108	1 in 16
5702	75.39	SW	74.25	225			VC	157.1755	
6606		SW		100			VC	39.09671	
6607		SW		100			VC	35.57747	
6602		FO		100			VC	7.912308	
6601		FO		100			VC	15.15215	
6604		FO		100			VC	35.42337	
6609		FO		100			VC	6.070738	
6608		FO		100			VC	15.98184	
6712	78.02	SW	76.66	150			VC	33.07931	1 in 50
6713	77.75	FO	76.44	150			VC	18.92321	1 in 65
6711	78.63	FO	77.22	150			VC	17.62618	1 in 23
6717		FO		100			VC	14.03801	
6709	77.27	SW	75.98	150			VC	16.1815	1 in 28
6707	76.16	SW	74.85	225			VC	24.15434	1 in 42
7617		FO		150			VC	27.94888	
7618		CO		150			VC	20.86497	
0506		CO		150			VC	20.91419	
7705		CO		150			VC	41.13361	
5701	75.61	FO	74.46	225			VC	3.126979	
9817		CO		100			VC	37.52711	
0507		CO		100			VC	3.817053	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:
red - combined, blue - surface water
brown - foul, purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

FO Foul
SW Surface Water
CO Combined
OV Overflow

SEWER SHAPE

CI Circular | TR Trapezoidal
EG Egg | AR Arch
OV Oval | BA Barrel
FT Flat Top | HO HorseShoe
RE Rectangular | UN Unspecified
SQ Square

SEWER MATERIAL

AC Asbestos Cement
BR Brick
PE Polyethylene
RP Reinforced Plastic Matrix
CO Concrete
CSB Concrete Segment Bolted
CSU Concrete Segment Unbolted
CC Concrete Box Culverted
PSC Plastic / Steel Composite
GRC Glass Reinforced Plastic
DI Ductile Iron
PVC Polyvinyl Chloride
CI Cast Iron
SI Spun Iron
ST Steel
VC Vitrified Clay
PP Polypropylene
PF Pitch Fibre
MAC Masonry, Coursed
MAR Masonry, Random
U Unspecified

Address or Site Reference:

Jacktrees Road,

Scale: 1:1250 **Date:** 09/04/2018

Sheet: 1 of 1

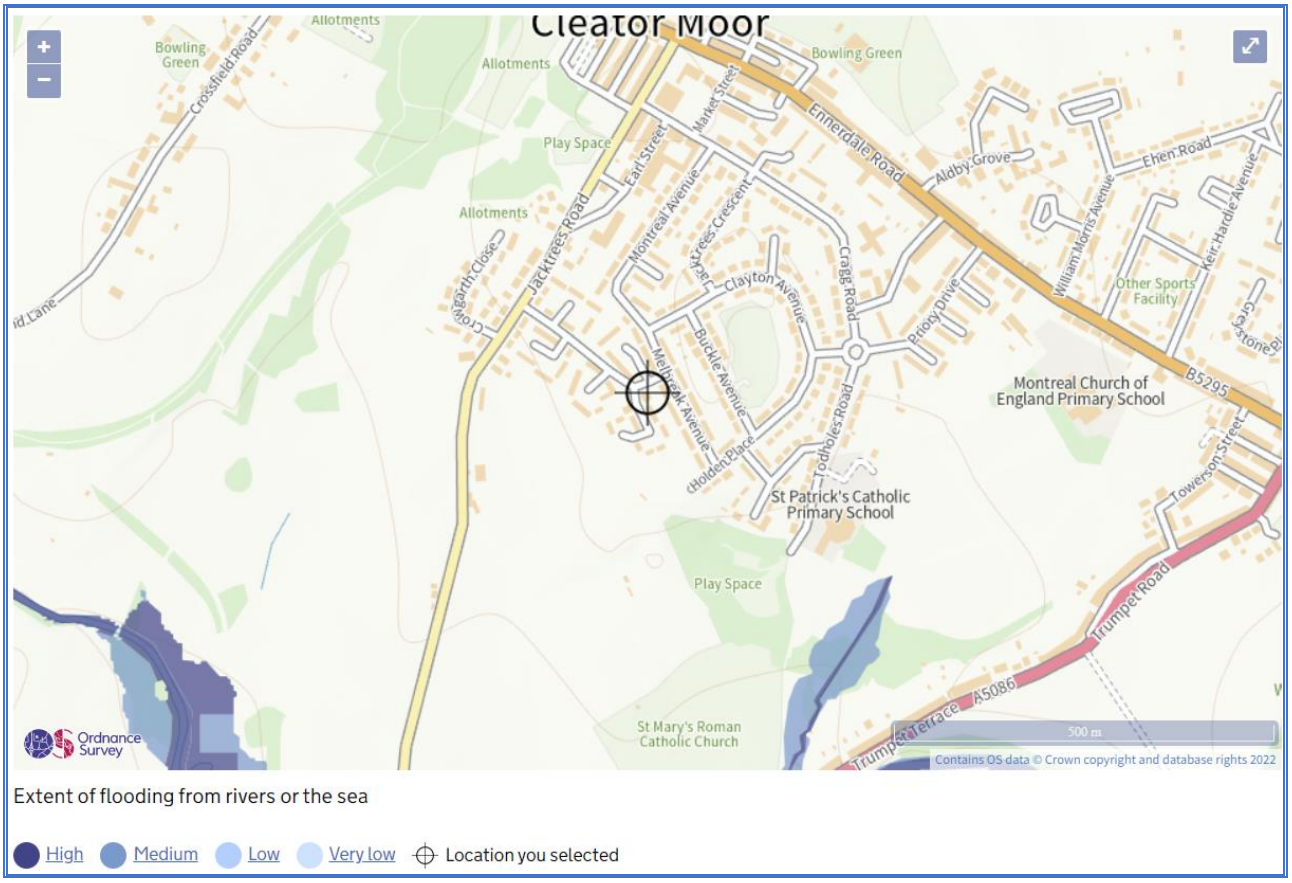
Printed by: Property Searches

SEWER RECORDS

United Utilities
helping life flow smoothly

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

Appendix E Gov.UK Flood Map



Flood map obtained from Gov.UK website [20/12/2022]

Appendix F IH124 Calculation

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Ross Oakley
Site name:	Jacktrees
Site location:	Cleator

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	54.51608° N
Longitude:	3.51877° W
Reference:	2575818686
Date:	Dec 15 2022 18:35

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 2.07

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1278	1278
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	20.21	20.21
1 in 1 year (l/s):	17.58	17.58
1 in 30 years (l/s):	34.36	34.36
1 in 100 year (l/s):	42.04	42.04
1 in 200 years (l/s):	47.9	47.9

Appendix G Surface Water Attenuation Calculations

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	72.240	0.440	20.0	167.0	O K
30 min Summer	72.375	0.575	20.0	234.6	O K
60 min Summer	72.504	0.704	20.0	306.5	O K
120 min Summer	72.603	0.803	20.0	367.2	O K
180 min Summer	72.634	0.834	20.0	387.3	O K
240 min Summer	72.643	0.843	20.0	393.6	O K
360 min Summer	72.640	0.840	20.0	391.7	O K
480 min Summer	72.630	0.830	20.0	385.1	O K
600 min Summer	72.615	0.815	20.0	375.4	O K
720 min Summer	72.598	0.798	20.0	364.0	O K
960 min Summer	72.557	0.757	20.0	338.3	O K
1440 min Summer	72.455	0.655	20.0	278.0	O K
2160 min Summer	72.284	0.484	20.0	188.2	O K
2880 min Summer	72.143	0.343	20.0	123.4	O K
4320 min Summer	71.977	0.177	19.5	58.2	O K
5760 min Summer	71.933	0.133	17.0	42.6	O K
7200 min Summer	71.911	0.111	14.6	35.2	O K
8640 min Summer	71.897	0.097	12.9	30.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	96.974	0.0	188.1	24
30 min Summer	69.046	0.0	267.9	38
60 min Summer	47.037	0.0	364.9	66
120 min Summer	31.058	0.0	481.8	122
180 min Summer	23.986	0.0	558.3	170
240 min Summer	19.795	0.0	614.4	200
360 min Summer	14.947	0.0	696.1	266
480 min Summer	12.246	0.0	760.3	336
600 min Summer	10.479	0.0	813.2	406
720 min Summer	9.220	0.0	858.5	476
960 min Summer	7.522	0.0	934.1	614
1440 min Summer	5.630	0.0	1048.8	884
2160 min Summer	4.200	0.0	1173.6	1240
2880 min Summer	3.404	0.0	1267.8	1584
4320 min Summer	2.526	0.0	1411.5	2244
5760 min Summer	2.047	0.0	1525.4	2936
7200 min Summer	1.740	0.0	1620.6	3672
8640 min Summer	1.524	0.0	1703.3	4400

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	71.887	0.087	11.5	27.1	O K
15 min Winter	72.286	0.486	20.0	189.2	O K
30 min Winter	72.435	0.635	20.0	266.7	O K
60 min Winter	72.574	0.774	20.0	349.2	O K
120 min Winter	72.687	0.887	20.0	422.9	O K
180 min Winter	72.727	0.927	20.0	450.6	Flood Risk
240 min Winter	72.736	0.936	20.0	457.2	Flood Risk
360 min Winter	72.729	0.929	20.0	452.3	Flood Risk
480 min Winter	72.713	0.913	20.0	440.5	Flood Risk
600 min Winter	72.688	0.888	20.0	423.7	O K
720 min Winter	72.659	0.859	20.0	404.2	O K
960 min Winter	72.593	0.793	20.0	361.3	O K
1440 min Winter	72.422	0.622	20.0	259.5	O K
2160 min Winter	72.153	0.353	20.0	127.7	O K
2880 min Winter	71.984	0.184	19.5	60.6	O K
4320 min Winter	71.917	0.117	15.3	37.3	O K
5760 min Winter	71.894	0.094	12.5	29.6	O K
7200 min Winter	71.880	0.080	10.6	24.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.363	0.0	1777.4	5136
15 min Winter	96.974	0.0	210.6	24
30 min Winter	69.046	0.0	300.0	38
60 min Winter	47.037	0.0	408.8	66
120 min Winter	31.058	0.0	539.9	122
180 min Winter	23.986	0.0	625.3	176
240 min Winter	19.795	0.0	688.3	226
360 min Winter	14.947	0.0	779.4	284
480 min Winter	12.246	0.0	851.5	362
600 min Winter	10.479	0.0	910.9	440
720 min Winter	9.220	0.0	961.8	516
960 min Winter	7.522	0.0	1046.3	666
1440 min Winter	5.630	0.0	1174.5	942
2160 min Winter	4.200	0.0	1314.6	1276
2880 min Winter	3.404	0.0	1420.2	1556
4320 min Winter	2.526	0.0	1580.9	2208
5760 min Winter	2.047	0.0	1708.5	2936
7200 min Winter	1.740	0.0	1815.0	3672

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
8640 min Winter	71.870	0.070	9.3	21.5	O K
10080 min Winter	71.862	0.062	8.4	19.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.524	0.0	1907.8	4400
10080 min Winter	1.363	0.0	1990.7	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	16.200	Shortest Storm (mins)	15
Ratio R	0.259	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.035

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.345	4	8	0.345	8	12	0.345

Model Details

Storage is Online Cover Level (m) 73.000

Tank or Pond Structure

Invert Level (m) 71.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	297.0	1.200	857.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0199-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	199
Invert Level (m)	71.750
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	20.0	Kick-Flo®	0.721	17.1
Flush-Flo™	0.340	20.0	Mean Flow over Head Range	-	16.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.9	1.200	21.8	3.000	33.8	7.000	51.0
0.200	18.7	1.400	23.5	3.500	36.4	7.500	52.7
0.300	19.9	1.600	25.0	4.000	38.9	8.000	54.4
0.400	19.9	1.800	26.5	4.500	41.1	8.500	56.0
0.500	19.5	2.000	27.8	5.000	43.3	9.000	57.6
0.600	19.0	2.200	29.1	5.500	45.3	9.500	59.1
0.800	18.0	2.400	30.4	6.000	47.3		
1.000	20.0	2.600	31.6	6.500	49.2		

Yorkshire Office
4 Park Place
Leeds
LS1 2RU
Tel: +44 (0)113 532 500
info@rwo.group
www.rwo.group

North East Office
19-20 Brenkley Way
Seaton Burn
Newcastle upon Tyne
Tyne & Wear
NE13 6DS
Tel: +44 (0)191 258 5632