Report Title	# Drainage Report
Property Address	Land at Scalegill Road Moor Row Whitehaven Cumbria
Client	O'Connor Fencing Ltd
Our Reference	21-305r001
Date	July 2021
Prepared by	Colin Aimers BEng Hons CEng MICE CEnv **Kingoor Consulting Ltd** 6B Clifford Court Parkhouse Carlisle CA3 0JG

Contents

Introduction

The purpose of this report is to provide support for a planning condition discharge associated with the proposed development on land adjacent at Scalegill Road, Moor Row, Whitehaven, Cumbria.

Research has been undertaken on the site and observations made regarding the existing site and the drainage servicing the site.

Calculations associated with the drainage have been performed by software packages from a recognised resource. Where appropriate copies of calculations are provided in the Appendices of this report.

Planning Conditions

Under consent reference 4/21/2099/001, the following conditions are required to be considered by this document.

Condition 4

4. No development shall commence until a surface water drainage scheme has been submitted to and approved in writing by the Local Planning Authority. The drainage scheme must include:

i. An investigation of the hierarchy of drainage options in the National Planning Practice Guidance (or any subsequent amendment thereof). This investigation shall include evidence of an assessment of ground conditions and the potential for infiltration of surface water;

ii. A restricted rate of discharge of surface water agreed with the local planning authority (if it is agreed that infiltration is discounted by the investigations);

and

iii. A timetable for its implementation.

The approved scheme shall also be in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacement national standards.

The development hereby permitted shall be carried out only in accordance with the approved drainage scheme.

Condition 5

5. Full details of the surface water drainage system (incorporating SUDs features as far as practicable) and a maintenance schedule (identifying the responsible parties) must be submitted to the Local Planning Authority for approval prior to development being commenced. Any approved works must be implemented prior to the development being completed and must be maintained thereafter in accordance with the schedule.

Condition 6

6. Foul and surface water must be drained on separate systems.

We consider that this document provides sufficient information to discharge the conditions associated with the outline planning permission.

The Site

Historic Usage and Site Description

The area of the proposed development has historically been used as an arable field and historically has experienced a number of residential developments in recent years around the fringes of the field.

The wider field abuts the C4003 Scalegill Road to the north, with the areas to the south and east having various residential developments present.

Fields are present to the western boundary of the proposed development.

Existing Sewer Network

A public combined sewer system is located on the site servicing the properties adjacent to the site. There is a 150mm dia system located at the site entrance servicing the properties on Scalegill Road, with a 300mm dia combined sewer passing the western boundary of the site possibly installed to alleviate flooding occurring on the historic system within the village.

Existing Site Drainage

The site has no natural drainage and all surface water naturally percolates on the site.

Drawing 21-305 DWG001 indicates the existing drainage arrangements on site. These are appended to this report.

Geology

The superficial geology indicates that the site is overlain by the Diamicton Till generally consisting of clays, and silts.

The solid geology of the site is Mercia Mudstone Formation with areas adjacent to the site having St Bees Sandstone and a Breccia Intrusion. A copy of the geological mapping is appended to this report.

A limited geotechnical investigation has been undertaken on the site including hand dug trial pits and percolation tests on the site and a copy of the records are appended to this report.

Drainage Strategy

Foul Drainage

It is proposed that a new foul drainage system shall discharge to the adjacent UU system located on the western boundary of the site.

Surface Water Drainage

Outline Strategy

It is proposed to discharge the surface water from the development to the adjacent UU system located on the western boundary of the site..

Following a review of the site conditions and tests undertaken (Percolation Tests), there is poor natural percolation which will prevent discharge to ground naturally to occur on the site. Percolation tests were conducted on the site and failed to achieve satisfactory results.

There are no adjacent watercourses present to facilitate discharge.

It is proposed to construct the drainage system at the time of the property construction.

Hydraulic Design

Foul Drainage

A preliminary scheme for the foul drainage design has been conducted on the site using Causeway Flow and has been based on the daily requirements of 1500l per day per property.

Drawing 21-305 DWG001 indicates the proposed arrangements for foul water on the site.

Surface Water Drainage

Principally the surface water drainage has been calculated on the impermeable areas of the development.

Modelling has been conducted on the following rainfall events:

- 1 in 30 years
- 1 in 100 years plus 40 % increase due to climate change over a 6 hour period

An assessment of the proposed network has been undertaken to identify the requirements of each property and requirements for the attenuation of water on the site to ensure that runoff from the site does not exceed the limits of Qbar (approx 1 in 2 year rainfall event).

The following parameters were adopted in the analysis. These were obtained from UK SUDS based on the site location and data held by HR Wallingford.

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	0.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	30 year (l/s)	3.0
Summer CV	0.750	100 year (l/s)	3.7
Winter CV	0.840	Check Discharge Volume	✓
Analysis Speed	Normal	100 year 360 minute (m³)	69
Skip Steady State	x		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	0	0	0
100	40	0	0

The following rates and volumes have been calculated for the predevelopment discharge and volumes from the site.

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.70
Greenfield Method	IH124	Growth Factor 100 year	2.08
Positively Drained Area (ha)	0.190	Betterment (%)	0
SAAR (mm)	1228	QBar	1.8
Soil Index	4	Q 30 year (l/s)	3.0
SPR	0.47	Q 100 year (l/s)	3.7
Region	10		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.190	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.520
CWI	125.570	Runoff Volume (m³)	69

Detailed Engineering

The detailed model presented in this report adopts the following engineering aspects specific to the site.

Attenuation

Attenuation in the form of inline storage, prevent flooding occuring within and outside the site for the 1 in 100 year + 40% climate change event.

Strage is to be formed using lined granular infiltration pits adjacent to Manholes S10.. The following summary is offered associated with the storage.

Node 10 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	78.760	Depth (m)	1.000
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	136	Inf Depth (m)	
Safety Factor	1.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.40	Pit Length (m)	2.000		

The following summary associated with the critical storm event is offered.

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	80.082	0.032	1.7	0.0051	0.0000	OK
15 minute summer	2	10	79.832	0.032	1.7	0.0051	0.0000	OK
60 minute winter	3	48	79.505	0.060	0.9	0.0095	0.0000	OK
60 minute winter	4	47	79.505	0.115	2.7	0.0182	0.0000	SURCHARGED
15 minute winter	5	10	80.074	0.024	1.0	0.0038	0.0000	OK
15 minute winter	6	10	79.957	0.032	1.7	0.0051	0.0000	OK
60 minute winter	7	49	79.503	0.379	3.6	0.0602	0.0000	SURCHARGED
15 minute winter	8	10	79.833	0.033	1.7	0.0053	0.0000	OK
60 minute winter	9	49	79.500	0.581	4.1	0.0924	0.0000	SURCHARGED
60 minute winter	10	49	79.497	0.737	4.4	3.1905	0.0000	SURCHARGED
15 minute summer	99	1	78.592	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	4	1.7	0.791	0.214	0.0478	
15 minute summer	2	1.000	3	1.7	0.799	0.217	0.0451	
60 minute winter	3	1.001	4	0.9	0.424	0.114	0.0205	
60 minute winter	4	1.002	7	2.7	0.807	0.344	0.1237	
15 minute winter	5	3.000	6	1.0	0.562	0.127	0.0134	
15 minute winter	6	3.001	7	1.7	0.788	0.214	0.0327	
60 minute winter	7	1.003	9	3.2	0.770	0.413	0.0953	
15 minute winter	8	4.000	9	1.7	0.775	0.216	0.0122	
60 minute winter	9	1.004	10	3.2	0.523	0.403	0.0740	
60 minute winter	10	Hydro-Brake®	99	1.4				8.4

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	92	80.135	0.085	1.1	0.0135	0.0000	OK
120 minute winter	2	92	80.135	0.335	1.1	0.0532	0.0000	SURCHARGED
120 minute winter	3	92	80.134	0.689	1.1	0.1096	0.0000	SURCHARGED
120 minute winter	4	92	80.134	0.744	2.9	0.1183	0.0000	SURCHARGED
120 minute winter	5	92	80.131	0.081	0.6	0.0129	0.0000	OK
120 minute winter	6	92	80.131	0.206	1.0	0.0328	0.0000	SURCHARGED
120 minute winter	7	92	80.131	1.007	3.5	0.1601	0.0000	SURCHARGED
120 minute winter	8	92	80.126	0.326	1.1	0.0519	0.0000	SURCHARGED
120 minute winter	9	92	80.126	1.207	3.4	0.1919	0.0000	SURCHARGED
120 minute winter	10	92	80.120	1.360	4.1	4.7401	0.0000	SURCHARGED
15 minute summer	99	1	78.592	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	1	2.000	4	1.1	0.697	0.136	0.1674	
120 minute winter	2	1.000	3	1.1	0.684	0.138	0.1652	
120 minute winter	3	1.001	4	1.0	0.417	0.121	0.0252	
120 minute winter	4	1.002	7	2.6	0.750	0.329	0.1237	
120 minute winter	5	3.000	6	0.6	0.489	0.076	0.0543	
120 minute winter	6	3.001	7	1.0	0.682	0.129	0.1197	
120 minute winter	7	1.003	9	2.6	0.726	0.335	0.0953	
120 minute winter	8	4.000	9	1.1	0.686	0.138	0.0436	
120 minute winter	9	1.004	10	2.8	0.496	0.355	0.0740	
120 minute winter	10	Hydro-Brake®	99	1.7				19.5

We consider that no flooding occurs on or off the site during the 1 in 100 year + 40% CC storm event.

Hydrobrakes

A hydrobrake shall be installed on the site for the control of flows at the agreed Qbar rate of 1.8 l/sec..

The following extract from the report indicates the arrangements.

Node 10 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	78.760	Product Number	CTL-SHE-0058-1800-1500-1800
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.8	Min Node Diameter (mm)	1200

Maintenance of Drainage

Operation and Maintenance Requirements

As with all traditional drainage systems, SuDS need to be inspected and maintained regularly to ensure that they operate correctly and efficiently. If SuDS are not properly maintained then there is a risk that the systems will become overloaded during periods of prolonged heavy rainfall, potentially resulting in localised flooding of the development. Recommendations for the SuDS maintenance activities for the privately maintained areas are detailed below.

All maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken in accordance with CDM regulations.

Inlets, Outlets, Controls and Inspection Chambers

- Inlets and outlets structures may be surface structures or conveyance pipes with guards or headwalls. They must be free from obstruction at all times.
- SuDS flow control structures can be protected orifices, slots weirs or other controls at or near the surface to be accessible and easy to maintain. They may be in baskets, in small chambers or in the open.
- Inspection Chambers and rodding eyes are used on bends or where pipes come together and allow cleaning of the system if necessary. They should be designed out of the system where possible.

Inlets, Outlets, Controls and Inspection Chambers	Frequency
Regular Maintenance ● Inspect surface structures removing obstructions and silt as necessary. ● Check there is no physical damage. ● Strim vegetation 1m min. surround structures and keep hard aprons free from silt and debris. ● Remove cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. ● Remove debris and silt.	Monthly

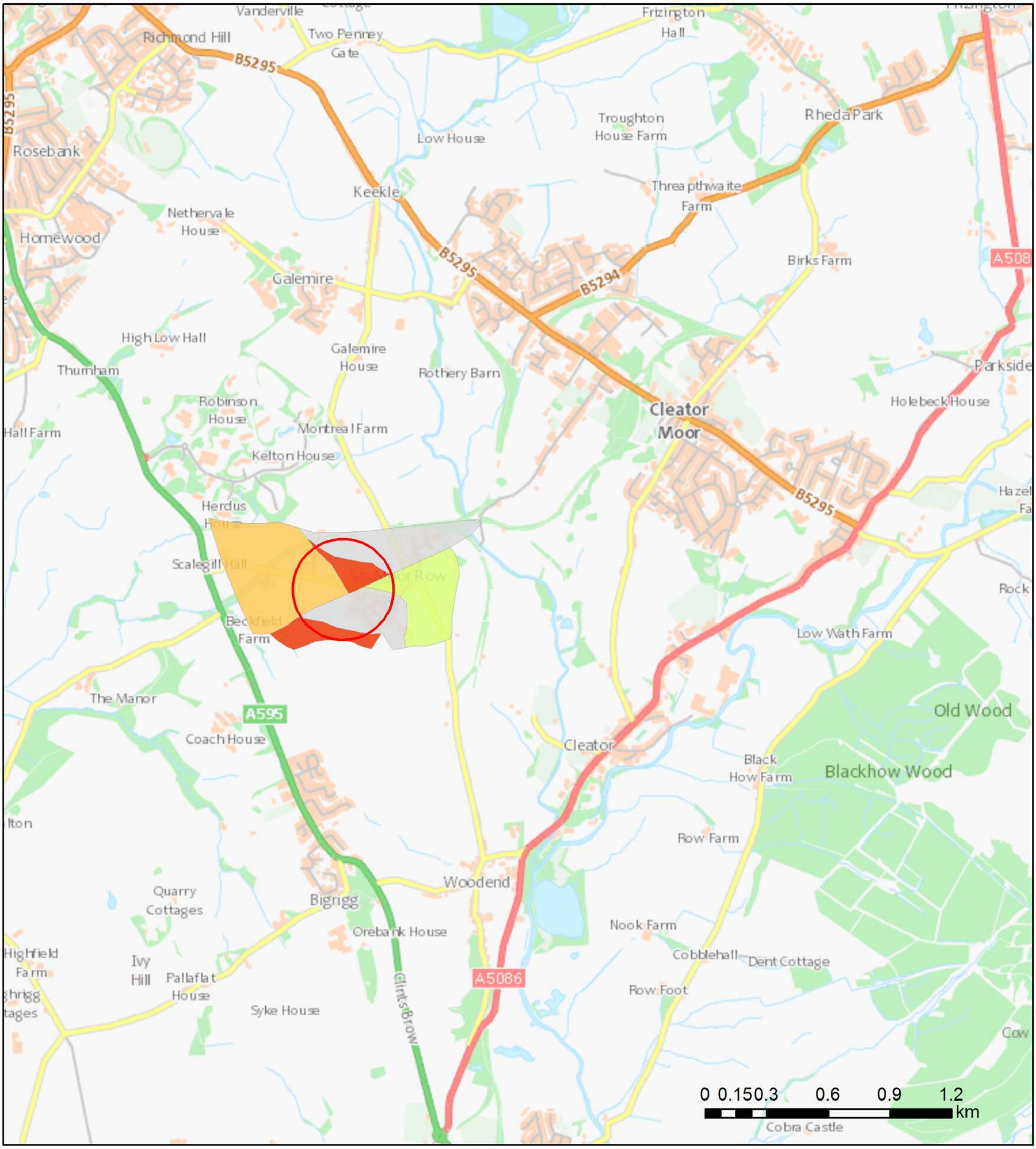
• Undertake inspection after leaf fall in autumn	
Occasional Tasks Check topsoil levels are 20mm above edges of manholes and chambers to avoid mower damage	Annual
Remedial Works Monitor effectiveness of the system and advise / inspect / clean and test if water is standing in the system. This may require specialist cleaning.	As Required

Appendices

BGS Geological Records

Solid Geology

British Geological Survey



GeoIndex Onshore Data Sources: NERC, Natural England, English Heritage and Ordnance Survey

Map Key

Bedrock geology 1:50,000 scale

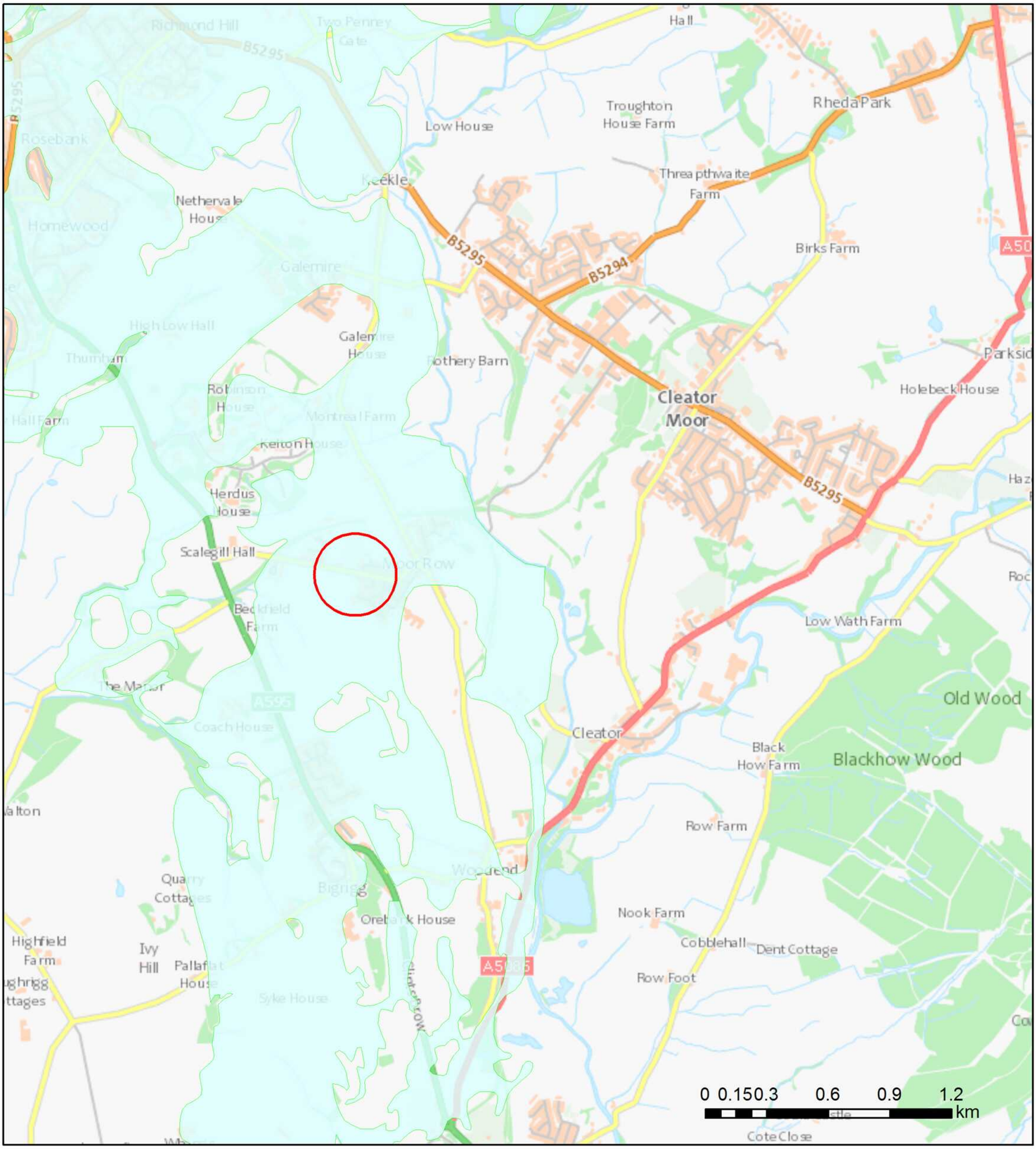
- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - MICRODIORITE
- KIRK STILE FORMATION - MUDSTONE AND SILTSTONE
- FIRST SHALE MEMBER - SANDSTONE, SILTSTONE AND MUDSTONE
- PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- FIRST LIMESTONE (CUMBRIA) - LIMESTONE
- MILLYEAT MEMBER - MUDSTONE, SANDSTONE AND LIMESTONE
- MARSETT SANDSTONE FORMATION - CONGLOMERATE
- DEVOKE WATER TUFF MEMBER - VOLCANICLASTIC-BRECCIA
- BUTTERMERE FORMATION - MUDSTONE AND SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- STAINMORE FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- ST BEES SANDSTONE MEMBER - SANDSTONE
- OREBANK SANDSTONE - SANDSTONE
- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - FELSITE
- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - ANDESITE
- ST BEES SHALE FORMATION - SILTSTONE AND MUDSTONE, INTERBEDDED
- WHITEHAVEN SANDSTONE FORMATION - SANDSTONE
- ST BEES EVAPORITE FORMATION - DOLOMITIC LIMESTONE, MUDSTONE AND ANHYDRITE-STONE
- LATTERBARROW SANDSTONE FORMATION - SANDSTONE
- HENSINGHAM GRIT - SANDSTONE
- BROCKRAM - BRECCIA

Selection Results

Bedrock geology 1:50,000 scale

Description	Details
BROCKRAM - BRECCIA	More Information
PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE	More Information
STAINMORE FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE	More Information
BROCKRAM - BRECCIA	More Information
PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE	More Information
ST BEES SANDSTONE MEMBER - SANDSTONE	More Information

Superficial Deposits



GeoIndex Onshore Data Sources: NERC, Natural England, English Heritage and Ordnance Survey

Map Key

Superficial deposits 1:50,000 scale

- GLACIOFLUVIAL DEPOSITS, DEVENSIAN - SAND AND GRAVEL
- TILL, DEVENSIAN - DIAMICTON
- HUMMOCKY (MOUNDY) GLACIAL DEPOSITS, DEVENSIAN - CLAY, SAND AND GRAVEL
- ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
- HEAD - CLAY, SILT, SAND AND GRAVEL
- RIVER TERRACE DEPOSITS, 1 - CLAY, SAND AND GRAVEL
- ALLUVIAL FAN DEPOSITS - SAND AND GRAVEL
- MARINE BEACH DEPOSITS - SAND AND GRAVEL
- PEAT - PEAT
- SUPERFICIAL THEME NOT MAPPED [FOR DIGITAL MAP USE ONLY] - UNKNOWN/UNCLASSIFIED ENTRY

Selection Results

Superficial deposits 1:50,000 scale

Description	Details
TILL, DEVENSIAN - DIAMICTON	More Information

Percolation Tests

PERCOLATION TESTS

Project : Scalegill Road, Moor Row
Project No : 21-305
Test Date : 07/07/21
Weather : Damp following period of wet weather.

Equipment **Auger / Hand Dug**
300 mm

Hole No.	Test	Depth (mm)	Fill Time	TIME @ 75%	TIME @ 25%	Finish	TIME 75-25 (sec)	Volume m3	Area m2	Infiltration Rate m/sec	Percolation Rate (sec/mm)
1	1	**950**	**09:17:00**	**Abandoned at 11:27 due to lack of percolation**							

Drawings

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone:

E-mail:

Your Ref: 21-305
Our Ref: UUPS-ORD-303158
Date: 06/07/2021

Kingmoor Consulting Ltd

6B Clifford Court
Clifford Way, Parkhouse
Carlisle, Cumbria
CA3 0JG

FAO:

Dear Sirs

Location: 40 SCALEGILL ROAD, MOOR ROW, CA24 3JN

I acknowledge with thanks your request dated 01/07/2021 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. http://www.unitedutilities.com/work-near-asset.aspx .

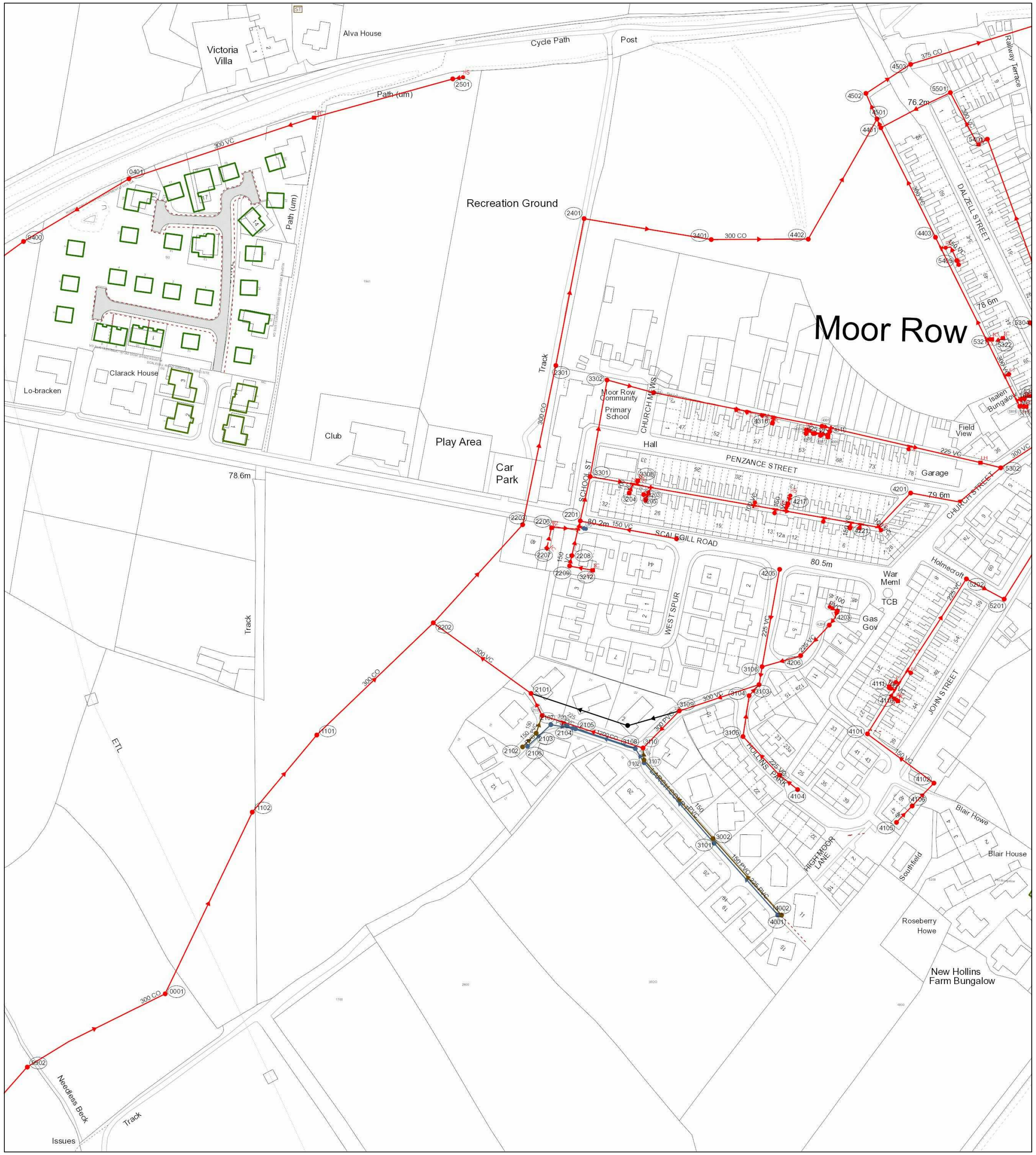
I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please contact us .

Yours Faithfully,

Karen McCormack
Property Searches Manager

United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP



Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
4503	74.95	CO	71.68	375			CO	80.13396	1 in 217
3205		CO	0	225			VC	2	
4204	80.56	CO	79.22	225			VC	23.30415	1 in 146
4103	80.51	CO	79.02	225			VC	29.4917	1 in 590
2106	80.63	SW	79.67	150			PVC	17.62644	1 in 71
4203		CO	0	150			VC	4.278563	
3102	80.47	FO	78.49	150			PVC	6.678741	1 in 18
2101	80.79	CO	77.98	300			VC	66.6721	1 in 202
2103	80.6	FO	79.3	150			PVC	10.29502	1 in 61
3401	74.71	CO	73.13	300			CO	53.84058	
2301	76.77	CO	75.14	300			CO	83.0415	
4307		CO	0	225			VC	1	
3108	80.5	SW	78.35	1200			CO	34.88231	1 in 388
3202		CO	0	150			VC	54.3741	
4105		CO		0			VC	12.53259	
9400		CO	0	300			VC	131.5989	
3104	80.45	CO	78.78	300			VC	8.286302	
3204		CO	0	100			VC	5.385165	
3109	80.55	CO	78.26	300			PVC	28.71653	1 in 191
4206	80.47	CO	79.06	225			VC	22.22357	1 in 74
4001	81.1	FO	80.17	150			PVC	56.95664	1 in 66
3301	79.72	CO	78.54	225			VC	54.46899	1 in 83
3107	80.49	SW	79.28	300			PVC	9.32388	1 in 186
4311		CO	0	225			VC	2.204654	
5304	78.54	CO	76.01	300			VC	92.64668	
4205	80.5	CO	79.3	225			VC	54.85829	1 in 102
3002	80.37	SW	79.73	225			PVC	59.14818	1 in 156
2501	73.24	CO	70.78	300			VC	187.7532	1 in 376
0401	73.08	CO	70.28	300			VC	68.07687	
2108	80.58	CO	77.8	300			PVC	13.85609	
3303	78.83	CO	77.77	225			VC	95.28481	1 in 217
4106		CO		0			VC	17.64139	
3110	80.49	CO	78.11	300			PVC	58.81406	1 in 190
2203		CO	0	300			CO	89.97649	
3106	80.45	CO	78.76	225			VC	9.965867	
4101	80.75	CO	79.92	150			VC	51.29895	1 in 77
3203		CO	0	225			VC	3.15913	
4502	73.22	CO	71.77	375			CO	29.51903	1 in 422
2104	80.54	SW	78.18	225			PVC	3.132667	1 in 10
0001	81.63	CO	79.7	300			CO	111.8805	1 in 133
4102	81.3	CO	80.41	150			VC	45.95133	1 in 98
4002	81.08	SW	80.13	225			PVC	53.17508	1 in 133
3103	80.52	CO	78.82	300			VC	46.64445	1 in 80
5202	79.92	CO	78.57	225			VC	23.73416	1 in 99
2107	80.47	SW	79.27	300			PVC	13.87111	1 in 51
5302	78.89	CO	76.91	300			VC	58.28695	1 in 117
3101	80.31	FO	79.31	150			PVC	57.95235	1 in 71
2401		CO	0	300			CO	71.34117	
2201	80	CO	78.65	225			VC	25.20541	1 in 280
5304	78.54	CO	76.01	300			VC	21.60512	
3105	80.47	CO	78.97	300			VC	22.91514	1 in 121
4111		CO		100			VC	3.430383	
2102	80.69	FO	79.48	150			PVC	10.74663	1 in 60
1101	79.74	CO	78.21	300			CO	89.60786	1 in 149
2202	79.01	CO	77.59	300			CO	73.73705	
3108	80.5	SW	78.26	225			PVC	4.855157	1 in 61
5401		CO	0	300			VC	38.51144	
4309		CO	0	225			VC	1	
4306		CO	0	225			VC	4	
9902	82.5	CO	0	300			CO	86.58465	
4304		CO	0	150			VC	2.231614	
1102	80.59	CO	78.84	300			CO	55.61797	1 in 91
4104	80.4	CO	79.27	225			VC	12.80641	1 in 61
4301	79.9	CO	77.31	225			VC	5.110793	
3302	78.68	CO	77.84	225			VC	26.58013	1 in 532
4201	79.79	CO	77.77	225			VC	57.29193	1 in 68
5308	79.38	CO	77.62	300			VC	104.8288	
4221		CO		150			VC	3.257772	
3301	79.72	CO	78.56	225			VC	34.18559	
4217		CO		150			VC	4.275103	
4401	73.99	CO	72.67	300			VC	5.236268	1 in 12
4403		CO		300			VC	67.85461	
4501	73.75	CO	71.96	375			CO	15.48105	1 in 91
2208		CO		150			VC	15.01619	
5501	76.27	CO	74.53	300			VC	43.1434	1 in 23
5409		CO		150			VC	13.76017	
5201	79.88	CO	78.31	225			VC	96.19003	1 in 48
4402	75.57	CO	0	300			CO	76.66841	

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

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:

40 SCALEGILL ROAD,
MOOR ROW,
CA24 3JN

Scale: 1:1250 **Date:** 06/07/2021

Sheet: 1 of 1

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

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.

ENGINEER

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CLIENT

PROJECT
HOUSING DEVELOPMENT, SCALEGILL ROAD
MOOR ROW, WHITEHAVEN

TITLE
DRAINAGE ARRANGEMENTS

SCALE	STATUS	
1:100	FOR PLANNING CONDITIONS	
PAPER SIZE	DRAWN BY	CHECKED AND APPROVED
A1	C AIMERS	C AIMERS
PROJECT PHASE	DATE	DATE
BUILD	JULY 2021	JULY 2021
DRAWING NUMBER		REVISION
21-305-DWG001		A

MANHOLE SCHEDULE

Manhole Number / Coordinates	Cover Level / Depth To Invert	Connections	Pipe	Code	Inverts	Diams	Manhole Size	Types: Manhole	Types: Cover
S1 E. 81.953 N. 13.244	80.800 0.750	0	0	2.000	80.050	100	450	4	A15
S2 E. 93.833 N. 55.307	80.550 0.750	0	0	1.000	79.800	100	450	4	A15
S3 E. 89.680 N. 34.612	80.550 1.105	1, 0	1	1.000	79.445	100	450	4	A15
			0	1.001	79.445	100			
S4 E. 86.524 N. 35.267	80.550 1.160	2, 1, 0	1	2.000	79.672	100	450	4	A15
			2	1.001	79.390	100			
			0	1.002	79.390	100			
S5 E. 66.793 N. 16.162	80.800 0.750	0	0	3.000	80.050	100	450	4	A15
S6 E. 68.183 N. 23.457	80.800 0.875	1, 0	1	3.000	79.925	100	450	4	A15
			0	3.001	79.925	100			
S7 E. 71.045 N. 38.482	80.550 1.426	1, 2, 0	1	3.001	79.668	100	450	4	A15
			2	1.002	79.124	100			
			0	1.003	79.124	100			
S8 E. 78.834 N. 49.385	80.550 0.750	0	0	4.000	79.800	100	450	4	A15
S9 E. 73.359 N. 50.444	80.550 1.631	1, 2, 0	1	1.003	78.919	100	450	4	A15
			2	4.000	79.706	100			
			0	1.004	78.919	100			
S10 E. 75.155 N. 59.732	80.550 1.790	1, 0	1	1.004	78.760	100	1200	4	A15
			0	1.005	78.760	100			

STORM Network 1

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Length	Upstream Manhole Number	Upstream Invert	Upstream Cover	Downstream Manhole Number	Downstream Invert	Downstream Cover
1.000	100	59	21.108	S2	79.800	80.550	S3	79.445	80.550
1.001	100	59	3.223	S3	79.445	80.550	S4	79.390	80.550
1.002	100	59	15.809	S4	79.390	80.550	S7	79.124	80.550
1.003	100	59	12.184	S7	79.124	80.550	S9	78.919	80.550
1.004	100	59	9.460	S9	78.919	80.550	S10	78.760	80.550
1.005	100	59	9.982	S10	78.760	80.550	S99	78.592	79.383
2.000	100	60	22.492	S1	80.050	80.800	S4	79.672	80.550
3.000	100	59	7.426	S5	80.050	80.800	S6	79.925	80.800
3.001	100	60	15.295	S6	79.925	80.800	S7	79.668	80.550
4.000	100	59	5.576	S8	79.800	80.550	S9	79.706	80.550

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PROJECT: HOUSING DEVELOPMENT, SCALEGILL ROAD MOOR ROW, WHITEHAVEN

TITLE: DRAINAGE ARRANGEMENTS MANHOLE AND PIPE SCHEDULES

SCALE	STATUS	
NOT TO SCALE	FOR PLANNING CONDITIONS	
PAPER SIZE: A1	DRAWN BY: C AIMERS	CHECKED AND APPROVED: C AIMERS
PROJECT PHASE: BUILD	DATE: JULY 2021	DATE: JULY 2021
DRAWING NUMBER: 21-305-DWG002		REVISION: A

Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.650
CV	0.750	Include Intermediate Ground	x
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.005	4.00	80.800	450	81.953	13.244	0.750
2	0.005	4.00	80.550	450	93.833	55.307	0.750
3			80.550	450	89.680	34.612	1.105
4	0.005	4.00	80.550	450	86.524	35.267	1.160
5	0.003	4.00	80.800	450	66.793	16.162	0.750
6	0.002	4.00	80.800	450	68.183	23.457	0.875
7			80.550	450	71.045	38.482	1.426
8	0.005	4.00	80.550	450	78.834	49.385	0.750
9			80.550	450	73.359	50.444	1.631
10	0.007	4.00	80.550	1200	75.155	59.732	1.790
99			79.383	950	68.370	67.054	0.791

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	1	4	22.492	0.600	80.050	79.672	0.378	59.5	100	4.37	50.0
1.000	2	3	21.108	0.600	79.800	79.445	0.355	59.5	100	4.35	50.0
1.001	3	4	3.223	0.600	79.445	79.390	0.055	58.6	100	4.40	50.0
1.002	4	7	15.809	0.600	79.390	79.124	0.266	59.4	100	4.67	50.0
3.000	5	6	7.426	0.600	80.050	79.925	0.125	59.4	100	4.12	50.0
3.001	6	7	15.295	0.600	79.925	79.668	0.257	59.5	100	4.38	50.0
1.003	7	9	12.184	0.600	79.124	78.919	0.205	59.4	100	4.87	50.0
4.000	8	9	5.576	0.600	79.800	79.706	0.094	59.3	100	4.09	50.0
1.004	9	10	9.460	0.600	78.919	78.760	0.159	59.5	100	5.03	50.0
1.005	10	99	9.982	0.600	78.760	78.592	0.168	59.4	100	5.19	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	1.000	7.9	0.7	0.650	0.778	0.005	0.0	20	0.610
1.000	1.001	7.9	0.7	0.650	1.005	0.005	0.0	20	0.610
1.001	1.008	7.9	0.7	1.005	1.060	0.005	0.0	20	0.614
1.002	1.001	7.9	2.0	1.060	1.326	0.015	0.0	35	0.840
3.000	1.001	7.9	0.4	0.650	0.775	0.003	0.0	15	0.515
3.001	1.000	7.9	0.7	0.775	0.782	0.005	0.0	20	0.610
1.003	1.001	7.9	2.7	1.326	1.531	0.020	0.0	40	0.906
4.000	1.002	7.9	0.7	0.650	0.744	0.005	0.0	20	0.611
1.004	1.000	7.9	3.4	1.531	1.690	0.025	0.0	46	0.961
1.005	1.001	7.9	4.3	1.690	0.691	0.032	0.0	53	1.023

Pipeline Schedule

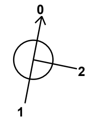
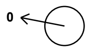
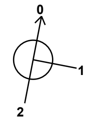
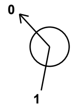
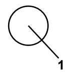
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.000	22.492	59.5	100	Circular	80.800	80.050	0.650	80.550	79.672	0.778
1.000	21.108	59.5	100	Circular	80.550	79.800	0.650	80.550	79.445	1.005
1.001	3.223	58.6	100	Circular	80.550	79.445	1.005	80.550	79.390	1.060
1.002	15.809	59.4	100	Circular	80.550	79.390	1.060	80.550	79.124	1.326
3.000	7.426	59.4	100	Circular	80.800	80.050	0.650	80.800	79.925	0.775
3.001	15.295	59.5	100	Circular	80.800	79.925	0.775	80.550	79.668	0.782
1.003	12.184	59.4	100	Circular	80.550	79.124	1.326	80.550	78.919	1.531
4.000	5.576	59.3	100	Circular	80.550	79.800	0.650	80.550	79.706	0.744
1.004	9.460	59.5	100	Circular	80.550	78.919	1.531	80.550	78.760	1.690
1.005	9.982	59.4	100	Circular	80.550	78.760	1.690	79.383	78.592	0.691

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	1	450	Manhole	Adoptable	4	450	Manhole	Adoptable
1.000	2	450	Manhole	Adoptable	3	450	Manhole	Adoptable
1.001	3	450	Manhole	Adoptable	4	450	Manhole	Adoptable
1.002	4	450	Manhole	Adoptable	7	450	Manhole	Adoptable
3.000	5	450	Manhole	Adoptable	6	450	Manhole	Adoptable
3.001	6	450	Manhole	Adoptable	7	450	Manhole	Adoptable
1.003	7	450	Manhole	Adoptable	9	450	Manhole	Adoptable
4.000	8	450	Manhole	Adoptable	9	450	Manhole	Adoptable
1.004	9	450	Manhole	Adoptable	10	1200	Manhole	Adoptable
1.005	10	1200	Manhole	Adoptable	99	950	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	81.953	13.244	80.800	0.750	450	0	2.000	80.050	100
2	93.833	55.307	80.550	0.750	450	0	1.000	79.800	100
3	89.680	34.612	80.550	1.105	450	1	1.000	79.445	100
						0	1.001	79.445	100
4	86.524	35.267	80.550	1.160	450	1	2.000	79.672	100
						2	1.001	79.390	100
						0	1.002	79.390	100
5	66.793	16.162	80.800	0.750	450	0	3.000	80.050	100
6	68.183	23.457	80.800	0.875	450	1	3.000	79.925	100
						0	3.001	79.925	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
7	71.045	38.482	80.550	1.426	450		1	3.001	79.668	100
							2	1.002	79.124	100
							0	1.003	79.124	100
8	78.834	49.385	80.550	0.750	450		0	4.000	79.800	100
9	73.359	50.444	80.550	1.631	450		1	4.000	79.706	100
							2	1.003	78.919	100
							0	1.004	78.919	100
10	75.155	59.732	80.550	1.790	1200		1	1.004	78.760	100
							0	1.005	78.760	100
99	68.370	67.054	79.383	0.791	950		1	1.005	78.592	100

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	0.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	30 year (l/s)	3.0
Summer CV	0.750	100 year (l/s)	3.7
Winter CV	0.840	Check Discharge Volume	✓
Analysis Speed	Normal	100 year 360 minute (m³)	69
Skip Steady State	x		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.70
Greenfield Method	IH124	Growth Factor 100 year	2.08
Positively Drained Area (ha)	0.190	Betterment (%)	0
SAAR (mm)	1228	QBar	1.8
Soil Index	4	Q 30 year (l/s)	3.0
SPR	0.47	Q 100 year (l/s)	3.7
Region	10		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.190	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.520
CWI	125.570	Runoff Volume (m³)	69

Node 10 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	78.760	Product Number	CTL-SHE-0058-1800-1500-1800
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.8	Min Node Diameter (mm)	1200

Node 10 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	78.760	Depth (m)	1.000
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	136	Inf Depth (m)	
Safety Factor	1.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.40	Pit Length (m)	2.000		

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.21%

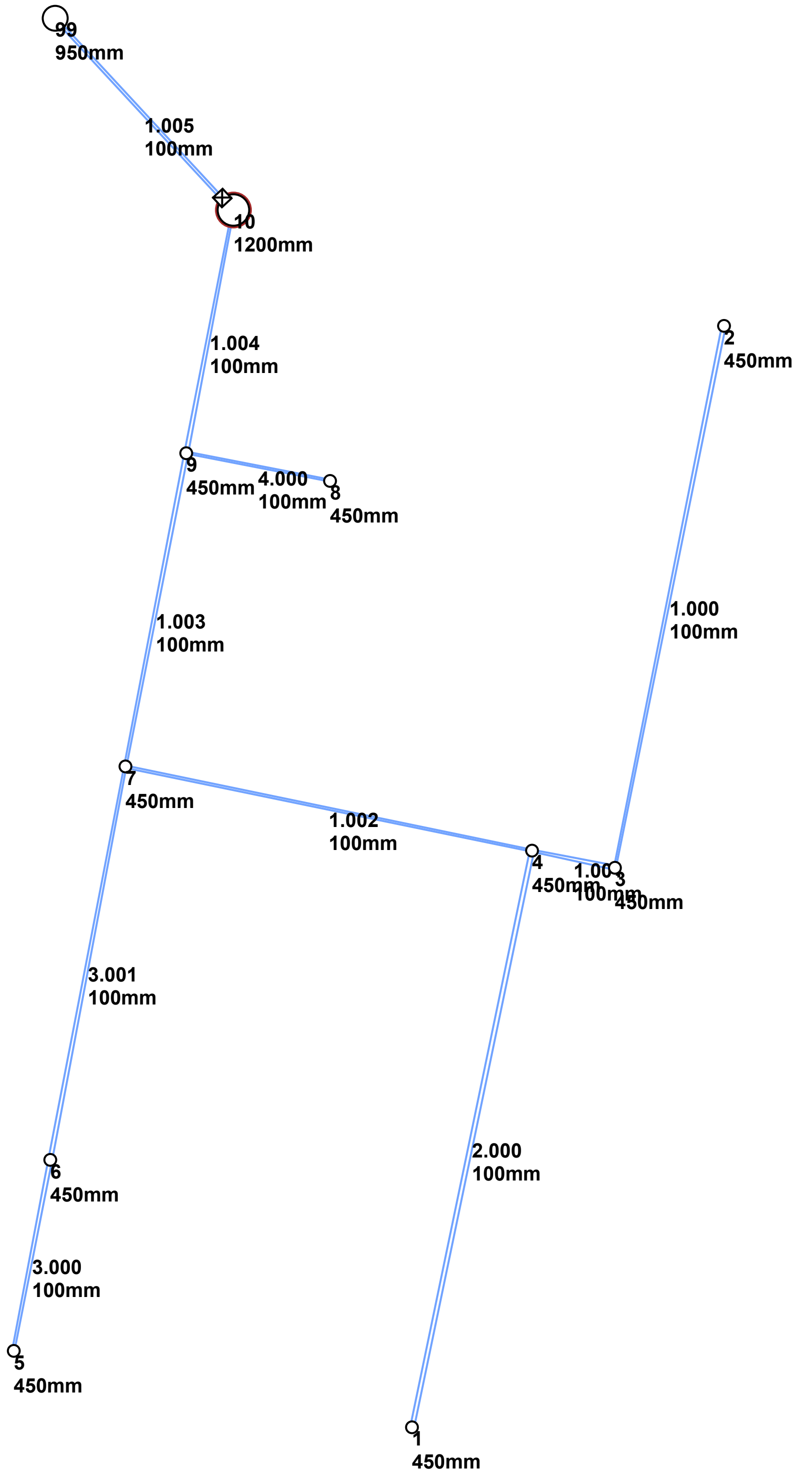
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	80.082	0.032	1.7	0.0051	0.0000	OK
15 minute summer	2	10	79.832	0.032	1.7	0.0051	0.0000	OK
60 minute winter	3	48	79.505	0.060	0.9	0.0095	0.0000	OK
60 minute winter	4	47	79.505	0.115	2.7	0.0182	0.0000	SURCHARGED
15 minute winter	5	10	80.074	0.024	1.0	0.0038	0.0000	OK
15 minute winter	6	10	79.957	0.032	1.7	0.0051	0.0000	OK
60 minute winter	7	49	79.503	0.379	3.6	0.0602	0.0000	SURCHARGED
15 minute winter	8	10	79.833	0.033	1.7	0.0053	0.0000	OK
60 minute winter	9	49	79.500	0.581	4.1	0.0924	0.0000	SURCHARGED
60 minute winter	10	49	79.497	0.737	4.4	3.1905	0.0000	SURCHARGED
15 minute summer	99	1	78.592	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	4	1.7	0.791	0.214	0.0478	
15 minute summer	2	1.000	3	1.7	0.799	0.217	0.0451	
60 minute winter	3	1.001	4	0.9	0.424	0.114	0.0205	
60 minute winter	4	1.002	7	2.7	0.807	0.344	0.1237	
15 minute winter	5	3.000	6	1.0	0.562	0.127	0.0134	
15 minute winter	6	3.001	7	1.7	0.788	0.214	0.0327	
60 minute winter	7	1.003	9	3.2	0.770	0.413	0.0953	
15 minute winter	8	4.000	9	1.7	0.775	0.216	0.0122	
60 minute winter	9	1.004	10	3.2	0.523	0.403	0.0740	
60 minute winter	10	Hydro-Brake®	99	1.4				8.4

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.21%

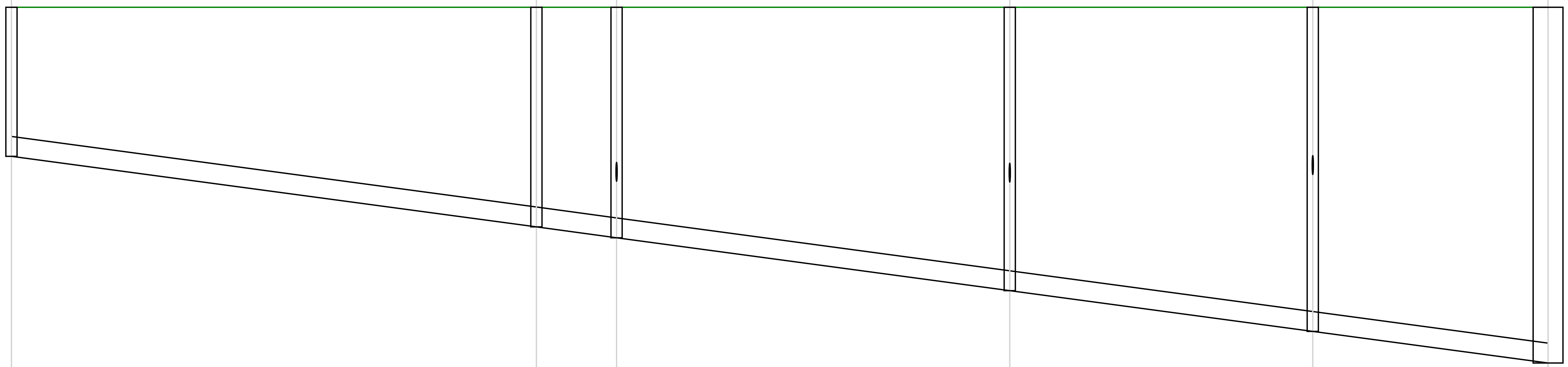
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	92	80.135	0.085	1.1	0.0135	0.0000	OK
120 minute winter	2	92	80.135	0.335	1.1	0.0532	0.0000	SURCHARGED
120 minute winter	3	92	80.134	0.689	1.1	0.1096	0.0000	SURCHARGED
120 minute winter	4	92	80.134	0.744	2.9	0.1183	0.0000	SURCHARGED
120 minute winter	5	92	80.131	0.081	0.6	0.0129	0.0000	OK
120 minute winter	6	92	80.131	0.206	1.0	0.0328	0.0000	SURCHARGED
120 minute winter	7	92	80.131	1.007	3.5	0.1601	0.0000	SURCHARGED
120 minute winter	8	92	80.126	0.326	1.1	0.0519	0.0000	SURCHARGED
120 minute winter	9	92	80.126	1.207	3.4	0.1919	0.0000	SURCHARGED
120 minute winter	10	92	80.120	1.360	4.1	4.7401	0.0000	SURCHARGED
15 minute summer	99	1	78.592	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	1	2.000	4	1.1	0.697	0.136	0.1674	
120 minute winter	2	1.000	3	1.1	0.684	0.138	0.1652	
120 minute winter	3	1.001	4	1.0	0.417	0.121	0.0252	
120 minute winter	4	1.002	7	2.6	0.750	0.329	0.1237	
120 minute winter	5	3.000	6	0.6	0.489	0.076	0.0543	
120 minute winter	6	3.001	7	1.0	0.682	0.129	0.1197	
120 minute winter	7	1.003	9	2.6	0.726	0.335	0.0953	
120 minute winter	8	4.000	9	1.1	0.686	0.138	0.0436	
120 minute winter	9	1.004	10	2.8	0.496	0.355	0.0740	
120 minute winter	10	Hydro-Brake®	99	1.7				19.5



99
950mm
1.005
100mm
10
1200mm
1.004
100mm
2
450mm
9
450mm
4.000
100mm
8
450mm
1.003
100mm
1.000
100mm
7
450mm
1.002
100mm
4
450mm
1.00
100mm
3
450mm
3.001
100mm
2.000
100mm
6
450mm
3.000
100mm
5
450mm
1
450mm

KINGMOOR CONSULTING	Kingmoor Consulting Ltd 6B Clifford Court Parkhouse Carlisle, CA3 0JG	File: surface.pfd Network: Storm Network Colin Aimers 07/07/2021	Page 1



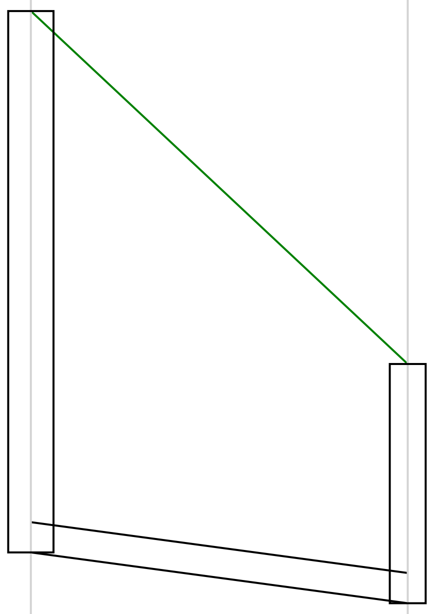
A3 drawing

Hor Scale 200
Ver Scale 25

Datum (m) 77.000

Node Name	2		3		4		7		9		10
Link Name		1.000		1.001		1.002		1.003		1.004	
Section Type		100mm		100mm		100mm		100mm		100mm	
Slope (1:X)		59.5		58.6		59.4		59.4		59.5	
Cover Level (m)	80.550		80.550		80.550		80.550		80.550		80.550
Invert Level (m)	79.800		79.445 79.445		79.390 79.390		79.124 79.124		78.919 78.919		78.760
Length (m)		21.108		3.223		15.809		12.184		9.460	

Node Name	10	99



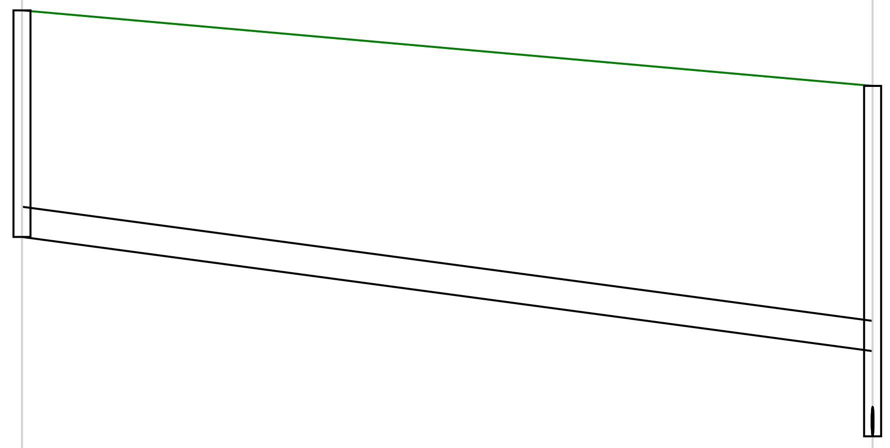
A3 drawing

Hor Scale 200
Ver Scale 25

Datum (m) 77.000

	10		99
Link Name		1.005	
Section Type		100mm	
Slope (1:X)		59.4	
Cover Level (m)	80.550		79.383
Invert Level (m)	78.760		78.592
Length (m)		9.982	

Node Name	1		4



A3 drawing

Hor Scale 200
Ver Scale 25

Datum (m) 78.000

Link Name		2.000	
Section Type		100mm	
Slope (1:X)		59.5	
Cover Level (m)	80.800		80.550
Invert Level (m)	80.050		79.672
Length (m)		22.492	

Kingmoor Consulting Ltd
6B Clifford Court
Parkhouse
Carlisle, CA3 0JG

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Network: Storm Network
Colin Aimers
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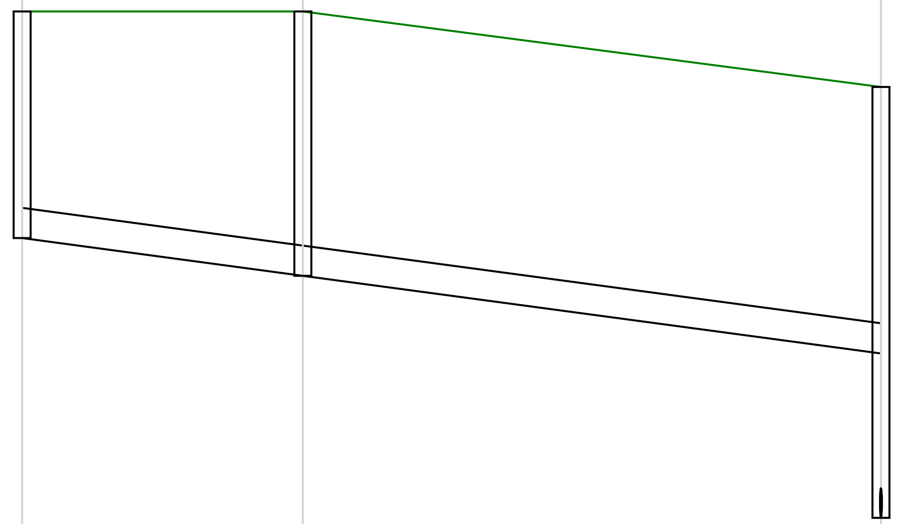
Node Name	5		6		7



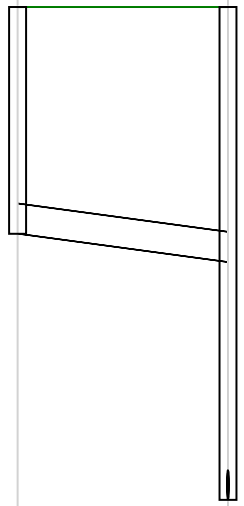
A3 drawing

Hor Scale 200
Ver Scale 25

Datum (m) 77.000

Link Name		3.000			3.001	
Section Type		100mm			100mm	
Slope (1:X)		59.4			59.5	
Cover Level (m)	80.800			80.800		80.550
Invert Level (m)	80.050		79.925	79.925		79.668
Length (m)		7.426			15.295	

Node Name	8	9



A3 drawing

Hor Scale 200
Ver Scale 25

Datum (m) 77.000

Link Name	4.000	
Section Type	100mm	
Slope (1:X)	59.3	
Cover Level (m)	80.550	80.550
Invert Level (m)	79.800	79.706
Length (m)	5.576	