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Civil Engineering Consultants Ltd

Proposed Residential Development Rowley Lane, Lepton

Flood Risk Assessment

February 2023

KCS Development Ltd

Report

This report consists of a Flood Risk Assessment and Drainage Strategy, produced to support the proposed residential development of the site located at Rowley Lane, Lepton. It has been produced by FORTEM Civil Engineering Consultants Ltd for KCS Development Ltd.

Revision History

Rev Ref	Date	Amendments	By	Chk'd
1	20.01.2021	First Issue	BS	ADC
2	06.02.2021	Updated with client comments	BS	ADC
3	03.04.2021	Updated in accordance with Kirklees Council consultation	BS	ADC
4	24.03.2022	Updated in accordance with revised layout	BS	ADC
5	29.04.2022	Updated in accordance with revised layout	BS	ADC
6	07.09.2022	Updated in accordance with revised layout, site visit and consultation with Kirklees Council	ML	ADC
7	07.10.2022	Updated in accordance with Kirklees Council consultation	ML	ADC
8	22.02.2023	Updated in accordance with revised layout	ML	RD

Contract

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Executive Summary

Site Description

The proposed development is located off Hermitage Park (Rowley Lane), Lepton. The site area is 6.13ha and the current use of the land is agricultural grassland.

There is a 100mm diameter combined water sewer crossing the site entrance and a 225mm diameter surface water and 300mm diameter combined water sewer located in Rowley Lane north-west of the site.

Two watercourses are located within the vicinity of the development. An unnamed watercourse on the north-eastern boundary and Beldon Brook approximately 300m south of the site boundary.

Proposed Development

It is proposed to construct 80 residential dwellings within the development parcel. This forms Phase 2 of the wider HS2/HS3 allocation, in accordance with the full allocation masterplan.

Flood Risk

Environment Agency Flood Mapping confirms the site is located in Flood Zone 1 with flood risk from all sources low.

In order to mitigate any potential overland flows from the east, a cut off swale is to be incorporated into the eastern boundary.

The following standard mitigation measures are recommended:

Finished floor levels for all new build properties are to be set minimum 150mm above external levels to mitigate any risk from blockage and exceedance events;

Drainage design blockage/exceedance events have been considered, ensuring the proposed development and surrounding areas are not put at risk from overland flows.

Drainage

Development surface water runoff is proposed to discharge to the open watercourse south of the development boundary (Beldon Brook).

The surface water discharge rate is to be limited to greenfield runoff (13.3l/s) and the surface water drainage designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.

It is proposed to discharge the foul water flows from the development to the 300mm combined network in Rowley Lane. Due to the topography of the site a pumped discharge will be required for the southern part of the development.

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	Drawing 338-P-007 Rev D - Phasing Plan (HS2/HS3 Masterplan)
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Appendix C	**Flood Risk Mapping**
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1. Introduction

1.1. Report Background

1.1.1. This report has been produced to support the planning application for the proposed residential development located off Hermitage Park (Rowley Lane), Lepton. It has been produced in accordance with the National Planning Policy Framework (NPPF) and guidance documents produced by Kirklees Council.

1.1.2. The study consists of data collection, consultation and review with regulatory bodies and third parties in relation to flood risk and drainage. FORTEM cannot guarantee the reliability of third party information and/or changes in consultee conclusions/responses.

1.2. Site Description

1.2.1. The site is located at Rowley Lane, Lepton, OS grid reference SE 19262 14731, see Appendix A for Development Location Plan. Details of the site are tabled below:

Site Area		6.13ha.
Topography		The site falls from north-east to south, with average gradients of 1 in 28, see appendix A for topographical survey.
Land Use		The proposed development site is currently agricultural grassland.
Boundaries	**North:**	Existing residential dwellings extending onto adoptable highway (Hermitage Park and Rowley Lane).
	South:	Dense woodlands (Lepton Great Wood).
	East:	Dense woodlands (Lepton Great Wood).
	West:	Existing residential dwellings and agricultural grassland.
Watercourses		Beldon Brook (ordinary watercourse) is located approximately 300m to the south of the proposed development. An unnamed open and culverted watercourse is located on the north-eastern boundary of the development. See Appendix A for drawings 1093-004D - Existing Drainage and 1093-010- North-Eastern Boundary Watercourse.
Public Sewers		Yorkshire Water record drawings confirm the existence of a 100mm diameter water sewer crossing the development site entrance and a 225mm diameter surface water and 300mm diameter combined water sewer in Rowley Lane, north-west of the site. See Appendix A for Yorkshire Water Records.
Other Drainage		Based upon the intrusive site investigation works, a small section of land drainage is evident on site. This system has historically been investigated by Kirklees Council due to localised flooding of the field. Dartmouth Estates undertook a repair to the land drain which rectified the problem. The historic use of the site it is likely the fields are served by an extensive land drainage system.
Ground		Geological and BGS records indicate that the strata of the area is CLAYS overlaying Mudstone. Anecdotal information indicates that rainfall infiltration into the ground is unlikely.

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1.3. Proposed Development

1.3.1. It is proposed to construct 80 No residential dwellings within the development boundary, see Appendix B for the Niemen Architects Proposed Site Layout drawing 3284-0-002 Rev DD.

1.3.2. This outline application is part of the wider HS2/HS3 allocation and is Phase 2 in accordance with the allocation masterplan, see Appendix B for the Urban Wilderness Phasing Plan 338-P-007 Rev D.

1.4. Consultation

1.4.1. Consultation with the relevant consultees has been undertaken, see summary below:

Consultee	Response Summary
Kirklees Council (KC)	KC Flood Risk Management team have been consulted as part of this report and have confirmed: • No records of flooding incidents on the site; • Their record drawings confirm an unnamed watercourse on the north-eastern boundary; • Due to ground conditions, they accept infiltration drainage is not suitable for the development; • Development surface water discharge to Beldon Brook at a restricted rate of 13.3l/s is acceptable. • Flood Risk and drainage for the HS2/HS3 full allocation will be addressed for each phase in accordance with the masterplan. See Appendix D for correspondence.
Yorkshire Water	Yorkshire Water Records have been received for the site and are included in Appendix A. Yorkshire Water were consulted as part of previous planning enquiries for the wider development regarding the proposed foul water discharge from the development. Yorkshire Water confirmed foul water should discharge to the 300mm combined sewer in Rowley Lane.

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2. Sources of Flood Risk

2.1. Summary

2.1.1. Below is a summary of the sources of flood risk and the potential risk associated to the proposed development:

Source	Risk Level	Notes
Fluvial/Tidal	Low	In accordance with the Environment Agency Flood Maps the site is located within Flood Zone 1.
Surface Water/Pluvial	Low	Environmental Agency maps confirm low risk of surface water flooding for the site. The open watercourse located on the north-eastern boundary is elevated to the proposed development, see Section 2.2 below.
Groundwater	Low	There are no known records of any historic groundwater flooding or risk.
Sewers	Low	Based upon searches undertaken, no historic incidents have been recorded within the vicinity of the proposed development.
Other Man-Made Sources	Low	The site is not in an area at risk from a major failure of a reservoir and there are no other known artificial sources of flood risk in the area.

Copies of the Environment Agency flood maps are included in Appendix C.

2.2. Surface Water/Pluvial

2.2.1. There is a part culverted/part open unnamed watercourse located outside of the proposed development on the north-eastern boundary, see drawings 1093-004D - Existing Drainage and 1093-010- - North-Eastern Boundary Watercourse, Appendix A. Anecdotal information indicates this system only operates during sustained rainfall (no base flow). The existing topography and site visit (31.08.2022) has confirmed that in the event of a blockage and/or exceedance event, overland flows will follow existing topography, routing between Numbers 34b and 36a before discharging onto Rowley Lane.

2.2.2. Based upon site visits in 2020 and 2021, there has been evidence that the watercourse has been blocked by works to divert flows onto and over the proposed development site. our site visit on 31.08.2022 confirmed that these changes to the watercourse have been removed, with the normal operation and failure arrangement returned in accordance with 2.2.1. Based upon the potential for future works to be undertaken to the watercourse which could increase flood risk, it is necessary to consider additional mitigation to ensure there is no potential for increased flood risk to the development or existing drainage systems.

2.2.3. The information gathered from site and surveys confirms that flows associated within the watercourse will not affect the proposed development (flows maintained off site) and the development will not increase off site flood risk (no discharge to watercourse from development). As the wood on the eastern boundary is elevated to the site, and to provide mitigation in the event the watercourse is modified increasing flood risk to the development, it is proposed that a cut off swale is incorporated on the eastern boundary of the site. This will mitigate any runoff from the wood, with flows routed to Beldon Brook see Appendix B for drawing 1093-006F - Proposed Drainage Strategy.

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2.3. Development Mitigation

2.3.1. The following standard mitigation measures are recommended:

2.3.2. Finished floor levels for all new build properties are to be set minimum 150mm above external levels to mitigate any risk from blockage and exceedance events;

2.3.3. Blockage/exceedance events have been considered as part of the concept design confirming the proposed development and surrounding areas are not put at risk from overland flows, see Appendix B for drawing 1093-009D - Exceedance Flow Routing;

2.3.4. The proposed development surface water drainage is to be designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year plus climate change (30%) event.

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3. Development Drainage

3.1. Existing Site Drainage

3.1.1. As covered in section 1.2, Yorkshire Water record drawings confirm there is an existing 100mm diameter combined water sewer crossing the site entrance and a 225mm diameter surface water and 300mm diameter combined water sewer located in Rowley Lane, north-west of the site, see drawing 1093-004D - Existing Drainage, Appendix A.

3.1.2. There is an unnamed watercourse located outside of the proposed development site on the north-eastern boundary. The watercourse is elevated and does not receive any runoff from the site, see drawing 1093-004D - Existing Drainage, Appendix A.

3.1.3. Located approximately 300m to the south of the development is Beldon Brook. There is no evidence that the agricultural grassland has been served by a positive drainage system, however based upon the topography of the site the existing surface water runoff discharges south to Beldon Brook, see drawing 1093-004D - Existing Drainage, Appendix A.

3.1.4. As part of the intrusive site investigation, a short length of land drainage has been identified in the northeast corner of the site (approx. 0.4m below ground level). Based upon the historic use of the site, it is anticipated that land drainage will be present. All existing land drainage will be removed as part of the site preparation works with positive drainage to serve the development.

3.1.5. The greenfield run-off for the site has been calculated using the IH124 method for 50Ha, with a resulting Q_{Bar} of 123.5l/s, which is equivalent to 2.47l/s/ha, see Appendix A for calculations. Therefore, the existing greenfield runoff for the site is:

Development Area (Excluding BNG)	Greenfield Runoff Rate	Existing Greenfield Runoff
5.39ha	x 2.47l/s/ha	= **13.3l/s**

3.2. Development Surface Water Drainage

3.2.1. The potential surface water outfall/discharge options have been considered and summarised below:

Outfall/Discharge Option (Ranked in order of Preference)	✓/✗	Notes
1. Infiltration	✗	The existing strata consists of CLAYS overlaying Mudstone, which is unsuitable for the use of infiltration drainage.
2. Discharge to Watercourse	✓	Existing watercourse (Beldon Brook) located to the south of the proposed development. The discharge is in accordance with the existing runoff off from the farmland.
3. Discharge to Public Surface Water Sewer	✗/✓	Existing 225mm diameter surface water sewer located in Rowley Lane to the north-west of the proposed development. No historic discharge proven, no capacity in network and due to topography it is necessary to pump flows.
4. Discharge to Public Combined Sewer	✗	Existing 300mm diameter combined sewer located in Rowley Lane to the north-west of the proposed development. Discharge cannot be considered where watercourse and surface water sewer options are available.

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3.2.2. Based upon the findings of the review above and in accordance with surface water drainage hierarchy, it is proposed to discharge the surface water from the proposed residential development to the existing open watercourse located south of the site (Beldon Brook), see drawing 1093-006F - Proposed Drainage Strategy.

3.2.3. Surface water discharge to Beldon Brook is to be restricted to the existing greenfield runoff of 13.3l/s.

3.2.4. The proposed development surface water drainage is to be designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.

3.2.5. Based upon a discharge rate of 13.3l/s, the total attenuation required for the development is 1,192m^3 (1 in 100 + 30% c/c event), see Appendix B for attenuation calculations. The attenuation is to be split over two attenuation basins with two flow control devices, see Appendix B for drawing 1093-006F - Proposed Drainage Strategy.

3.2.6. The Microdrainage calculations are preliminary only to ensure sufficient space is provided within the site for the 2no. basins. A level check has been undertaken to verify the design with more detail to be provided at Reserved Matters submission.

3.2.7. The development surface water discharge to Beldon Brook at a restricted flow rate of 13.3l/s has been agreed with Kirklees Council LLFA, see Appendix D for correspondence.

3.2.8. Blockage/exceedance events have been assessed for the proposed drainage design, see Appendix B for drawing 1093-009D - Exceedance Flow Routing. The assessment confirms the proposed development and surrounding areas are not put at risk from overland flows.

3.3. Surface Water Treatment

3.3.1. Surface Water treatment is to be incorporated into the surface water detailed design and installation. The treatment of the surface water run-off to Beldon Brook has been considered in accordance with CIRIA SuDs Manual 2015 (Chapter 4 and 26) and the assessment is tabled below:

Pollution Hazard / Mitigation Indices for discharge to Beldon Brook			
Land Use/Treatment	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Residential development general access road (minimum requirement)	0.5	0.4	0.4
Online Detention Basin	0.5	0.5	0.6
Total Mitigation	**0.5 ✓**	**0.5 ✓**	**0.6 ✓**

The above review confirms the proposed drainage for the development meets the necessary water quality requirements.

3.3.2. In accordance with the above assessment, runoff from the proposed development discharging to Beldon Brook is to be treated by the proposed detention basins, see drawing 1093-006F – Proposed Drainage Strategy, Appendix B. This is to be supplemented by the use of trapped gullies throughout the development.

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3.4. Development Foul Water Drainage

3.4.1. It is proposed to discharge the foul water flows from the development to the existing 300mm combined sewer in Rowley Lane.

3.4.2. The northern part of the site will discharge via gravity, whilst due to the site topography the southern part requires a pumping station, see drawing 1093-006F - Proposed Drainage Strategy, Appendix B.

3.5. Maintenance

3.5.1. It is proposed for both the foul and surface water drainage networks to be adopted by Yorkshire Water under a Section 104 agreement. Therefore, the long term maintenance of the adoptable drainage system will be the responsibility of Yorkshire Water.

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4. Conclusion

4.1. Flood Risk

4.1.1. Environment Agency Flood Mapping confirms the site is located in Flood Zone 1, with all other forms of flood risk low.

4.1.2. In order to mitigate any potential overland flows from the steeply sloping land to the east of the development, it is recommended for a cut off swale to be incorporated on the eastern boundary of the proposed development.

4.1.3. The following standard mitigation measures are recommended:

- Finished floor levels of all new build properties to be set 150mm above the surrounding ground levels;
- Blockage/exceedance events have been considered confirming the proposed development and surrounding areas are not put at risk from overland flows.

4.2. Drainage

4.2.1. Development surface water runoff is proposed to discharge to the open watercourse south of development boundary (Beldon Brook).

4.2.2. The surface water discharge rate is to be limited to greenfield runoff (13.3l/s) and the surface water drainage designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.

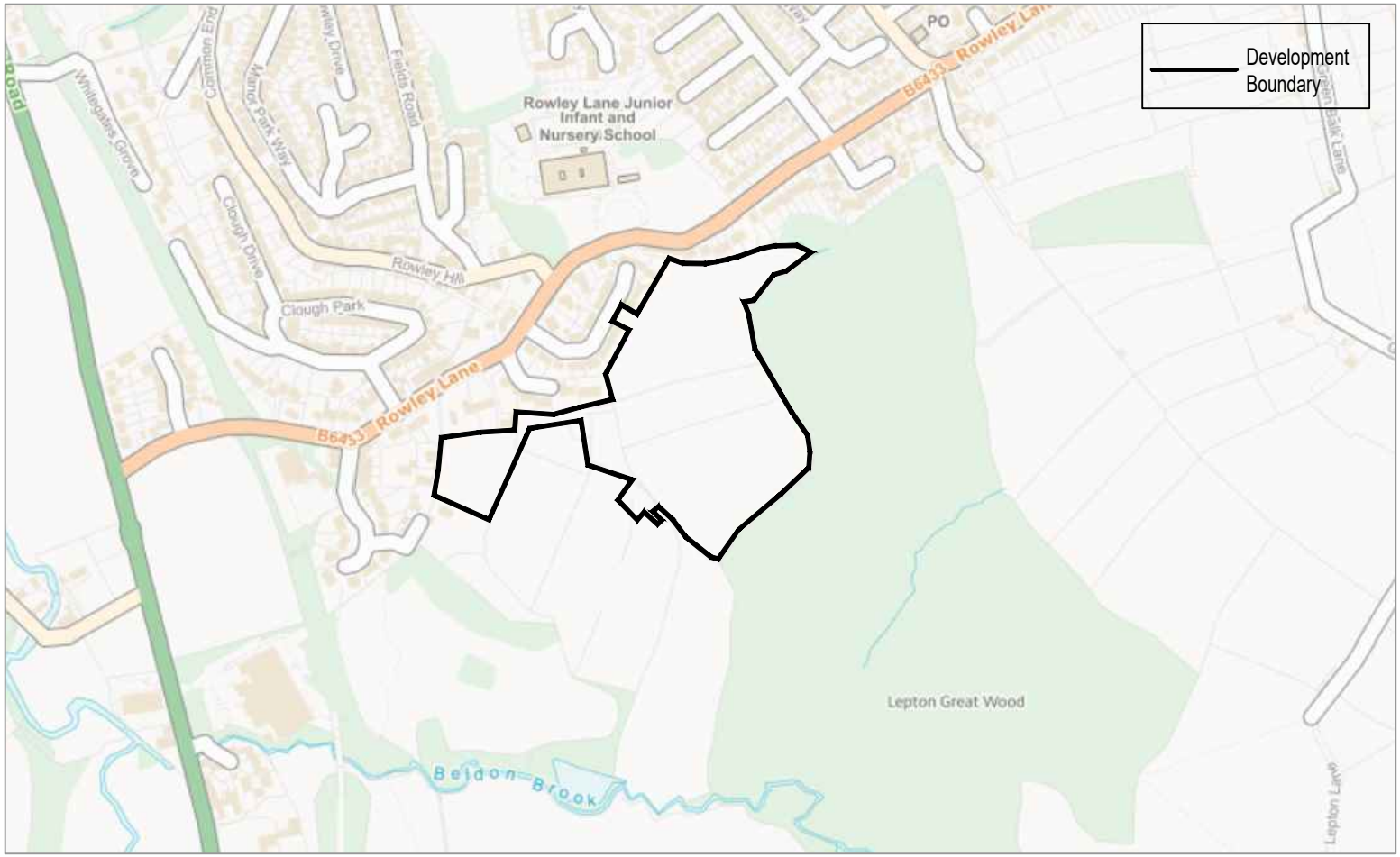
4.2.3. It is proposed to discharge the foul water flows from the development to the 300mm combined network in Rowley Lane. Due to topography a pumping station will be required for the southern part of the site.

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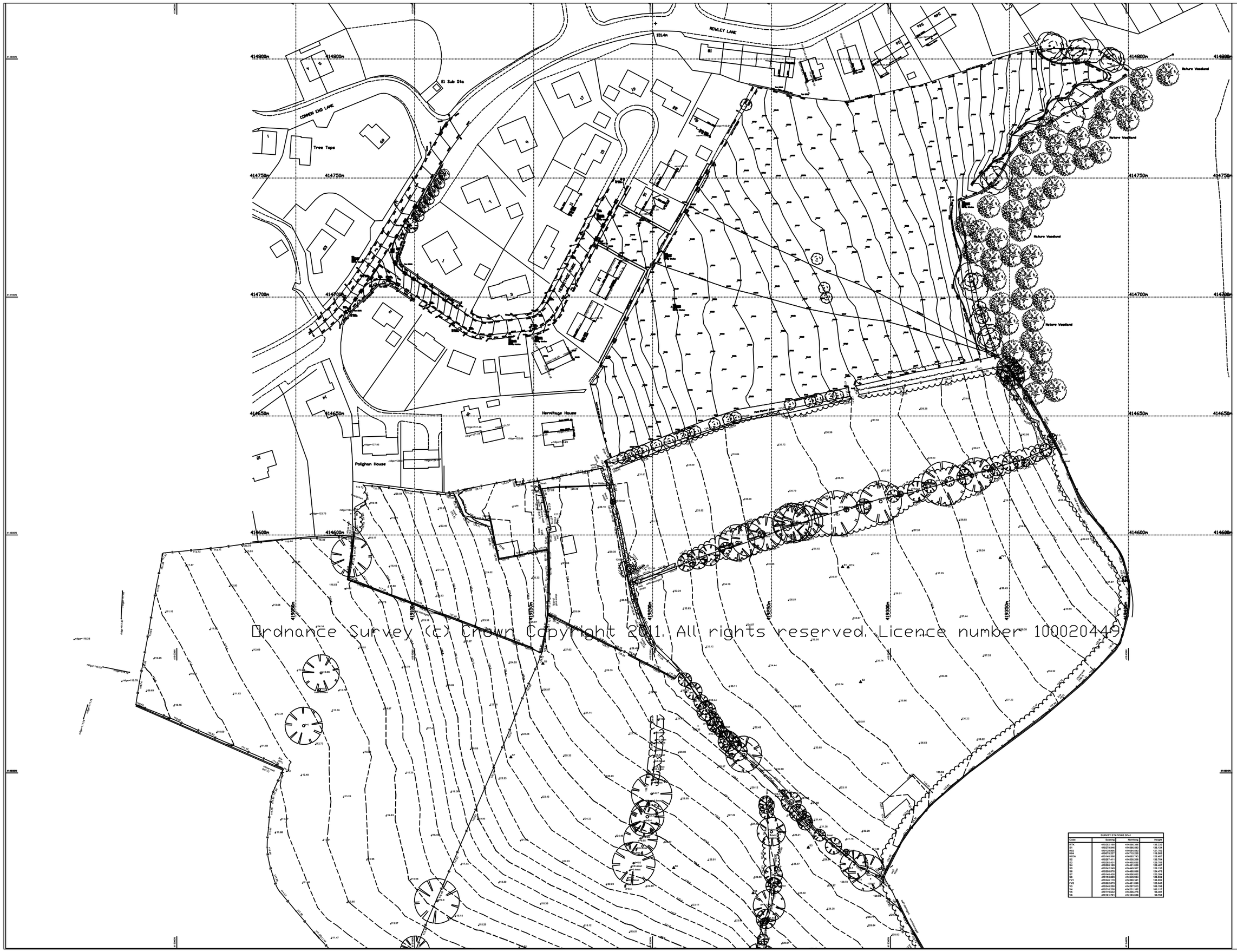
Appendix A **Existing Site**

Development Location Plan
Drawings SSS-4806 Lepton Rev A - Topographical Survey
Yorkshire Water Sewer Records
Drawing 1093-004D - Existing Drainage
Drawing 1093-010- - North-Eastern Boundary Watercourse
IH124 Calculation

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ROWLEY LANE, LEPTON
DEVELOPMENT LOCATION PLAN
EXTRACT TAKEN 09.11.2020 : NTS


ROVLEY LANE
COWEN END LANE
El Sub Sta
Tree Tops
Polighan House
Herritage House
Future Woodland
Future Woodland
Future Woodland

safe-move

Lepton

Little Lepton

Woodsome Hall Golf Course

Carr Wood

Lepton Great Wood

Highlanders Sports and S

Pond Lane Farm

Greenly Farm

Low Fold Farm

Fourlands Farm

Four Fumbers

Great Oak Barn

Manor Mill Farm

Beldon Brook

Beldon Brook Bridge

Black Farm

Woodsome Lees Farm

Woodsome Cottage

Woodsome Mill

Woodsome Bridge

Woodsome Hall Farm

Meadowcroft Farm

Moor Lane Villa Farm

Burton Royd Farm

Lepton Cof (VC) Junior and Infant and Nursery School

Lepton Methodist Church

Lepton Kings Church of England (Aided) Primary School

Woodville Nursing Home

Chantry Hill

Chantry View

Windsor Close

Dryden Grange

Dryden Square

Dryden Lane

Dryden Mount

Dryden Rise

Dryden Way

Dryden Close

Dryden Court

Dryden Gardens

Dryden Crescent

Dryden Avenue

Lepton Farm

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NOTES:

1. THIS DRAWING IS BASED UPON NIEMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002 REV S, YORKSHIRE WATER RECORD DRAWINGS, SITE WALKOVER DATED 09.03.21. KIRKLEES COUNCIL DRAINAGE RECORDS AND ORDNANCE SURVEY MAPS.

KEY:

- DEVELOPMENT BOUNDARY
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PUBLIC FOUL SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING OPEN WATERCOURSE - BELDON BROOK (ORDINARY WATERCOURSE)
- EXISTING CULVERTED WATERCOURSE
- EXISTING OPEN WATERCOURSE (ORDINARY WATERCOURSE)

INLET MANHOLE TO CULVERTED SECTION

UNNAMED WATERCOURSE

FOR DETAILED INFORMATION ON NORTH-EASTERN BOUNDARY WATERCOURSE REFER TO DRAWING 1093 - 010

ROWLEY LANE

HERMITAGE PARK

BELDON BROOK

EXISTING 225Ø
EXISTING 300Ø
EXISTING 150Ø
EXISTING 100Ø
EXISTING 300Ø
EXISTING 375Ø

Rev	Date	Amendments	By
D	07.09.22	Existing drainage updated in accordance with site visit.	JOH
C	29.04.22	Updated to suit revised layout	BS
B	24.03.22	Updated to suit revised layout	BS
A	23.03.21	Updated to suit Kirklees CC comments received 15.02.21 and site walkover 09.03.21	BS

Drawing Status.

INFORMATION

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Client

KCS DEVELOPMENT LIMITED

Project

ROWLEY LANE, LEPTON

Drawing Title.

EXISTING DRAINAGE

Drawn: BS
Checked: ADC

Scale: 1:1000 @ A1
Date: JAN 2021

Drawing No. 1093 - 004

Rev. D

C:\Users\matth\FORTEM\Andrew Calvert - FORTEM Projects\1093 - Rowley Lane, Lepton KCS\2. Drawings\1. FORTEM2. Drawings\1. Current\1093 - 004 Existing Drainage Network.dwg 07 Sep, 2022 - 1:52pm





EXISTING CULVERTED WATERCOURSE INLET MANHOLE



EXISTING GROUND LEVEL BELOW DEVELOPMENT BOUNDARY



EXISTING GROUND BUNDED OUTSIDE OF DEVELOPMENT BOUNDARY



EXISTING UPSTREAM CULVERTED WATERCOURSE OUTLET PIPE



SITE BOUNDARY LEVEL ABOVE LEVEL OF ADJACENT WATERCOURSE



EASTERN SITE BOUNDARY

N

NOTES:

1. THIS DRAWING IS BASED ON UPON:
   - NIEMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002 REV S;
   - HOLDEN SURVEYS LTD SITE PLAN PPL_09_LEPTON;
   - SITE SURVEYING SERVICES TOPOGRAPHICAL SURVEY SSS-4806 LEPTON-A;
   - LAND REGISTRY TITLE PLAN WYK84238;
   - LAND REGISTRY TITLE PLAN WYK76804;
   - YORKSHIRE WATER SEWER RECORDS;
   - SITE WALKOVER DATED 31.08.22;
   - KIRKLEES COUNCIL DRAINAGE RECORDS; AND,
   - ORDNANCE SURVEY MAPS.

KEY:

- DEVELOPMENT BOUNDARY
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING CULVERTED WATERCOURSE
- EXISTING OPEN WATERCOURSE (NON MAIN RIVER)
- OVERLAND FLOW ROUTE FROM WOODLAND

Rev	Date	Amendments	By

Drawing Status.
INFORMATION

FORTEM

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Client
KCS DEVELOPMENT LIMITED

Project
ROWLEY LANE, LEPTON

Drawing Title.
EXISTING NORTH-EASTERN BOUNDARY WATERCOURSE

Drawn: ML	Scale: 1:1000 @ A3
Checked: ADC	Date: SEPT 2022

Drawing No. 1093 - 010
Rev. -

C:\Users\matth\FORTEM\Andrew Calvert - FORTEM Projects\1093 - Rowley Lane, Lepton KCS\2. Drawings\1. FORTEM\2. Drawings\1. Current\1093 - 010 Existing NE Boundary WC.dwg 07 Sep, 2022 - 1:48pm

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.300
Area (ha)	50.000	Urban	0.000
SAAR (mm)	908	Region Number	Region 3

Results l/s

QBAR Rural	123.5
QBAR Urban	123.5
Q1 year	106.2
Q1 year	106.2
Q2 years	116.6
Q5 years	154.4
Q10 years	179.1
Q20 years	202.9
Q25 years	210.8
Q30 years	217.2
Q50 years	234.0
Q100 years	257.0
Q200 years	291.6
Q250 years	302.7
Q1000 years	375.6

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Appendix B **Proposed Development**

Drawing 3284-0-002 Rev DD - Proposed Site Layout
Drawing 338-P-007 Rev D - Phasing Plan
Drawing 1093-006F - Proposed Drainage Strategy
Drawing 1093-009D - Exceedance Flow Routing
Attenuation Calculations

KEY:

- ANCIENT WOODLAND 15m OFFSET TO ROADS / PATHS
- ANCIENT WOODLAND 20m OFFSET TO BUILDINGS
- ANCIENT WOODLAND SEMI NATURAL BUFFER
- CLAIMED PUBLIC RIGHT OF WAY
- EXISTING PUBLIC RIGHT OF WAY
- 240ltr WHEELED BIN STORAGE
- 240ltr WHEELED BIN SCREENED COLLECTION POINT
- 660ltr WHEELED BIN SCREENED COLLECTION POINT
- AFFORDABLE RENTED
- INTERMEDIATE HOUSING
- FIRST HOMES

TREE RETENTION CATEGORY A
HIGH QUALITY WITH AN ESTIMATED LIFE EXPECTANCY OF AT LEAST 40 YEARS

TREE RETENTION CATEGORY B
MODERATE QUALITY WITH AN ESTIMATED LIFE EXPECTANCY OF AT LEAST 20 YEARS

TREE RETENTION CATEGORY C
LOW QUALITY WITH AN ESTIMATED LIFE EXPECTANCY OF AT LEAST 10 YEARS,
OR YOUNG TREE WITH A STEM DIAMETER BELOW 150MM

TREE REMOVAL CATEGORY U
POOR QONDITION WITH AN ESTIMATED LIFE EXPECTANCY OF LESS THAN 10 YEARS

RPA
MINIMUM ROOT PROTECTION AREA

TREE TO BE REMOVED

EXISTING HEDGE

SWALE

* 18No. VISITOR PARKING SPACES*

N

S

ROWLEY LANE

ROWLEY HILL

HERMITAGE PARK

131.4m

124.6m

El Sub Sta

Tree Tops

Hermitage House

Polighon House

SURFACE WATER ATTENUATION POND 1

SURFACE WATER ATTENUATION POND 2

P.O.S.

PUMPING STATION

W1: Mature oak on boundary, 20m high with 800mm stem diameter.

W1: Canopy dominated by oak/sycamore/ash with an average 500mm stem diameter. Holly understorey.

W1: Oak with decay hollow located on woodland edge

W1: Canopy dominated by oak with an average 500mm stem diameter. Occasional holly understorey.

W1: Canopy dominated by oak with an average 500mm stem diameter. Occasional holly understorey.

W1: Canopy dominated by oak/silver birch with an average 400/500mm stem diameter

W1: Canopy dominated by oak/silver birch with an average 400/500mm stem diameter

W1 - Veteran beech (20m high)

Schedule of Accommodation

To be read in conjunction with drawing no. 3294-0-002

Ref.	No. of Beds	No. of Units	Percentage	M²	Total M²
A	2 Bedrooms	4	5.00	95.00	380.00
B	2 Bedrooms	11	13.75	70.00	770.00
C	3 Bedrooms	13	16.25	84.00	1092.00
D	3 Bedrooms	12	15.00	84.20	1010.40
E	3 Bedrooms	9	11.25	98.00	882.00
F	4 Bedrooms	3	3.75	110.50	331.50
G	4 Bedrooms	5	6.25	117.00	585.00
H	4 Bedrooms	6	7.50	120.50	723.00
J	4 Bedrooms	7	8.75	128.00	896.00
K	4 Bedrooms	10	12.50	140.00	1400.00
		80	95.00		7689.90

Hermitage Park, LEPTON

DO NOT SCALE - ALL DIMENSIONS & LEVELS TO BE CHECKED ON SITE - THIS DRAWING IS COPYRIGHT

revision	date	comment	initials
DD	20.02.23	SEPARATION DISTANCE BETWEEN PLOTS 08/09, 65/66 & 74/75 INCREASED. PLOT 01/02 MOVED TO CREATE 12M DISTANCE TO NEIGHBOURING PROPERTY. AFFORDABLE UNITS REVISED AND TENURES CLARIFIED.	ED
CC	30.01.23	PATH TO SIDE OF PLOT 70 EXTENDED. HARD MARGIN WIDENED TO SIDE OF PLOT 72 AS PER VIS SPLAYS.	ED
BB	24.01.23	LAYOUT AMENDED IN LINE WITH HIGHWAY CONSULTANTS COMMENTS.	ED
AA	20.01.23	PROPOSED ACCESS ONTO HERMITAGE PARK AMENDED IN LINE WITH HIGHWAY CONSULTANTS DRAWINGS.	ED
Z	18.01.23	LAYOUT AMENDED IN LINE WITH HIGHWAY CONSULTANTS COMMENTS, SQA REVISED, PLOTS 03/19/20 SUBSTITUTED. VISITOR PARKING AMENDED. PLOT 69 HANDED.	ED
Y	03.01.23	LAYOUT AMENDED TO NORTHERN & SOUTHERN PORTIONS IN LINE WITH ARCHITECTS SKETCH DATED 03.01.23. PROW TRACKS ADDED. HIGHWAY LEADING TO PUMP STATION WIDENED.	JB
X	20.12.22	LAYOUT AMENDED TO NORTHERN & SOUTHERN PORTIONS IN LINE WITH ARCHITECTS SKETCH DATED 12.12.22. SCHEDULE OF ACCOMMODATION UPDATED. TYPE E AMENDED TO 3 BED TYPE.	JB
W	10.11.22	PLOT 37 GARAGE MOVED FORWARD BY 1.5M	ED
V	17.10.22	TREES REMOVED IN LINE WITH LANDSCAPE ARCHITECTS DRAWING. SWALE ADDED.	ED
U	12.09.22	TREE SURVEY INFORMATION REVISED SHOWING REMOVED TREES ALONG ACCESS ROAD. ATTENUATION BASIN UPDATED INLINE WITH DRAINAGE ENGINEERS DRAWING.	SM

SKETCH
subject to structural review
subject to accurate measured survey

project: PROPOSED RESIDENTIAL HERMITAGE PARK LEPTON, HUDDERSFIELD

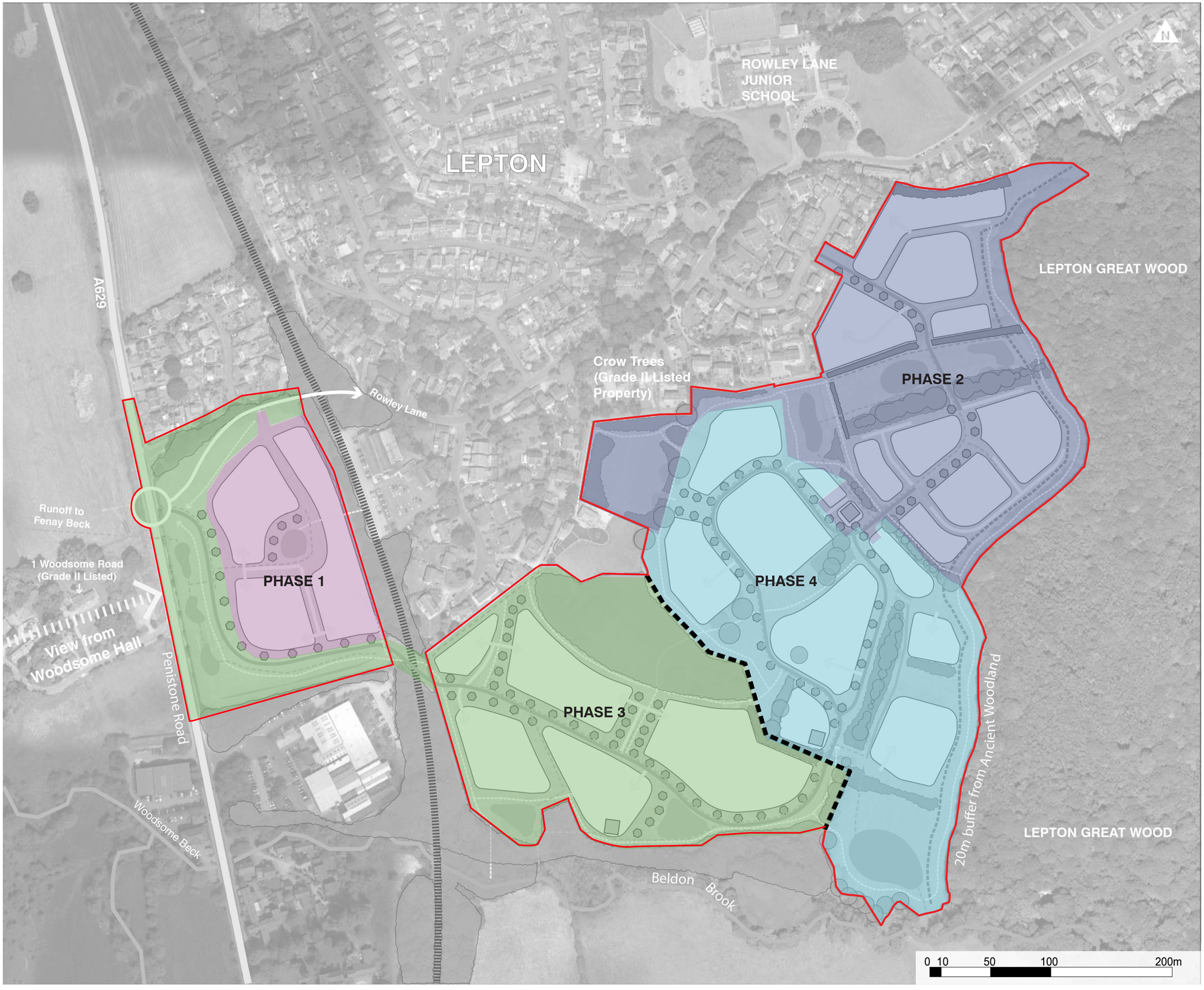
client: KCS DEVELOPMENTS

title: PROPOSED SITE LAYOUT

date: 17.06.20 | scale: 1:500 @A0 | drawn: SN

drawing number: 3284-0-002 DD | checked:

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NOTES

All dimensions to be verified on site. Do not scale this drawing. All discrepancies to be clarified with project Landscape Architect.

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Drawing for planning purpose only.

KEY

Combined Allocation Boundaries
Combined Net Area: 21.5ha

Phase 1

Phase 2

Phase 3

Phase 4

Area Measurements

HS2

Phase 1 (1.7ha)
- Developable Area 1.61Ha
- Plus infrastructure

Phase 3 (7.5ha)
(excluding the roundabout works)
- Developable Area 3.8Ha
- POS 2.7Ha
- Plus infrastructure

HS3

Phase 2 (6.1ha)
- Developable Area: 3.12Ha
- POS Area: 2.7Ha
- Plus infrastructure

Phase 4 (6.2ha)
- Developable Area: 3.2Ha
- POS Area: 2.6Ha
- Plus infrastructure

rev	details	date
D	Amendments made to notes, minor roads and area measurements Play area added to Phase 1	31 Aug 22

URBAN WILDERNESS

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client		
KCS Developments		
project		
Land off Hermitage Park, Lepton		
drawing title		
Phasing Plan		
drawing status		
Planning		
drawn by	*checked by*	*date*
BVL/CH	*TBR*	*01 Mar 21*
scale		*paper size*
1:2000		*A2*
job/dwg no.		*rev.*
338-UW-P-007		*D*

N

NOTES:

1. THIS DRAWING IS BASED ON UPON:
   - NIEMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002 REV DD;
   - HOLDEN SURVEYS LTD SITE PLAN PPL_09_LEPTON;
   - SITE SURVEYING SERVICES TOPOGRAPHICAL SURVEY SSS-4806 LEPTON-A;
   - LAND REGISTRY TITLE PLAN WYK84238;
   - LAND REGISTRY TITLE PLAN WYK76804;
   - KIRKLEES COUNCIL DRAINAGE RECORDS; AND,
   - ORDNANCE SURVEY MAPS.
2. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE FORTEM FLOOD RISK ASSESSMENT R002-V8.

KEY:

- DEVELOPMENT BOUNDARY
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PUBLIC FOUL SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING OPEN WATERCOURSE - BELDON BROOK (ORDINARY WATERCOURSE)
- EXISTING CULVERTED WATERCOURSE
- EXISTING OPEN WATERCOURSE (ORDINARY WATERCOURSE)
- PROPOSED SURFACE WATER HIGHWAY DRAIN
- PROPOSED SURFACE WATER SEWER / MANHOLE
- PROPOSED FOUL WATER SEWER / MANHOLE
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED COMBINED WATER MANHOLE
- PROPOSED EASEMENT (SEWER NETWORK LOCATED OUTSIDE ADOPTABLE HIGHWAY)
- BOUNDARY CUT-OFF SWALE

EXISTING 225Ø
EXISTING 300Ø
EXISTING 150Ø
EXISTING 375Ø
EXISTING 450Ø
EXISTING 100Ø
ROWLEY LANE
HERMITAGE PARK
UNNAMED WATERCOURSE
PROPOSED FOUL WATER DISCHARGE TO EXISTING 300Ø COMBINED WATER SEWER IN ROWLEY LANE
FLOW CONTROL MANHOLE 1
PUMPED FOUL WATER FLOWS DISCHARGE TO ADOPTABLE GRAVITY SYSTEM
SURFACE WATER ATTENUATION BASIN 1
SURFACE WATER ATTENUATION BASIN 2
PROPOSED FOUL WATER PUMPING STATION
FLOW CONTROL MANHOLE 2 RESTRICTED IN ACCORDANCE WITH FORTEM FRA
BELDON BROOK
SURFACE WATER TO DISCHARGE TO BELDON BROOK

Rev	Date	Amendments	By
F	22.02.23	Updated to suit revised site layout.	RD
E	07.10.22	Updated in accordance with Kirklees Council consultation.	ML
D	06.09.22	Updated to suit revised layout. road contours added.	ML
C	29.04.22	Updated to suit revised layout.	BS
B	24.03.22	Updated to suit revised layout.	BS
A	30.03.21	Eastern boundary bund added and minor updates.	BS

Drawing Status.
PLANNING

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Client
KCS DEVELOPMENT LTD

Project
ROWLEY LANE, LEPTON

Drawing Title.
PROPOSED DRAINAGE STRATEGY

Drawn: BS
Checked: ADC
Scale: 1:1000 @ A1
Date: JAN 2021

Drawing No. 1093 - 006
Rev. F

C:\Users\matth\FORTEM\Andrew Calvert - FORTEM Projects\1093 - Rowley Lane, Lepton KCS\2. Drawings\1. FORTEM\2. Drawings\1. Current\1093 - 006 Proposed Drainage Strategy.dwg 22 Feb, 2023 - 9:31am

N

NOTES:

1. THIS DRAWING IS BASED ON UPON NEIMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002 REV DD (WITH FORTEM AMENDMENTS), TURNBULL SURVEYING TOPOGRAPHICAL SURVEY S1158, YORKSHIRE WATER SEWER RECORDS AND ORDINANCE SURVEY MAPS.
2. THIS DRAWING PROVIDES AN OVERVIEW OF THE DEVELOPMENT DRAINAGE NETWORK AND PROPOSED TOPOGRAPHY IN RELATION TO EXCEEDANCE EVENTS ARISING FROM EXTREME RAINFALL.

KEY:

- PROPOSED SURFACE WATER HIGHWAY DRAIN
- PROPOSED SURFACE WATER SEWER / MANHOLE
- PROPOSED FOUL WATER SEWER / MANHOLE
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED COMBINED WATER MANHOLE
- BOUNDARY CUT-OFF SWALE
- FLOW ROUTE MAPPING
- BOUNDARY RETAINING WALL

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE DOWNSTREAM OF THE MANHOLE ADJACENT TO PLOT 033, WATER WILL OVERTOP THE GULLY AT THE SITE ENTRANCE AND BE ROUTED DOWN HERMITAGE PARK ROAD.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE WITHIN THE HIGHWAY LOOP, SURFACE WATER FLOWS WILL OVERFLOW ONTO THE HIGHWAY.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE DOWNSTREAM OF THE MANHOLE ADJACENT TO PLOT 024, WATER WILL OVERFLOW ONTO THE HIGHWAY.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE UPSTREAM OF THE FLOW CONTROL MANHOLE, WATER WILL OVERTOP THE MANHOLE AND OVERLAND FLOW TO BASIN 2.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE UPSTREAM OF THE P.O.S., FLOWS WILL BE ROUTED BETWEEN PLOTS 36 & 37 TO THE P.O.S. AND OVERLAND FLOW TO BASIN 2

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE IN THE SURFACE WATER SYSTEM, WATER WILL OVERTOP THE GULLY AT THE END OF ROAD, TO HE P.O.S. AND OVERLAND FLOW TO BASIN 2.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE UPSTREAM OF THE FLOW CONTROL CHAMBER, WATER WILL OVERTOP THE DOUBLE GULLY AT THE LOW POINT IN ROAD 7 WITH FLOWS ROUTED ALONG THE PRIVATE ROAD TO THE WATERCOURSE VIA OVERLAND FLOWS.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE DOWNSTREAM OF THE FLOW CONTROL CHAMBER, WATER WILL OVERTOP THE GULLY AT THE END OF THE TURNING HEAD AND WILL ENTER THE WATERCOURSE VIA OVERLAND FLOWS.

EXCEEDANCE FLOW ROUTING NOTES:

THE PROPOSED SURFACE WATER DRAINAGE SYSTEM HAS BEEN DESIGNED TO ENSURE NO FLOODING UP TO AND INCLUDING 1 IN 100 YEAR + 30% CLIMATE CHANGE, WITH 10% ALLOWANCE FOR URBAN CREEP.

BEYOND THIS EXTREME EVENT, ANY EXCESS WATER WILL OVERTOP BASIN 2 WITH OVERLAND FLOWS ONTO THE ADJACENT FIELD, MIMICKING EXISTING FLOWS.

THIS WOULD POSE NO INCREASED RISK TO THE EXISTING OR PROPOSED DWELLINGS.

Rev	Date	Amendments	By
D	22.02.23	Updated to suit revised layout	ML
C	24.11.22	Updated to suit Kirklees Council requirements.	ML
B	07.10.22	Updated in accordance with Kirklees Council consultation.	ML
A	06.09.22	Updated to suit revised layout, road contours added.	JOH

Drawing Status.
PLANNING

FORTEM

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Client
KCS DEVELOPMENT LTD

Project
ROWLEY LANE, LEPTON

Drawing Title.
EXCEEDANCE FLOW ROUTING

Drawn: JOH
Checked: AC
Scale: 1:1000 @ A1
Date: APR 2022

Drawing No.
1093 - 009

Rev.
D

C:\Users\matth\FORTEM\Andrew Calvert - FORTEM Projects\1093 - Rowley Lane, Lepton KCS\2. Drawings\1. FORTEM\2. Drawings\1. Current\1093 - 009 Exceedance Flow Routing.dwg 22 Feb, 2023 - 12:02pm

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	102.351	0.351	13.3	418.2	O K
30 min Summer	102.469	0.469	13.3	559.0	O K
60 min Summer	102.594	0.594	13.3	708.1	O K
120 min Summer	102.718	0.718	13.3	856.2	O K
180 min Summer	102.782	0.782	13.3	932.0	O K
240 min Summer	102.818	0.818	13.3	974.8	O K
360 min Summer	102.856	0.856	13.3	1019.8	O K
480 min Summer	102.871	0.871	13.3	1037.8	O K
600 min Summer	102.872	0.872	13.3	1039.6	O K
720 min Summer	102.868	0.868	13.3	1034.6	O K
960 min Summer	102.856	0.856	13.3	1020.6	O K
1440 min Summer	102.822	0.822	13.3	979.9	O K
2160 min Summer	102.760	0.760	13.3	906.1	O K
2880 min Summer	102.691	0.691	13.3	823.3	O K
4320 min Summer	102.550	0.550	13.3	655.4	O K
5760 min Summer	102.435	0.435	13.3	519.0	O K
7200 min Summer	102.345	0.345	13.3	410.7	O K
8640 min Summer	102.278	0.278	13.3	331.0	O K
10080 min Summer	102.230	0.230	13.1	274.3	O K
15 min Winter	102.394	0.394	13.3	469.6	O K
30 min Winter	102.527	0.527	13.3	628.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.731	0.0	403.8	26
30 min Summer	77.804	0.0	547.1	41
60 min Summer	49.937	0.0	728.9	70
120 min Summer	30.956	0.0	905.2	128
180 min Summer	23.058	0.0	1011.8	188
240 min Summer	18.577	0.0	1086.9	246
360 min Summer	13.656	0.0	1198.1	364
480 min Summer	10.974	0.0	1282.9	482
600 min Summer	9.254	0.0	1351.2	598
720 min Summer	8.046	0.0	1408.5	648
960 min Summer	6.447	0.0	1500.9	768
1440 min Summer	4.709	0.0	1629.3	1030
2160 min Summer	3.432	0.0	1828.9	1452
2880 min Summer	2.739	0.0	1945.0	1856
4320 min Summer	1.989	0.0	2113.6	2604
5760 min Summer	1.583	0.0	2257.0	3344
7200 min Summer	1.325	0.0	2360.5	4040
8640 min Summer	1.147	0.0	2449.2	4680
10080 min Summer	1.015	0.0	2523.3	5352
15 min Winter	115.731	0.0	454.0	26
30 min Winter	77.804	0.0	613.6	40

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	102.669	0.669	13.3	797.0	O K
120 min Winter	102.810	0.810	13.3	965.0	O K
180 min Winter	102.882	0.882	13.3	1051.7	O K
240 min Winter	102.925	0.925	13.3	1102.0	O K
360 min Winter	102.971	0.971	13.3	1157.8	O K
480 min Winter	102.993	0.993	13.3	1183.7	O K
600 min Winter	103.000	1.000	13.3	1191.8	O K
720 min Winter	102.997	0.997	13.3	1189.0	O K
960 min Winter	102.977	0.977	13.3	1165.0	O K
1440 min Winter	102.933	0.933	13.3	1111.9	O K
2160 min Winter	102.845	0.845	13.3	1007.1	O K
2880 min Winter	102.747	0.747	13.3	890.3	O K
4320 min Winter	102.526	0.526	13.3	627.3	O K
5760 min Winter	102.359	0.359	13.3	428.1	O K
7200 min Winter	102.247	0.247	13.2	294.8	O K
8640 min Winter	102.185	0.185	12.7	220.6	O K
10080 min Winter	102.163	0.163	11.6	194.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	49.937	0.0	817.3	70
120 min Winter	30.956	0.0	1014.4	126
180 min Winter	23.058	0.0	1133.5	184
240 min Winter	18.577	0.0	1217.5	242
360 min Winter	13.656	0.0	1341.6	356
480 min Winter	10.974	0.0	1436.0	470
600 min Winter	9.254	0.0	1511.9	580
720 min Winter	8.046	0.0	1575.2	688
960 min Winter	6.447	0.0	1676.2	872
1440 min Winter	4.709	0.0	1808.3	1100
2160 min Winter	3.432	0.0	2048.9	1564
2880 min Winter	2.739	0.0	2178.8	2024
4320 min Winter	1.989	0.0	2369.4	2776
5760 min Winter	1.583	0.0	2528.5	3464
7200 min Winter	1.325	0.0	2644.6	4104
8640 min Winter	1.147	0.0	2744.5	4600
10080 min Winter	1.015	0.0	2829.0	5248

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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)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.985

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.662	4	8	0.662	8	12	0.662

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Model Details

Storage is Online Cover Level (m) 104.000

Tank or Pond Structure

Invert Level (m) 102.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1192.0	1.000	1192.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0166-1330-1000-1330
Design Head (m)	1.000
Design Flow (l/s)	13.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	166
Invert Level (m)	102.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	13.3
Flush-Flo™	0.315	13.3
Kick-Flo®	0.694	11.2
Mean Flow over Head Range	-	11.3

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	5.9	1.200	14.5	3.000	22.4	7.000	33.7
0.200	12.8	1.400	15.6	3.500	24.2	7.500	34.9
0.300	13.3	1.600	16.6	4.000	25.8	8.000	36.0
0.400	13.2	1.800	17.6	4.500	27.3	8.500	37.0
0.500	12.9	2.000	18.5	5.000	28.7	9.000	38.1
0.600	12.4	2.200	19.3	5.500	30.0	9.500	39.1
0.800	12.0	2.400	20.2	6.000	31.3		
1.000	13.3	2.600	20.9	6.500	32.5		

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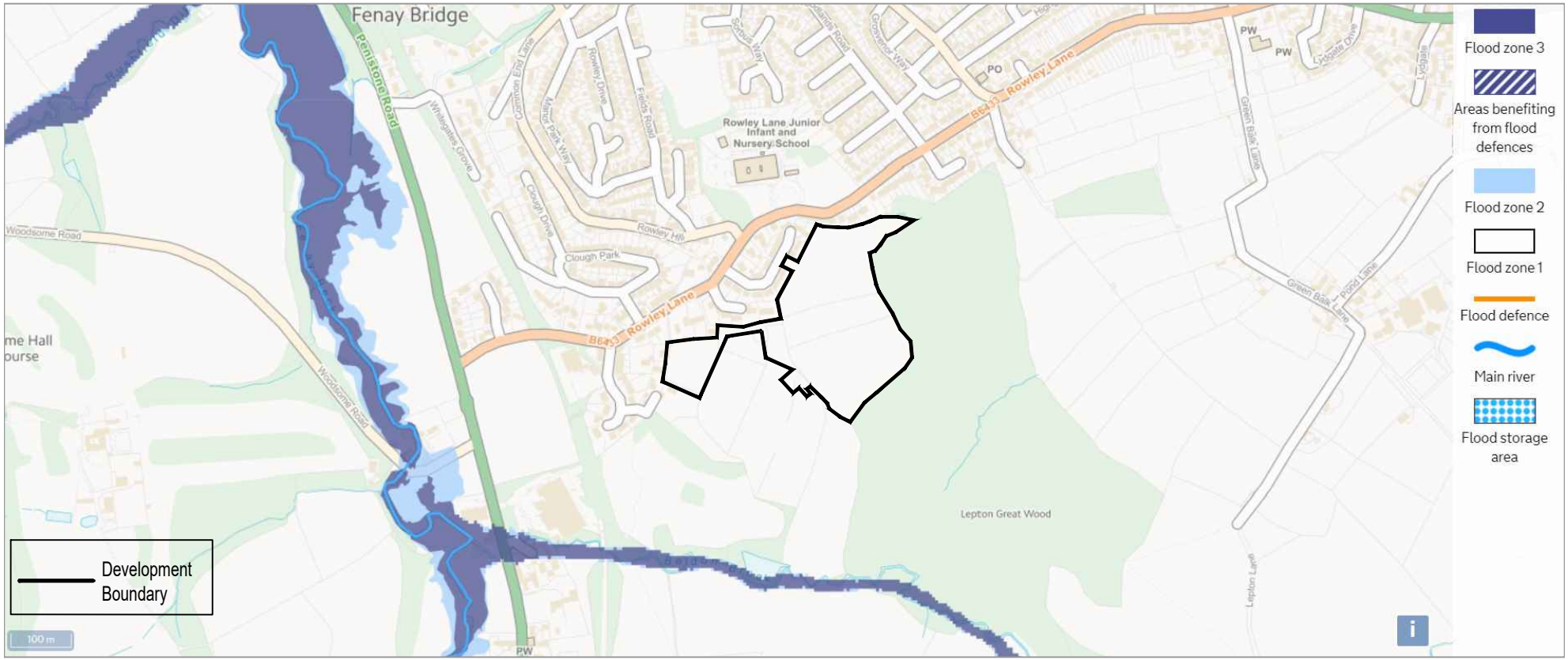
Appendix C **Flood Risk Mapping**

EA Flood Risk from Rivers and Sea

EA Map Risk of Flooding from Surface Water

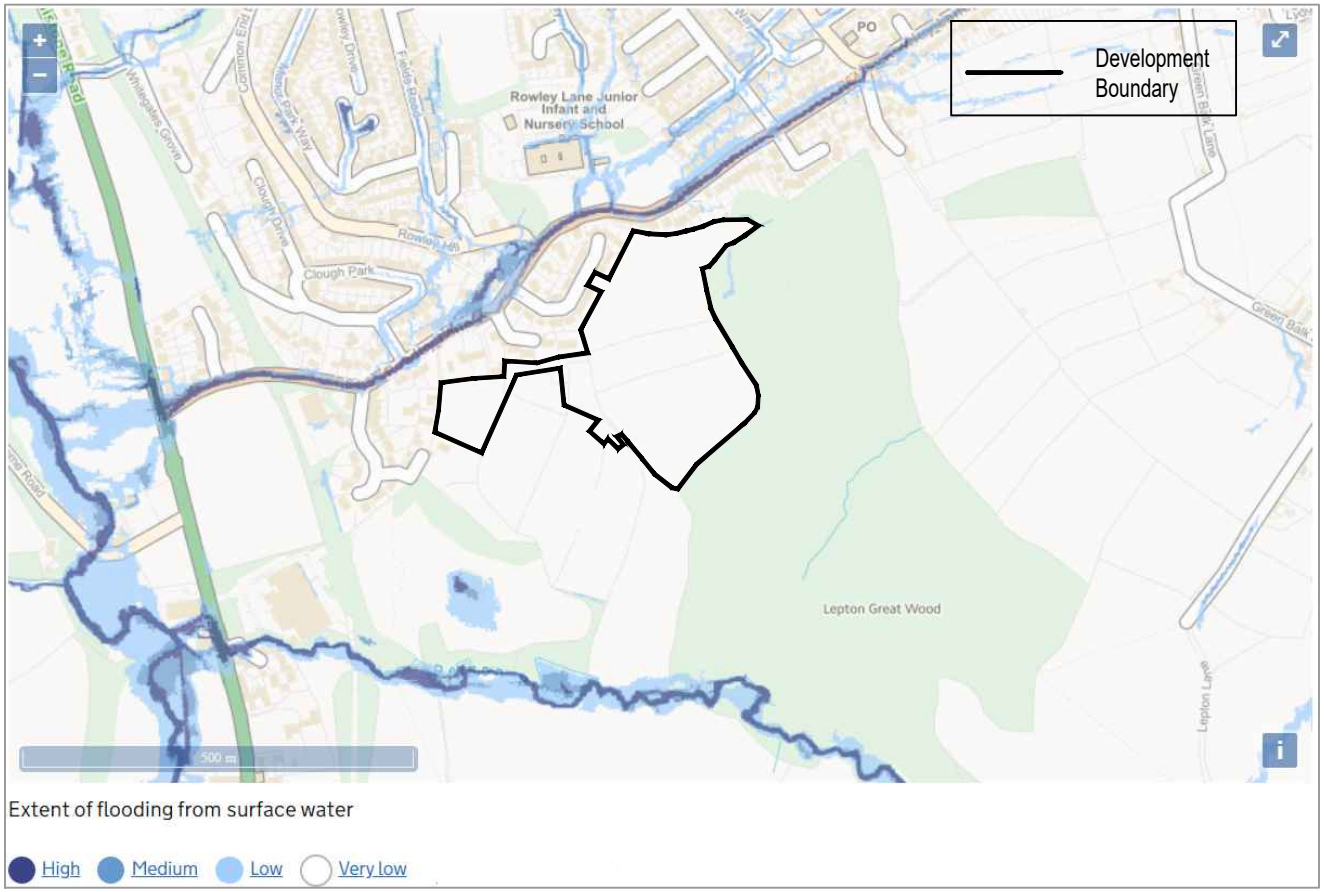
EA Map Risk of Flooding from Reservoir

FORTEM



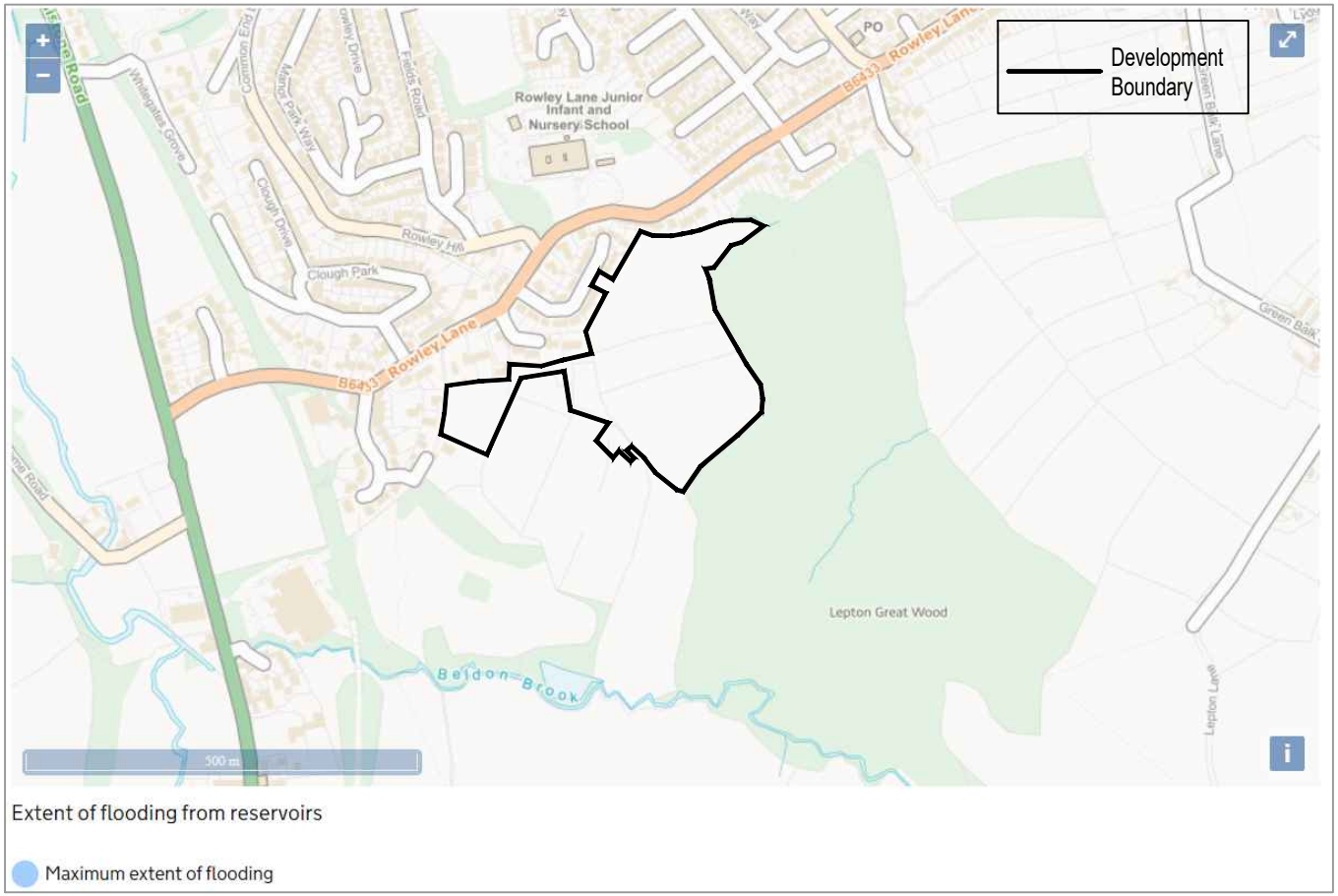
ROWLEY LANE, LEPTON
EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
FLOOD RISK FROM RIVERS AND SEA
EXTRACT TAKEN 09.11.2020 : NTS

FORTEM



ROWLEY LANE, LEPTON
EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
RISK FROM FLOODING FROM SURFACE WATER
EXTRACT TAKEN 09.11.2020 : NTS

FORTEM



ROWLEY LANE, LEPTON
EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
RISK FROM FLOODING FROM RESERVOIR
EXTRACT TAKEN 09.11.2020 : NTS

Appendix D **Consultation**

Kirklees Council LLFA Correspondence

Beth Scully

From: Paul Farndale <Paul.Farndale@kirklees.gov.uk>
Sent: 15 February 2021 09:51
To: Andrew Calvert <andrew.calvert@fortemconsultants.co.uk>
Cc: Customer Enquiries <Customer.Enquiries@kirklees.gov.uk>
Subject: RE: 210206KCC_Rowley Lane, Lepton

Hello Andy,

No flooding incidents recorded but this is unlikely to be reported for undeveloped land. No surface water flood risk shown on relevant mapping.

Please note the minor watercourse in the north east corner that has a trash screen on it prior to being culverted. Please run a total blockage scenario in a flood risk assessment to show where water would go and see what is affected on site.

We show the culvert then going north but old plans suggest the northern boundary for the site might be the original line. You will need to verify this.

Lastly plans right up to 1970 show a wall at the southern border. Please check.

Happy with 13.3l/s to Beldon Brook. Using a 5l/s/ha for a site that measures around 5.3ha @ 50% hardstanding is pretty much the same figure. BGS shows severe constraints for infiltration.

As with any application you need to examine possibilities for water treatment associated with SUDS conduits that can be adopted.

You will need to look at any other allocations around with a view to having a drainage strategy that incorporates master planning. Please talk to the LPA on this matter.

Any queries please give me a call.

Kind regards,

Paul Farndale
Kirklees LLFA