

ADEPT

CIVIL AND STRUCTURAL CONSULTING ENGINEERS



Flood Risk Assessment & Drainage Strategy Blue Hills Estate Farm, Birkenshaw

Contents

1.0	Introduction.....	4
2.0	Limitations of Report	4
3.0	Site Description	5
4.0	Drainage and Existing Watercourse Error! Bookmark not defined.	
5.0	Proposed Development.....	7
6.0	Flood Risk Sources and Extents.....	8
7.0	Conclusions.....	11





Client: Vistry Partnerships Yorkshire
Project Name: Blue Hills Estate Farm, Birkenshaw
Report Title: Flood Risk Assessment & Drainage Strategy
Document ref: 08.21011-ACE-00-ZZ-RP-C-1000
Date: March 2022

Revision	Suitability	Date	Author	Checked	Approved	Description
P1	S2	18.03.22	NP	RP	RP	Initial Issue
P2	S3	21.03.22	NP	RP	RP	Revised to suit late Architectural Site Plan
P3	S3	09.05.22	NP	RP	RP	Updated to suit LLFA comments
P4	S3	17.05.22	NP	JS	JS	Foul Discharge rated added
P5	S3	06.07.22	NP	RP	RP	Updated to suit LLFA comments
P6	S3	10.08.22	NP	JS	JS	Updated to suit YW Comments- Foul Flow rate

Registered Office

Adept Consulting Engineers Ltd.
1912 Mill, Sunny Bank Mills,
Leeds, LS28 5UJ
Tel: 0113 239 4518

Manchester Office

Adept Consulting Engineers Ltd.
Sevendale House, Dale Street,
Manchester, M1 1JB
Tel: 0161 672 7383

London Office

Adept Consulting Engineers Ltd.
85 Tottenham Court Road,
London W1T 4TQ
Tel: 020 3287 6677

1.0 Introduction

Adept Consulting Engineers Ltd was commissioned to provide a Flood Risk Assessment (FRA) and Drainage Strategy (DS) for VISTRY in support of a full planning application for a RESIDENTIAL development within Birkenshaw, West Yorkshire.

The site is identified on the appended location plan within Appendix A. The Site is effectively split into 2 phases noted as Phase 1 & 2 and delineated on the appended Site Layout Plan within Appendix A

This FRA and DS is for both Phase 1 & Phase 2 of the application site.

2.0 Limitations of Report

Preliminary calculations and a concept drainage design have been undertaken as part of this study. The preliminary calculations and concept design are based on the information and assumptions covered in this report at the time of preparation and provide a concept design for points of connection and general design parameters only.

The report is based on the interpretation and assessment of data provided by third parties. Adept Consulting Engineers Limited cannot guarantee the reliability of the third party information obtained. The conclusions and findings of the report may change if the third-party data is subsequently amended or updated.

3.0 Site Description

The site is located off Whitehall Road West, Birkenshaw. The nearest approximate postcode is BD11 2DU and the NGR SE198277.

Site description	
Gross Site Area – Phase 1	2.61 Ha
Gross Site Area – Phase 2	0.56 Ha
Gross Site Area	3.20 Ha
Developable Site Area – Phase 1	1.94 Ha
Developable Site Area – Phase 2	0.27 Ha
Developable Site Area	2.21 Ha
Existing Impermeable Area	N/A
Land use	Greenfield
Topography	Appendix A – Drg Ref: sss-8251 - Rev A - Topo Survey The Application Site generally falls from North- to South with existing levels ranging from approximately 172m AoD to 152m AOD An extensive earthworks cut/fill operation is proposed to create the various plateaus and corridors required for the units and associated infrastructure.

4.0 Hydrology, Hydrogeology and Geology

Watercourses and Waterbodies

There are no known watercourse or water bodies within a practical connection distance.

Ground Water

Groundwater was encountered at depths ranging from 1.2m to 2.1m within 3 sample locations. The investigation was done in November 2020

Sewerage

There are no known surface water sewers crossing within or close to the development. An extract from Yorkshire Waters (YW) sewer network is appended within Appendix A

The nearest Foul Water Sewer is advised to be 225mm in diameter and is to the west of the development with the head of run located within Whitehall Road West, just before the existing roundabout.

There is an existing Surface Water Highway Drain running west within Whitehall Road West

Geology

The Ian Farmer Associates ground investigation report March 2021 has typically encountered topsoil of approximately 0.2m to 0.4m thick on Made ground ranging from 1.4m to 2.0m deep to the northern portion of the site and 0.3m to 0.9m to the southern portion of the site. Underlying the Made Ground, the investigation states a sandy gravelly Clay.

Bedrock was encountered within rotary boreholes at depths ranging from 2.5m to 6.0m

5.0 Proposed Development

Development Outline

The proposed development entails 91 Residential units as indicated on the appended site layout drawing (4035.20.105K - Site Plan).

Proposed Surface Water Drainage Strategy

The discharge rate for the site has been based on the following criteria. In conjunction with Kirkless Council LLFA guidance, we have used the IH124 HR Wallingford Greenfield Runoff Estimation generating the following criteria (all calculations are appended).

Developable Site Area	2.21 ha
Total impermeable area	1.441 ha
Peak discharge from site	5.0 l/s
Maximum attenuation volume required to accommodate the peak 1 in 100 year + 30% CC storm	1155m³

A drainage strategy drawing is appended, based upon these figures.

In line with discussion with the LLFA, 5l/s is applied to the surface water discharge for the Applicant Site. This would be controlled via a flow control unit, prior to discharge to the existing Surface Water Highway drainage infrastructure. The storage required to accommodate the M100 + 30% climate change factor is 1155m³

The critical storm is the 15 min and the 1440 min winter.

SuDS Assessment and Water Quality

The use of soakaways has been considered and infiltration is deemed unfeasible based on preliminary findings of the existing geology and topography of the site.

Discharge to a watercourse is not feasible as there are no, known, watercourses nearby.

Discharge to the nearest surface water system (Highway drain) is feasible and shown on the drainage strategy within Appendix B

Foul Drainage

Foul drainage will be discharged to the Foul Sewer currently running to the east of the Application Site in accordance and in agreement with Yorkshire Water. Due to the existing levels of infrastructure, there will need to be an on-site pumping station to facilitate the connection. The maximum discharge of 4.75 l/s is anticipated as agreed with Yorkshire Water.

Land Drainage

Due to the expected topography of the proposed development, a land drainage scheme will be proposed across the development picking up the northern boundary and rear of retaining walls. There is an existing land drainage discharge point along the southern boundary of the site. It is anticipated that this will be a suitable location for an unrestricted discharge of the land drainage.

6.0 Flood Risk Sources and Extents

Summary

A summary of the sources and level of flood risk (negligible, low, medium or high) is given in Table 1 below.

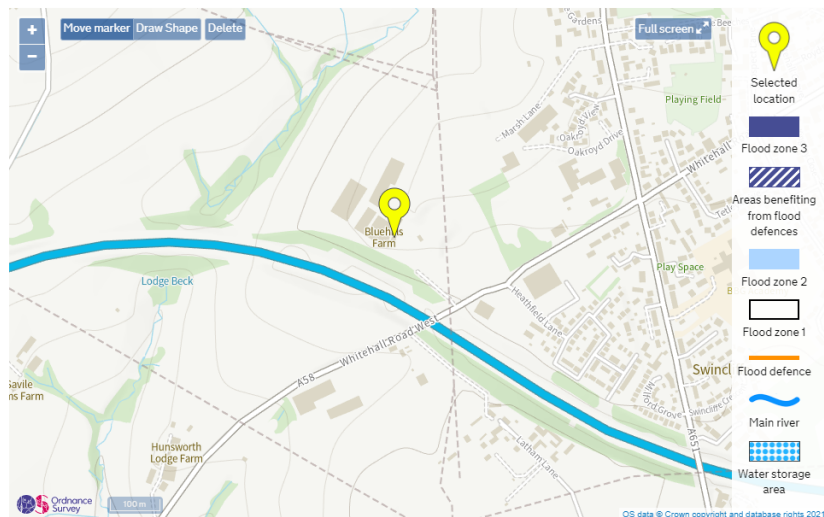
Table 1. Summary of the Sources and Extent of Flood Risk	
Source	Risk Level
Fluvial	Low
Tidal / Coastal	Low
Surface Water / Pluvial	Low
Groundwater	Low
Surcharged Sewers	Low
Other Man-Made Sources	Low

The sources and level of flood risk are demonstrated below.

Fluvial

Shown to be in Flood Zone 1.

An extract from the gov.uk website is shown below,



The site is not at risk of Fluvial flooding

Tidal

The site is not at risk of tidal flooding.

Surface Water / Pluvial

Surface water flood risk mapping from the gov.uk website shows that the majority of the site is at low risk with certain areas that have medium to high risk.



Groundwater Flooding

Further investigation is being carried out to ascertain the route and extents of an existing land drain found along the southern boundary.

Surcharged Sewers

No known sewers within the site boundary. Maintenance for the sewer and Highway drain offsite will remain with Yorkshire Water and the Local Authority (Highways), it is not deemed to pose any significant flood risk to the application site.

Other Man Made Sources

There are no man-made sources that we believe would be present a flood risk.

Climate Change

Based on a typical lifespan for this type of development of 100 years, the contingency allowance for climate change has been based on 40% climate change.

Design Consideration and Flood Mitigation

To further mitigate against surface run off flooding in the event of exceedance of failure, consideration should be made for the proposed development levels to have designed falls away from thresholds and 150mm steps.

7.0 Conclusions

Existing Drainage

No existing sewers crossing the application site.

Proposed Drainage Strategy and SuDS Hierarchy

The ground topography and geology will not support the disposal of surface water by infiltration.

Surface water will discharge to the Highway drain located to the south west corner of the site at a peak rate of **5.0/s**

The proposed drainage strategy complies with the National Planning Policy Framework (NPPF) and will be put up for adoption with the Local Water Authority (Yorkshire Water).

Flood Risk

The site is not at risk of flooding.

Recommendations for further work/investigation and obtaining agreement

- Consent Required from the Local Authority (Highways) for the connection and discharge of surface water drainage.
- Approval and / or consent required for the connection of the Foul Water system, and, adoption of the Surface Water and Foul Water systems.
- Any land drains that are exposed during the cut and fill are to be traced and confirmed redudamt. Any drains still live are to be diverted through the site into the existing outall

Appendix A

- Location Plan
- Site layout
- Topographical Survey
- Water Authority (Yorkshire Water) Records



DESIGN REVIEW

Residual hazards:



Key

Blue Hill Farm,
Whitehall Road West,
Birkenshaw,
BD11 2DU

Easting : 419840
Northing : 427765

Project Number	Originator	Volume	Level	Type	Role	Drq.No.	Rev.
09.21011-ACE-00-XX-DR-C-3001							P1

Revisions:		
Rev A	19.01.2022	NG/DRP
Plots 16-21 swapped.		
Electrical sub-station & car parking introduced.		
Rev B	02.02.2022	NG/DRP
Attenuation tank indicated.		
Rev C	08.02.2021	NG/DRP
Bicycle sheds & visitors parking indicated.		
Rev D	14.02.2022	NG/DRP
Additional fencing added. Visitors parking to POS area added.		
Rev E	18.02.2022	NG/DRP
Phasing boundary amended.		
Rev F	28.02.2022	NG/DRP
Layout updated to accommodate the OH powerline easement.		
Rev G	03.03.2022	NG/DRP
Phase 2 units added.		
Rev H	04.03.2022	NG/DRP
Layout updated following Clients comments.		
Rev J	14.03.2022	NG/DRP
New PROW route introduced.		
Rev K	15.03.2022	NG/DRP
Plot 13 relocated, site access amended, planning red line boundary updated, plots renumbered.		



Key		

Notes

Layout dependant upon confirmation of legal site boundary, agreement of tree removal with the council, Statutory Services Information.

Drainage strategy subject to further detailed design, subject to Phase I & II Geo-technical Survey and Drainage Assessment.

Boundary Treatments, Finish floor levels & Retainment structures subject to further detailed design.

Aspect distances subject to agreement with local authority approval.

Levels, batters and retainment shown indicatively, subject to coordinated design with structural engineer and specialist retaining contractor.

Location and provision of land drains behind retaining structure and to patio areas subject to drainage engineers design and specification.

Layout based on topographical survey by Survey Association drw no sss-8779-Blue Hill Farm

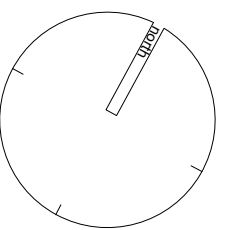
Any change in external levels greater than 0.6m to have edge protection.

Level access to front and back of houses to be provided.

Existing services and street furniture to be identified by main contractor and capped off/grubbed up/diverted as required.

Phase 1 of development		Phase 2 of development							
Gross site area phase 1		Gross site area phase 2							
Hectares	2.61 ha	Hectares	0.59 ha						
Acres	6.45 acres	Acres	1.46 acres						
Net developable area phase 1		Net developable area phase 2							
Hectares	1.94 ha	Hectares	0.27ha						
Acres	4.79 acres	Acres	0.66 acres						
Phase 1:									
House Type	Type	Bedrooms	Persons	Amount	%	Sq.ft	Sq. m	Total sq. ft	Total sq. m
CARTWRIGHT	Terrace	2	3	7	9.1	768.80 ft²	71.43m²	5381.60 ft²	500.01m²
ELMSIE	Semi-det	3	4	26	33.7	933.90 ft²	86.77m²	24281.40 ft²	2256.02m²
MOUNTFORD	Detached	3	4	6	7.8	970.60 ft²	90.18m²	5823.60 ft²	541.08m²
BLOOMFIELD	Terrace	3	6	19	24.7	1170.46 ft²	108.75m²	22238.74 ft²	2066.25m²
GOODRIDGE	Detached	4	5	8	10.4	1111.76 ft²	103.30m²	8894.08 ft²	826.40m²
MYLNE	Detached	4	6	11	14.3	1136.00 ft²	105.58m²	12496.00 ft²	1161.38m²
Total units:		77	100%	Total area:				79115.42ft²	7351.14m²
Phase 2:									
House Type	Type	Bedrooms	Persons	Amount	%	Sq.ft	Sq. m	Total sq. ft	Total sq. m
TYPE 1	Terrace	2	3	3	21.4	768.80 ft²	71.43m²	2306.40 ft²	214.29m²
TYPE 2	Semi-det	3	4	4	28.5	933.90 ft²	86.77m²	3735.60 ft²	347.08m²
TYPE 3	Detached	3	4	1	7.3	970.60 ft²	90.18m²	970.60 ft²	90.18m²
TYPE 4	Terrace	3	6	4	28.5	1170.46 ft²	108.75m²	4681.84 ft²	435.00m²
TYPE 5	Detached	4	5	2	14.3	1111.76 ft²	103.30m²	2223.52 ft²	206.60m²
Total units:		14	100%	Total area:				13917.96ft²	1293.16m²

Gross site area	
Hectares	3.22 ha
Acres	7.95 acres
Net developable area	
Hectares	2.50 ha
Acres	6.17 acres
Density	
Dwellings/ ha	36.40
Dwellings/ acre	14.75
Sq. ft/ acre	15078
Road lengths	
General Road	501m
Shared surface	77m
Private drive	61m

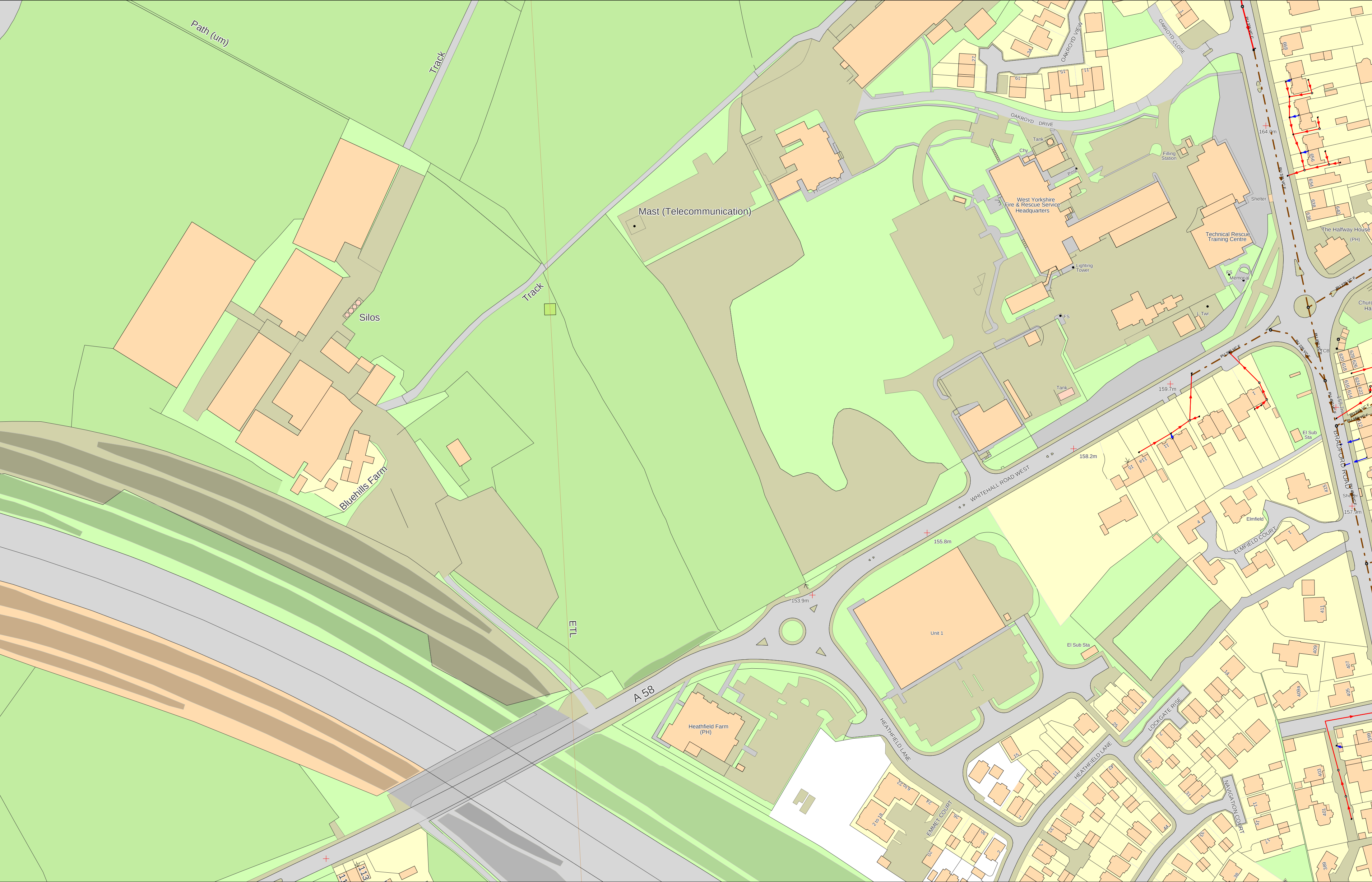


Vistry Partnerships

Drawing Status	
☐ preliminary	☒ planning
☐ information	☐ tender
☐ comment	☐ construction
☐ approval	☐ record/as built
Scale	
1:500 @ A1	
Date	
Jan. 2022	
Drawn/Checked	
NG/DRP	
Dwg No	
4035.20.105K	

Acanthus WSM Architects

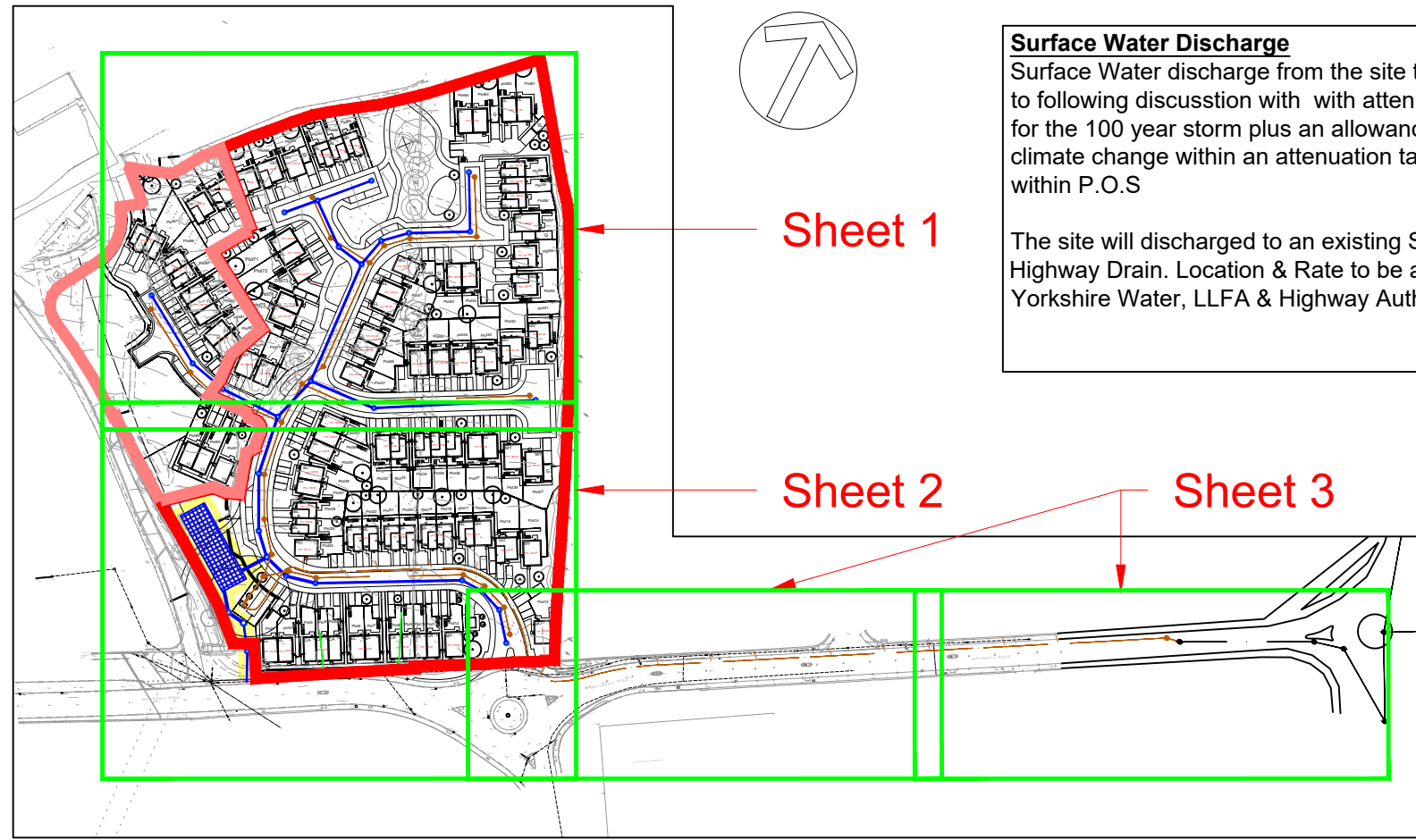
Site Layout,
Blue Hills Estate Farm,
Birkenshaw



419938 : 427722		Map Name : SE1927NE	Title	Partial Key	
		Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : G Mullaney Contact Tel :	Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS	
			(Ord) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.	
				Date Req : 20/12/2021, 16:28:23	Date Gen : 20/12/2021, 16:28:32
				Source : Sewer Network Enquiry	

Appendix B

- Drainage Strategy
- Land Drainage Strategy
- Overland Flow Routing
- Drainage Calculations



Site Location Plan
Scale 1:2500

Surface Water Discharge
Surface Water discharge from the site to be restricted to following discussion with with attenuation provided for the 100 year storm plus an allowance of 30% for climate change within an attenuation tank positioned within P.O.S

The site will be discharged to an existing Surface Water Highway Drain. Location & Rate to be agreed with Yorkshire Water, LLFA & Highway Authority

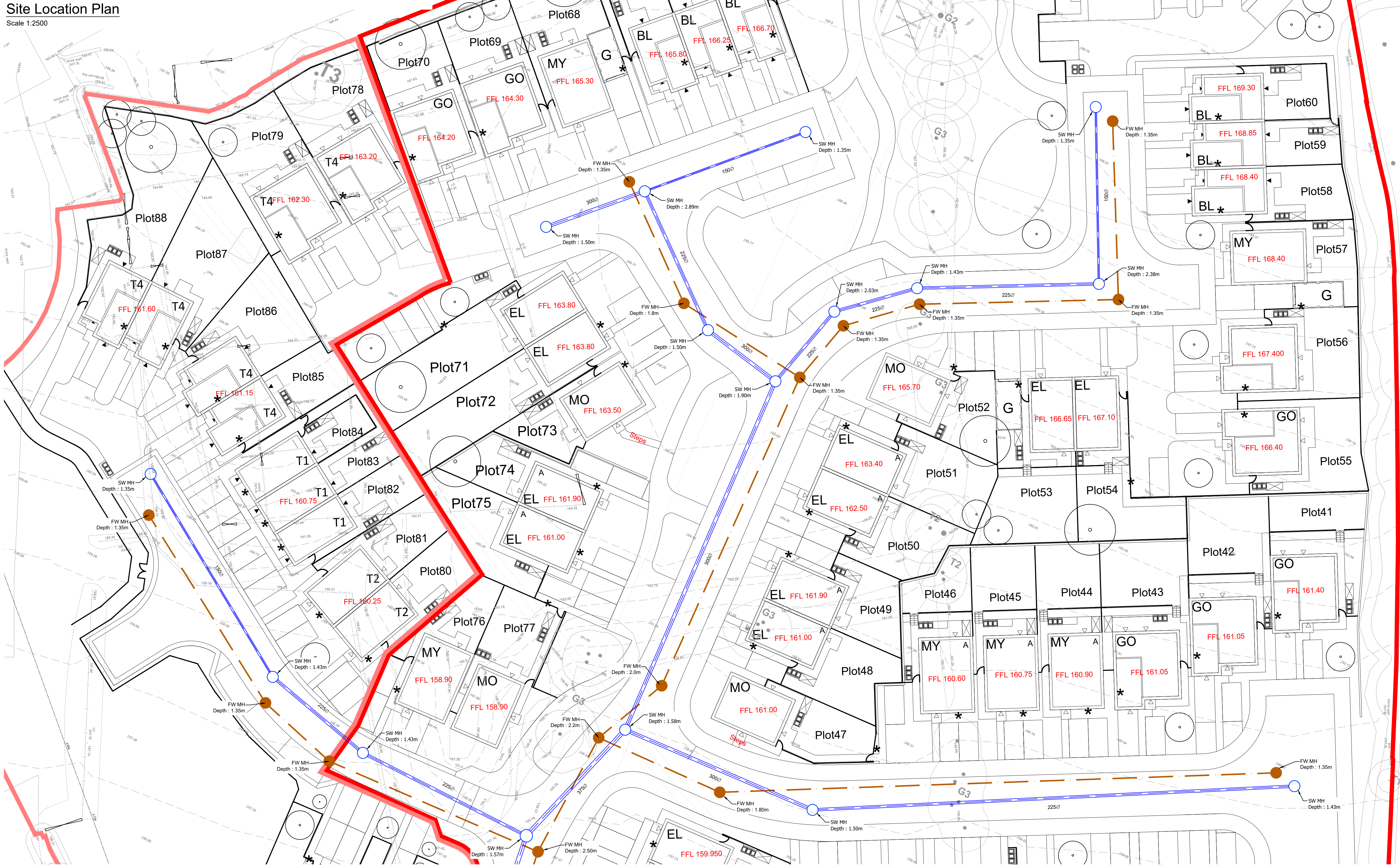
Surface Water Assumptions
Developable Area: 2.21 ha
Discharge Rate: 5.0 l/s

Total Proposed Imp. Area: 1.441 ha
Storage Solution: 32m x 10m x 3.8m PCC structure

The system will be put up for adoption with the Local Adopting Water Authority

Foul Water Discharge
Foul water to discharge via a pumping station to an existing Foul sewer outside of the Site Boundary within Whitehall Road.

The system will be put up for adoption with the Local Adopting Water Authority



Refer to Drawing 09.21011-ACE-00-ZZ-DR-C-1002 for Sheet 2

Do Not Scale

DESIGN REVIEW

Design review by: ** Checked by: **

Residual hazards:

Health, Safety & Environmental Notes

NOTES

General Notes

Architectural Site Plan

- Acanthus WSM
- 4035.20.105B - Site Layout

Existing Topographical Survey

- Blue Hills topo survey 3D

- All Coordinates relate to Topographical survey coordination
- All Dimension in mm unless notified otherwise
- All Levels in mAOD in relation to Topographical survey coordination unless notified otherwise

05.07.22	Design Philosophy amended inline with LLFA comments	NP	RP	P4
09.05.22	Flow restriction reduced to accommodate comments from the LLFA	NP	RP	P3
21.03.22	Updated to suit revised Architectural Layout	NP	RP	P2
18.03.22	Initial Issue	NP	RP	P1
Date	Description	By	Chk	Rev

ADEPT

CIVIL AND STRUCTURAL CONSULTING ENGINEERS

Web: www.adeptcsce.com
Email: info@adeptcsce.com
Tel: 0113 239 4518 (Leeds)
Tel: 0161 974 3620 (Manchester)

Originating Office
1312 Mills, Sunny Bank Mills,
Farsley, Leeds, LS28 5UJ

Project

Blue Hills Farm, Birkenshaw

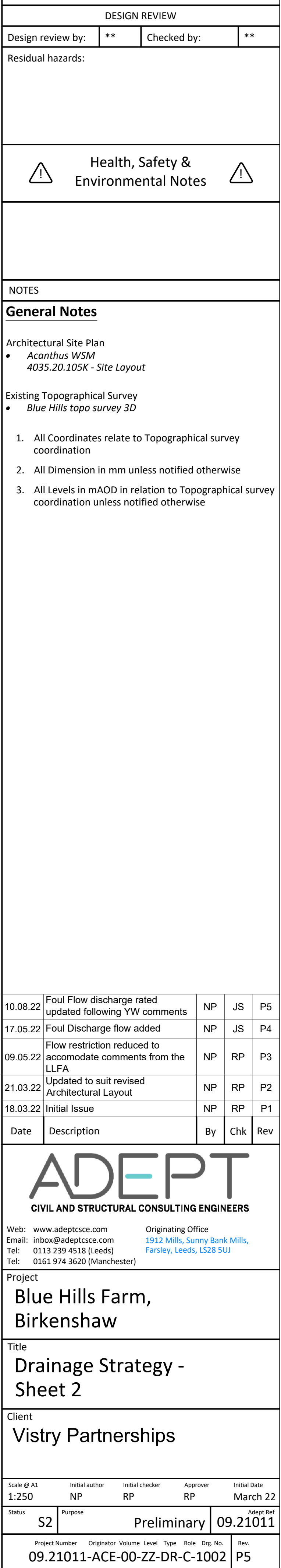
Title

Drainage Strategy - Sheet 1

Client

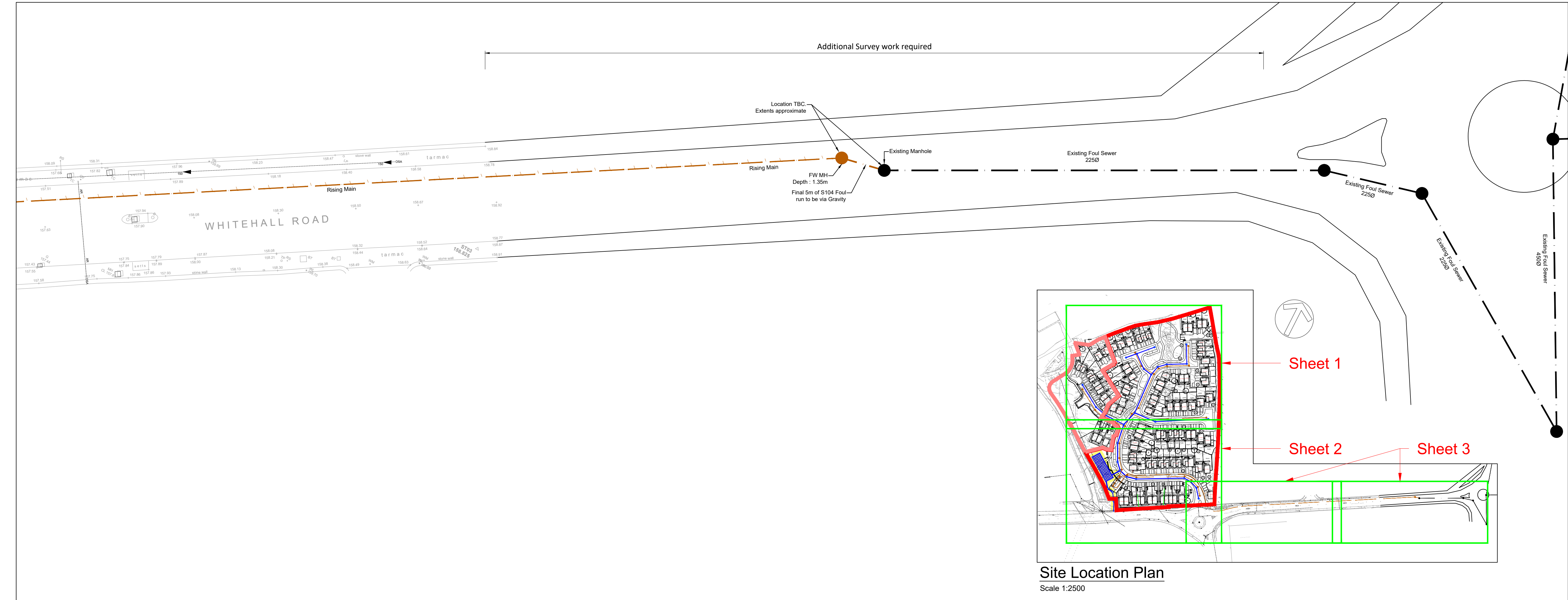
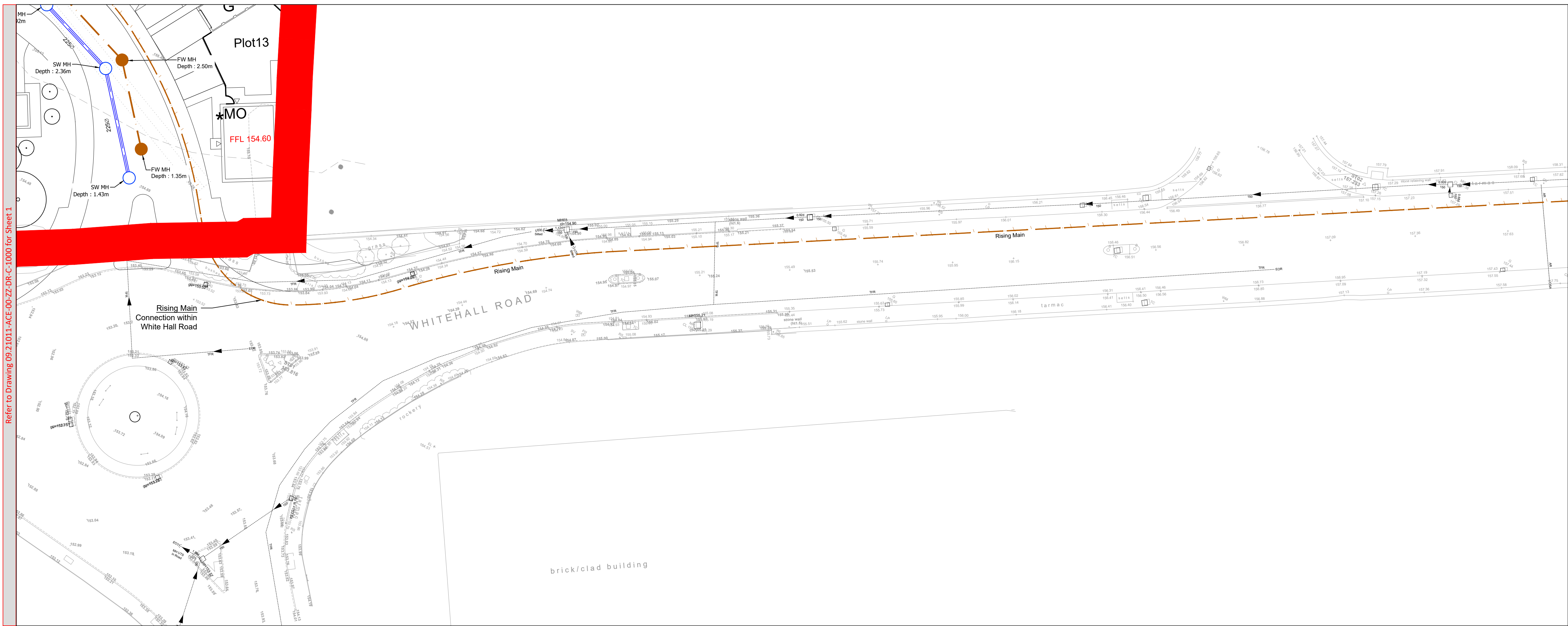
Vistry Partnerships

Scale @ A1	Initial author	Initial checker	Approver	Initial Date			
1:250	NP	RP	RP	March 22			
Status	S2	Purpose	Preliminary	09.21011			
Project Number	Originator	Volume	Level	Type	Role	Org. No.	Rev.
09.21011-ACE-00-ZZ-DR-C-1001							P4



Scale 1:2500

Refer to Drawing 09.21011-ACE-00-ZZ-DR-C-1000 for Sheet 1



Do Not Scale

DESIGN REVIEW

Design review by:	**	Checked by:	**
-------------------	----	-------------	----

Residual hazards:

Health, Safety & Environmental Notes

NOTES

General Notes

Architectural Site Plan

- Acanthus WSM
- 4035.20.105K - Site Layout

Existing Topographical Survey

- Blue Hills topo survey 3D

- All Coordinates relate to Topographical survey coordination
- All Dimension in mm unless notified otherwise
- All Levels in mAOD in relation to Topographical survey coordination unless notified otherwise

17.05.22	Foul connection location adjusted	NP	JS	P2
09.05.21	Initial Issue	NP	RP	P1
Date	Description	By	Chk	Rev

ADEPT

CIVIL AND STRUCTURAL CONSULTING ENGINEERS

Web: www.adeptcsce.com
Email: inbox@adeptcsce.com
Tel: 0113 239 4518 (Leeds)
Tel: 0161 974 3620 (Manchester)

Originating Office
1312 Mills, Sunny Bank Mills,
Farsley, Leeds, LS28 5UJ

Project

Blue Hills Farm,
Birkenshaw

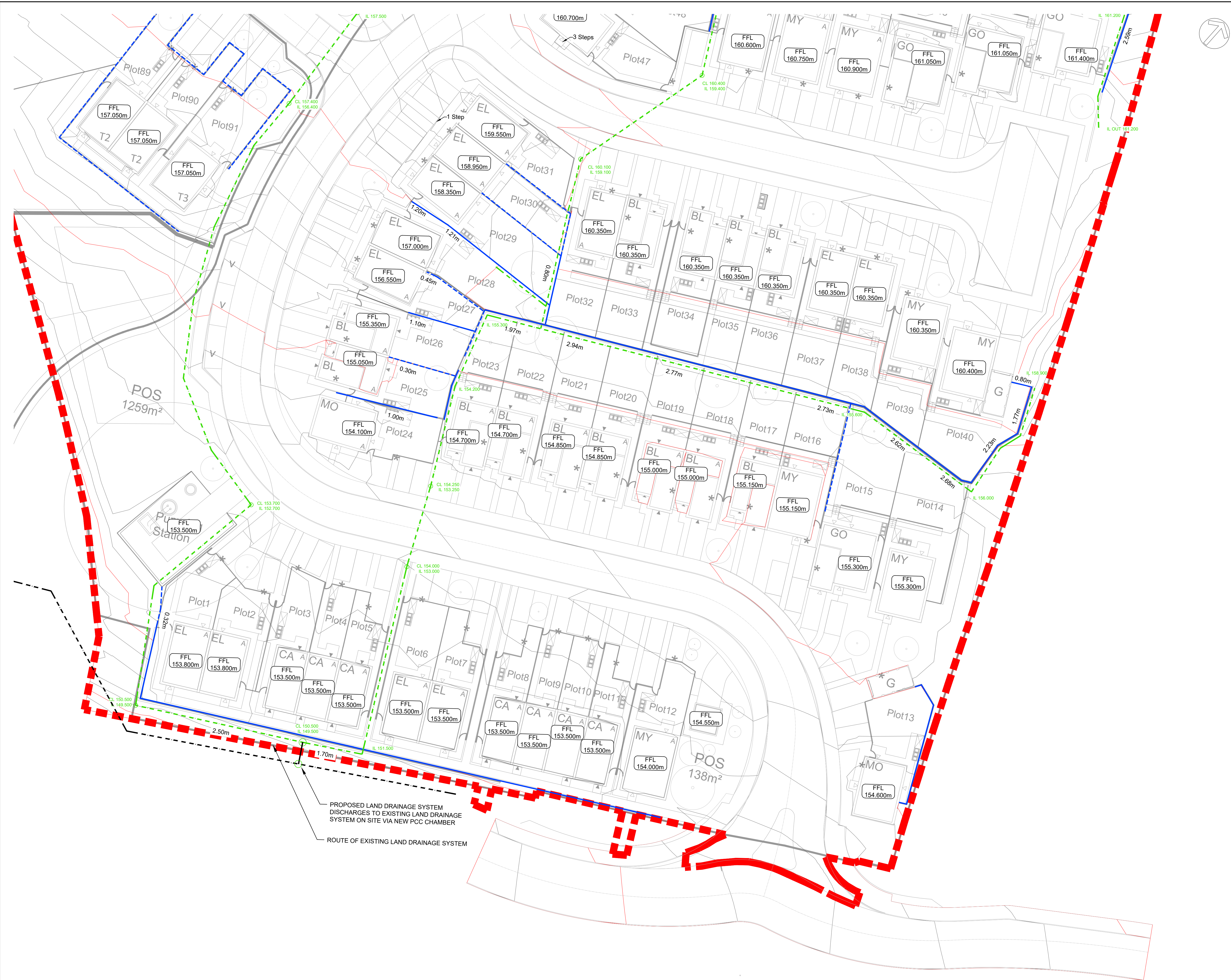
Title

Drainage Strategy -
Sheet 3

Client

Vistry Partnerships

Scale @ A1	Initial author	Initial checker	Approver	Initial Date			
1:250	NP	RP	RP	March 22			
Status	Purpose	Adopt Ref					
S2	Preliminary	09.21011					
Project Number	Originator	Volume	Level	Type	Role	Drig. No.	Rev.
09.21011-ACE-00-ZZ-DR-C-1003							P2



Do Not Scale

DESIGN REVIEW

Design review by: ** Checked by: **

Residual hazards:

Health, Safety & Environmental Notes

NOTES

General Notes

Architectural Site Plan
Acanthus WSM
4035.20.105K - Site Layout

Existing Topographical Survey
Blue Hill topo survey 3D

1. All Coordinates relate to Topographical survey coordination

2. All Dimension in mm unless notified otherwise

3. All Levels in mAOD in relation to Topographical survey coordination unless notified otherwise

4. Access chambers on land drain to be silt traps. ILS minimum 300mm below outgoing pipework

5. Land drains to be perforated 150mm wrapped in permeable geotextile.

Key:

Site Boundary

Gravel Board <600mm

Retaining Wall

Land Drain

05.07.22

Initial Issue

JS

NP

P1

Date

Description

By

Chk

Rev

ADEPT

CIVIL AND STRUCTURAL CONSULTING ENGINEERS

Web: www.adeptcsce.com
Email: inbox@adeptcsce.com
Tel: 0113 239 4518 (Leeds)
Tel: 0161 974 3620 (Manchester)

Originating Office
1312 Mills, Sunny Bank Mills,
Farsley, Leeds, LS28 5UJ

Project

Blue Hills Farm,
Birkenshaw

Title

Land Drainage
Sheet 1 of 3

Client

Vistry
Partnerships

Scale @ A1

Initial author

Initial checker

Approver

Initial Date

1:250

JS

NP

RP

July 22

Status

Purpose

Adapt Ref

S2

Preliminary

09.21011

Project Number

Originator

Volume

Level

Type

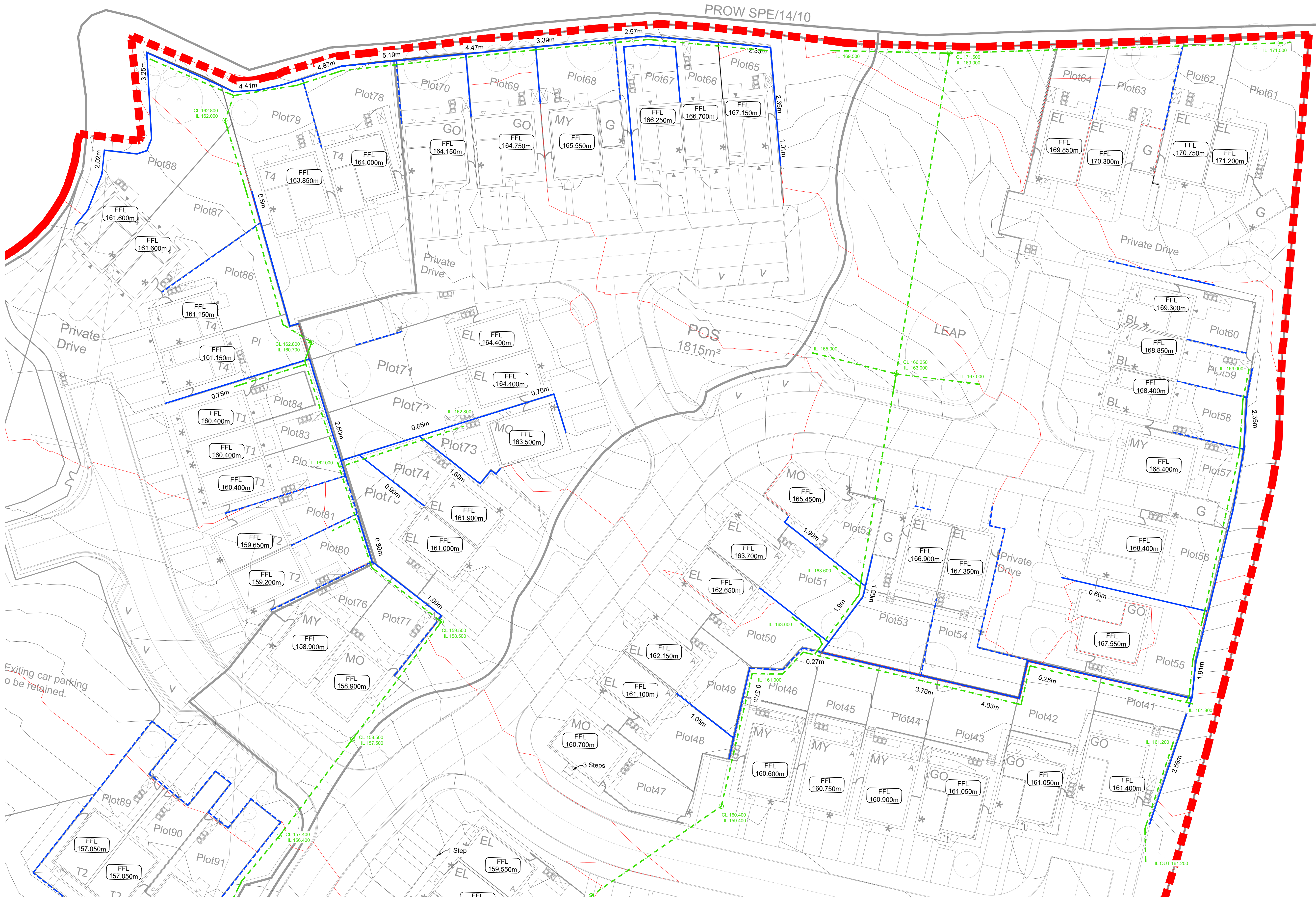
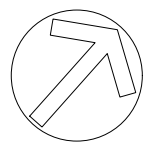
Role

Drg. No.

Rev.

09.21011-ACE-00-ZZ-DR-C-4200

P1



Do Not Scale

DESIGN REVIEW

Design review by: **Checked by: **

Residual hazards:

Health, Safety & Environmental Notes

NOTES

General Notes

Architectural Site Plan
Acanthus WSM
4035.20.105K - Site Layout

Existing Topographical Survey
Blue Hill topo survey 3D

1. All Coordinates relate to Topographical survey coordination

2. All Dimension in mm unless notified otherwise

3. All Levels in mAOD in relation to Topographical survey coordination unless notified otherwise

4. Access chambers on land drain to be silt traps. ILS minimum 300mm below outgoing pipework

5. Land drains to be perforated 150mm wrapped in permeable geotextile.

Key:

Site Boundary

=

Gravel Board <600mm

=

Retaining Wall

=

Land Drain

=

05.07.22Initial IssueJSNP

DateDescriptionByChkRev

05.07.22Initial IssueJSNP

DateDescriptionByChkRev

ADEPT

CIVIL AND STRUCTURAL CONSULTING ENGINEERS

Web: www.adeptcsce.com

Email: info@adeptcsce.com

Tel: 0113 239 4518 (Leeds)

Tel: 0161 974 3620 (Manchester)

Originating Office
1312 Mills, Sunny Bank Mills,
Farsley, Leeds, LS28 5UJ

Project

Blue Hills Farm,
Birkenshaw

Title

Land Drainage
Sheet 2 of 3

Client

Vistry
Partnerships

Scale @ A1
1:250

Initial author
JS

Initial checker
NP

Approver
RP

Initial Date
July 22

Status
S2

Purpose
Preliminary

Adapt Ref
09.21011

Project Number
09.21011-ACE-00-ZZ-DR-C-4201

Originator
S2

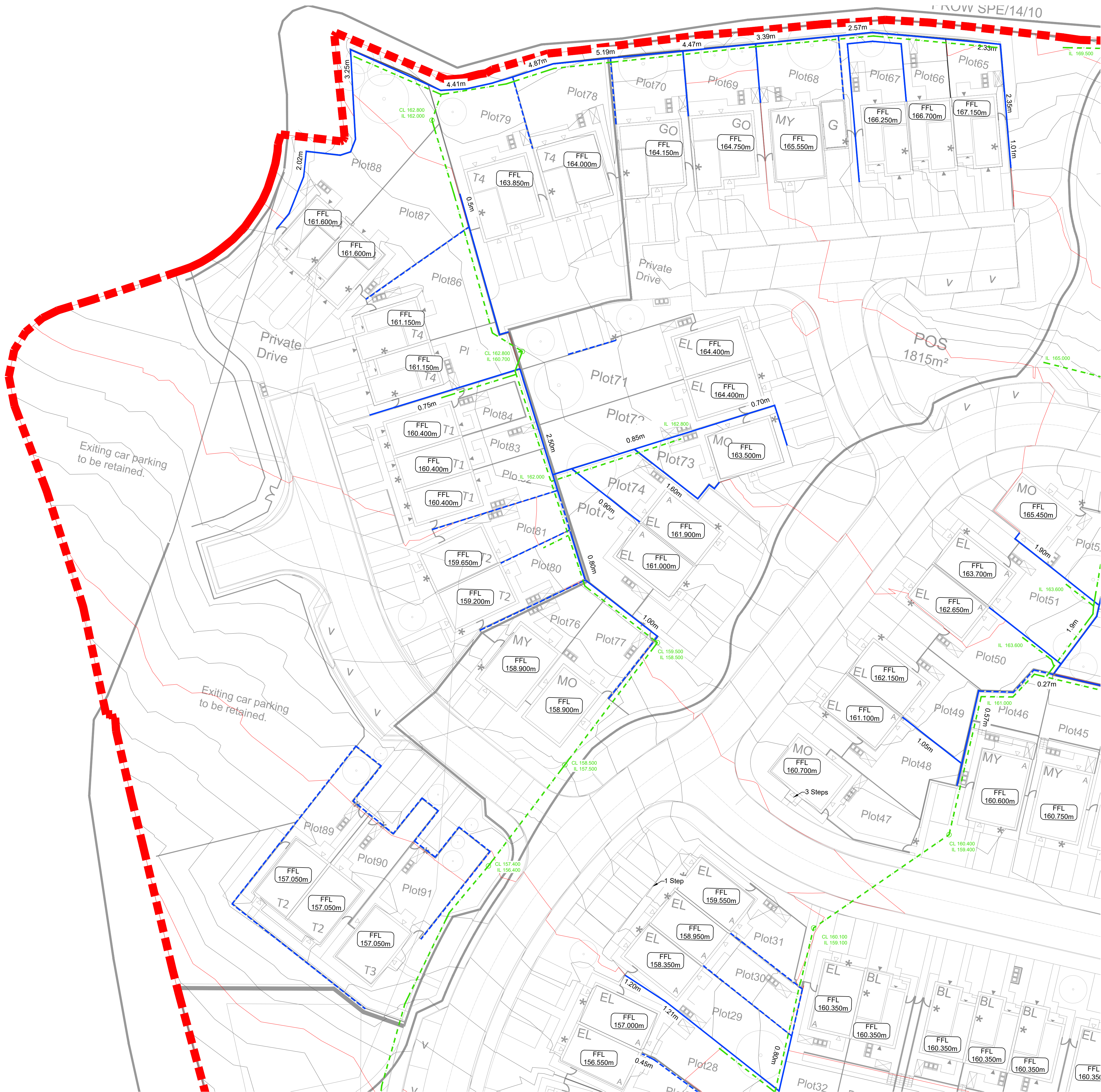
Volume
09.21011

Level
Preliminary

Type
09.21011

Role
P1

Rev.
09.21011



Do Not Scale					
DESIGN REVIEW					
Design review by:	**	Checked by:	**		
Residual hazards:					
Health, Safety & Environmental Notes					
NOTES					
General Notes					
Architectural Site Plan <i>Acanthus WSM</i> <i>4035.20.105K - Site Layout</i>					
Existing Topographical Survey <i>Blue Hill topo survey 3D</i>					
1. All Coordinates relate to Topographical survey coordination					
2. All Dimension in mm unless notified otherwise					
3. All Levels in mAOD in relation to Topographical survey coordination unless notified otherwise					
4. Access chambers on land drain to be silt traps. ILS minimum 300mm below outgoing pipework					
5. Land drains to be perforated 150mm wrapped in permeable geotextile.					
Key:					
Site Boundary		=			
Gravel Board <60mm Retaining Wall		=			
Land Drain		=			
05.07.22 Initial Issue JS NP P1					
Date Description		By	Chk	Rev	
ADEPT CIVIL AND STRUCTURAL CONSULTING ENGINEERS					
Web: www.addeptcsce.com		Originating Office			
Email: inbox@addeptcsce.com		1912 Mills, Sunny Bank Mills,			
Tel: 0113 239 4518 (Leeds)		Farsley, Leeds, LS28 5UJ			
Tel: 0161 974 3620 (Manchester)					
Project					
Blue Hills Farm, Birkenshaw					
Title					
Land Drainage Sheet 3 of 3					
Client					
Scale @ A1	Initial author	Initial checker	Approver	Initial Date	
1:250	JS	NP	RP	July 22	
Status	Purpose			Adept Ref	
S2	Preliminary			09.21011	
Project Number		Originator	Volume	Level	Type
09.21011-ACE-00-ZZ-DR-C-4202					
					Rev.
					P1



Do Not Scale					
DESIGN REVIEW					
Design review by:	**	Checked by:	**		
Residual hazards:					
Health, Safety & Environmental Notes					
NOTES					
General Notes					
Architectural Site Plan					
• Acanthus WSM 4035.20.105B - Site Layout					
Existing Topographical Survey					
• Blue Hills topo survey 3D					
1. All Coordinates relate to Topographical survey coordination					
2. All Dimension in mm unless notified otherwise					
3. All Levels in mAOD in relation to Topographical survey coordination unless notified otherwise					

Project:	Date: 03/02/2022			
	Designed by: rachel.park	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Network Design Criteria Storm Phase: Phase				

Flow Options

Peak Flow Calculation	(UK) Modified Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30
09.21011 - Birkenshaw	

Type: FSR

Return Period (years)	100.0
Region	England and Wales
M5-60 (mm)	19.0
Ratio R	0.352

Pipe Options

Lock Slope Options	None
Design Level	Level Soffits
Min. Cover Depth (m)	1.200
Min. Slope (1:x)	300.00
Max. Slope (1:x)	10.00
Min. Backdrop (m)	0.600
Max. Backdrop (m)	3.000
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☐
Reduce Channel Depths	☐

Manhole Options

Apply Offset	☐
Synchronise Manhole Invert Levels	☒

Project:	Date: 03/02/2022			
	Designed by: rachel.park	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	1
Time Step	Shortest
Urban Creep	Use Catchment Values
Junction Flood Risk Margin (mm)	50
Perform No Discharge Analysis	☐

Rainfall	
09.21011 - Birkenshaw	Type: FSR

Region	England and Wales
M5-60 (mm)	19.0
Ratio R	0.352
Summer	☒
Winter	☒

Return Period	
Return Period (years)	Increase Rainfall (%)
100.0	30

Storm Durations	
Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

Project:	Date: 03/02/2022		
	Designed by: rachel.park	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		



09.21011 - Birkenshaw: 100 years: Increase Rainfall (%): +30: Critical Storm Per Item

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
SW14	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	160.300	158.950	159.086	0.136	33.8	0.154	0.000	32.8	15.598	OK
SW15	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	159.300	157.875	158.033	0.158	61.5	0.179	0.000	61.2	28.860	OK
SW16	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	158.900	157.475	157.677	0.202	82.9	0.229	0.000	81.7	38.755	OK
SW17	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	156.000	154.425	155.536	1.111	531.5	1.590	0.000	522.5	259.604	Surcharged
SW18	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	154.000	152.425	153.623	1.198	538.8	1.714	0.000	534.6	267.781	Surcharged
SW19	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	153.600	151.252	153.039	1.786	39.9	3.156	0.000	39.9	1363.541	Surcharged
SW30	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	149.450	148.260	148.309	0.049	5.2	0.000	0.000	5.2	689.790	OK
SW13	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	158.150	156.575	157.224	0.649	483.9	0.928	0.000	482.5	236.972	Surcharged
SW1	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	168.900	167.550	167.651	0.101	34.4	0.114	0.000	34.1	15.901	OK
SW2	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	167.400	165.025	165.196	0.171	93.8	0.193	0.000	93.4	43.506	OK
SW3	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	165.300	163.875	164.008	0.133	93.4	0.151	0.000	92.9	43.502	OK
SW4	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	164.800	162.775	162.936	0.161	101.8	0.182	0.000	101.2	47.618	OK
SW5	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	163.700	161.802	162.002	0.200	220.6	0.226	0.000	221.6	106.460	OK
SW10	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	159.650	158.075	158.343	0.268	401.0	0.303	0.000	401.2	192.656	OK
SW6	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	163.800	162.300	162.633	0.333	41.0	0.377	0.000	39.2	18.956	Surcharged

Project:	Date: 03/02/2022		
	Designed by: rachel.park	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase		Company Address:	



SW7	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	165.1 00	162.2 13	162.61 1	0.397	74.3	0.449	0.000	74.9	36.001	Surcharged
SW9	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	163.3 50	161.8 50	162.12 0	0.270	90.7	0.305	0.000	90.7	43.660	OK
SW8	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	167.0 50	165.7 00	165.77 2	0.072	23.7	0.081	0.000	23.5	10.951	OK
SW11	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	160.8 00	159.3 75	159.54 0	0.165	49.6	0.187	0.000	48.2	22.911	OK
SW12	09.21011 - Birkenshaw: 100 years: +30 %: 15 mins: Winter	160.1 00	158.6 00	159.02 2	0.422	158.0	0.478	0.000	153.4	73.655	Surcharged
SW20	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	153.6 50	152.2 25	153.03 8	0.813	1.6	0.920	0.000	1.6	56.226	Surcharged
SW21	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	154.5 00	152.1 41	153.03 9	0.897	1.6	1.015	0.000	1.6	56.805	Surcharged
SW23	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	154.8 00	151.9 55	153.03 9	1.083	3.7	1.225	0.000	3.7	128.850	Surcharged
SW24	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	153.5 00	151.5 59	153.03 8	1.479	8.8	1.673	0.000	8.8	303.776	Surcharged
SW25	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	153.4 00	151.4 79	153.03 8	1.559	9.1	1.764	0.000	9.1	313.240	Surcharged
SW22	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	155.0 00	152.0 81	153.03 8	0.957	1.6	1.083	0.000	1.6	57.586	Surcharged
SW29	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	152.0 00	148.4 44	148.49 5	0.051	5.2	0.090	0.000	5.2	689.790	OK
SW27	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	153.2 00	148.5 72	153.03 8	4.466	5.8	7.892	0.000	5.4	697.438	Surcharged
SW28	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	153.2 00	148.5 49	153.03 8	4.489	5.4	11.425	0.000	5.2	689.975	Surcharged

Project:	Date: 03/02/2022			
	Designed by: rachel.park	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



09.21011 - Birkenshaw: 100 years: Increase Rainfall (%): +30: Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Tank (1)	09.21011 - Birkenshaw: 100 years: +30 %: 1440 mins: Winter	153.038	153.038	4.438	4.438	39.9	1011.500	0.000	0.000	5.8	707.528	0	OK

Project:	Date: 03/02/2022		
	Designed by: rachel.park	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		



09.21011 - Birkenshaw: 100 years: Increase Rainfall (%): +30: Critical Storm Per Item

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
SW5.000	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW14	SW15	160.3	159.08 ₆	0.129	15.598	2.0	1	32.8	OK
SW5.001	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW15	SW16	159.3	158.03 ₃	0.179	28.860	1.9	0.71	61.2	OK
SW1.007	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW17	SW18	156.0	155.53 ₆	0.375	259.604	4.7	0.85	522.5	Surcharged
SW1.008	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW18	SW19	154.0	153.62 ₃	0.375	267.781	4.9	0.87	534.6	Surcharged
SW1.006	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW13	SW17	158.2	157.22 ₄	0.375	236.972	5.0	0.77	482.5	Surcharged
SW1.000	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW1	SW2	168.9	167.65 ₁	0.098	15.901	2.8	0.73	34.1	OK
SW1.001	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW2	SW3	167.4	165.19 ₆	0.152	43.506	3.3	0.79	93.4	OK
SW1.002	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW3	SW4	165.3	164.00 ₈	0.147	43.502	3.4	0.55	92.9	OK

Project:	Date: 03/02/2022		
	Designed by: rachel.park	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		



SW1.003	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW4	SW5	164.8	162.93 6	0.149	47.618	3.6	0.69	101.2	OK
SW1.004	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW5	SW10	163.7	162.00 2	0.196	106.460	4.6	0.71	221.6	OK
SW1.005	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW10	SW13	159.7	158.34 3	0.375	192.656	4.8	0.69	401.2	OK
SW5.002	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW16	SW13	158.9	157.67 7	0.225	38.755	2.5	0.86	81.7	OK
SW2.000	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW6	SW7	163.8	162.63 3	0.300	18.956	0.6	0.43	39.2	Surcharged
SW2.001	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW7	SW9	165.1	162.61 1	0.225	36.001	1.9	1.04	74.9	Surcharged
SW2.002	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW9	SW5	163.4	162.12 0	0.235	43.660	1.5	1.21	90.7	OK
SW3.000	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW8	SW7	167.1	165.77 2	0.070	10.951	2.9	0.43	23.5	OK
SW4.000	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW11	SW12	160.8	159.54 0	0.225	22.911	1.4	0.86	48.2	OK
SW4.001	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW12	SW10	160.1	159.02 2	0.300	73.655	2.2	1.03	153.4	Surcharged

Project:	Date: 03/02/2022		
	Designed by: rachel.park	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		



SW6.000	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW20	SW21	153.7	152.39 0	0.167	14.403	1.0	0.73	30.8	OK
SW6.003	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW23	SW24	154.8	152.19 5	0.221	32.662	1.2	0.91	67.6	OK
SW6.004	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW24	SW25	153.5	151.88 2	0.321	77.864	1.4	0.59	160.7	OK
SW6.005	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW25	SW19	153.4	151.79 9	0.315	80.364	1.5	0.59	166.6	OK
SW6.001	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW21	SW22	154.5	152.31 2	0.171	14.399	1.0	0.74	30.2	OK
SW6.002	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW22	SW23	155.0	152.25 1	0.167	14.370	1.0	0.73	30.1	OK
SW1.009	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW19	Tank (1)	153.6	151.71 2	0.415	350.686	3.4	0.7	701.8	OK
SW1.014	09.21011 - Birkenshaw : 100 years: +30 %: 1440 mins: Winter	Pipe	SW29	SW30	152.0	148.49 5	0.050	689.790	1.0	0.23	5.2	OK
SW1.012 (1)	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	SW27	SW28	153.2	149.86 4	0.600	8.331	0.6	0.04	16.9	Surcharged
SW1.013	09.21011 - Birkenshaw : 100 years: +30 %: 1440 mins: Winter	Pipe	SW28	SW29	153.2	153.03 8	0.055	689.915	0.9	0.29	5.2	Surcharged

Project:				Date: 03/02/2022							
				Designed by: rachel.park		Checked by:					
Report Details: Type: Connections Summary Storm Phase: Phase				Company Address:							

SW1.010	09.21011 - Birkenshaw : 100 years: +30 %: 15 mins: Winter	Pipe	Tank (1)	SW27	153.8	149.86 4	0.600	15.202	0.6	0.34	42.3	Surcharged
---------	---	------	----------	------	-------	-------------	-------	--------	-----	------	------	------------