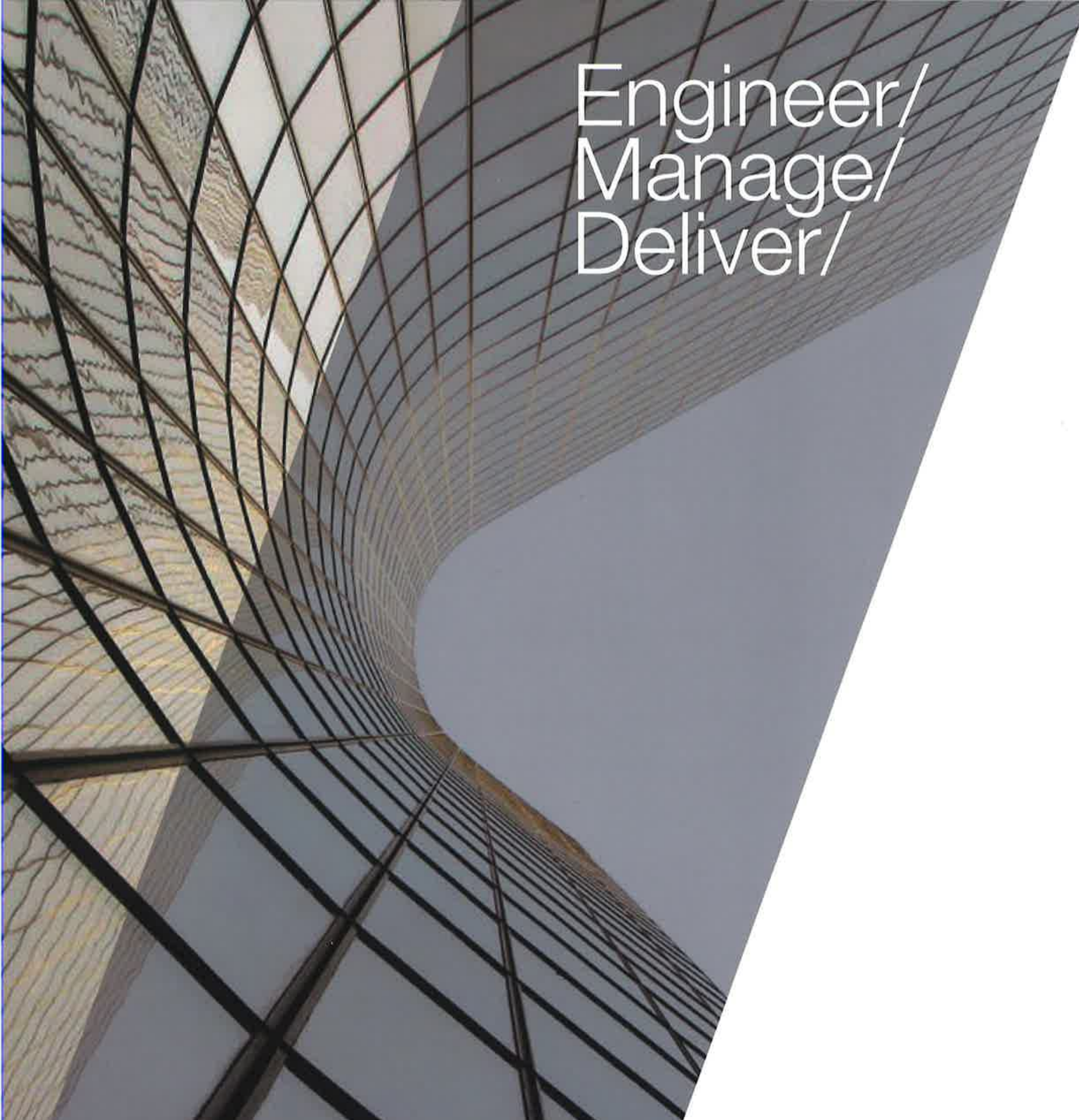

DRAINAGE IMPACT ASSESSMENT FOR PROPOSED ALTERATIONS AT HOTHAM HALL, THE PARK, HOTHAM, EAST YORKSHIRE

PROJECT NO. JAG/AD/JF/49932-Rp001

Alan Wood & Partners

DECEMBER 2023

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DRAINAGE IMPACT ASSESSMENT FOR PROPOSED ALTERATIONS AT HOTHAM HALL, THE PARK, HOTHAM, EAST YORKSHIRE

Prepared by: A Dunn

Signed: ....
Date: 21st December 2023

Approved by: J Gibson, MEng (Hons), CEng, CWEM MCIWEM
Director

Signed: ....
Date: 21st December 2023

Issue	Revision	Revised by	Approved by	Revised Date

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Background

1.1.1 Alan Wood & Partners were commissioned by Hotham Hall Estate Ltd to prepare a Drainage Impact Assessment Report for proposed alterations at Hotham Hall, The Park, Hotham, East Yorkshire in support of an application for outline planning consent.

1.1.2 A Drainage Impact Assessment Report (DIA) considers the drainage requirements of the proposed development.

2.0 EXISTING SITE DESCRIPTION

2.1 Location

2.1.1 The development is located at Hotham Hall which lies to the south east of the village of Hotham, East Yorkshire.

2.1.2 An aerial photograph is included in Figure 1 below, which identifies the location of the site.

Figure 1: Aerial Photograph

2.1.3 The Ordnance Survey grid reference for the centre of the site development is approximately 489575, 533735.

2.2 Existing Site Description

2.2.1 The site comprises the existing stable block and courtyards together with areas of residential gardens at Hotham Hall.

2.3 Surrounding Features

2.3.1 To the south of the application site lies agricultural land extending to the village of North Cave.

2.3.2 There is a small open watercourse situated approximately 300m to the east of the site (Hotham Beck), beyond which lies an extensive area of agricultural land.

2.3.3 The grounds of the Estate lie to the north, with a number of farm buildings and a public road beyond.

2.3.4 To the west is a private access road with a small watercourse and agricultural land beyond.

2.4 Topography

2.4.1 A topographic survey of the site has been undertaken which shows that the existing ground levels over the courtyard and around the stable block vary from approximately 20.86m to 22.45m OD(N)

2.4.2 Existing ground levels over the area of the new car park are shown to vary from approximately 21.43m to 22.81m OD(N).

2.4.3 The existing floor level of the stable block building is shown to be at approximately 21.33m OD(N).

2.4.4 A copy of the topographic survey drawing is included in Appendix A.

2.5 Ground Conditions

2.5.1 A desktop study of the British Geological Survey map shows that the local geology comprises superficial deposits of Bielby Sand Member – Sand, Clayey overlaying bedrock comprising Charmouth Mudstone Formation – Mudstone.

2.5.2 A study of the local groundwater maps show that the site overlays a Secondary B Aquifer and lies in an area where the groundwater vulnerability classification is ‘Medium-High’.

3.0 CONSULTATION

3.1 Consultation has taken place with the Architect in order to obtain relevant information pertaining to the proposed development.

3.2 Consultation has taken place with East Riding of Yorkshire Council in respect of surface water drainage in their role as Lead Local Flood Authority in the region.

4.0 PROPOSED DEVELOPMENT

4.1 The Development

4.1.1 The development comprises the following:-

- The refurbishment and alterations to a number of existing buildings to create a new function room.
- The refurbishment and alterations to the existing stable block buildings to create a number of new accommodation units, club room and bar.
- The construction of a new toilet block serving the facilities.
- The construction of a new spa complex building
- The construction of a new car park
- Surfacing works to the existing courtyard

4.1.2 Drawings showing details of the development are included in Appendix B.

5.0 FOUL WATER DRAINAGE

5.1 Design Criteria

5.1.1 Based upon the British Water Publication 'Flows and Loads – 4' and an estimated 150 occupants, the average flow generated by the new development would be approximately 0.26l/s per second (unfactored).

5.1.2 Assuming a peak flow rating of 6 is applied, this would result in a maximum discharge rate of approximately 1.6l/s for design purposes.

5.1.3 The pipe size required to accommodate the foul water run-off from the development is 100mm.

5.2 Run-off Destination

5.2.1 The foul water run-off from the development will be discharged to the existing foul drainage network at a point to the west of the Main Hall.

5.3 Outfall

5.3.1 The design work undertaken has shown that a gravity outfall to the existing sewer network can be achieved.

5.4 Drawing

5.4.1 A drawing showing the foul water drainage strategy for the development is included within Appendix C.

6.0 SURFACE WATER DRAINAGE

6.1 General

6.1.1 The surface water drainage has been designed in accordance with current CIRIA C753 SuDS Manual guidelines.

6.2 Existing Site

6.2.1 From the aerial photograph included in Figure 2 below, it can be seen that the site comprises existing buildings, an external yard area, landscaped areas and a temporary car park within Hotham Hall Estate.

Figure 2: Aerial Photograph

6.3 Run-off Destination

6.3.1 Requirement H3 of the Building Regulations establishes a preferred hierarchy for disposal of surface water. Consideration should firstly be given to soakaway, infiltration, watercourse and sewer in that priority order.

6.3.2 The underlying strata in the vicinity of the development is considered to be unsuitable for soakaways to be used as the means for disposal of surface water run-off from the new development (see Section 2.5 of this report).

6.3.3 The second preferred option would be to discharge the surface water run-off from the development to a watercourse.

6.3.4 There is a small open watercourse situated to the west of the proposed development which is the obvious point of discharge for the surface water run-off from the main development. It is therefore proposed that the run-off from the development discharges to this watercourse.

6.4 Flood Risk

6.4.1 For new developments, the current design criteria required for the surface water drainage will need to be based upon the critical 1 in 100 year storm event, with an additional allowance to account for climate change resulting from global warming. There should be no above ground flooding for the 1 in 30 year return period and no property flooding or off site flooding from the critical 1 in 100 year storm event, with the additional allowance to account for climate change.

6.5 Climate Change

6.5.1 An additional allowance of 30% has been included in the preliminary surface water drainage design to account for the anticipated increase in peak rainfall due to climate change resulting from global warming in accordance with East Riding of Yorkshire Council SuDS Guidance.

6.6 Peak Flow Control

6.6.1 Based upon the site layout drawings included in Appendix B, the new impermeable area created by the development which will need to be positively drained has been calculated at approximately 3450m^2.

6.6.2 The uncontrolled surface water run-off from the new development could be approximately 48l/s based on BS EN 752 calculations, using a rainfall intensity of 50mm/hour. However, to meet the flood risk planning requirements, it is normally unacceptable to discharge flows freely from the proposed development site at an unrestricted rate.

6.6.3 SuDS Guidance advises that flows from the proposed development should be limited to the greenfield run-off rate.

6.6.4 Based on the greenfield discharge rate of 1.4/s/ha and the contributing impermeable area of the development, the equivalent greenfield run-off rate for the site equates to approximately 0.49l/s, which cannot be achieved in practical terms.

6.6.5 It is considered that the lowest discharge rate which can be achieved in order to avoid blockages and future maintenance issues is 3.5l/s and consequently it is proposed that a discharge rate of 3.5l/s is used for design purposes, as was approved for the previous planning application.

6.7 Design Output

6.7.1 Based upon the design criteria set out above, hydraulic calculations have been undertaken in order to assess the pipe sizes and gradients required and to calculate the likely volume of surface water storage which will need to be provided.

6.7.2 The pipe sizes required are shown to vary from 225mm to 375mm in diameter.

6.7.3 The design work undertaken has shown that a gravity outfall to the watercourse can be achieved. On this basis the required restriction to the discharge rate will be achieved by means of an appropriate vortex flow control.

6.7.4 A summary of the likely storage volumes required is set out in Table 1 below.

Table 1: Volume of Surface Water Storage Required

Storm Event	1 in 1 Probability Storm Event	1 in 30 Probability Storm Event	1 in 100 Probability Storm Event + 30%
Storage Volume Required	32m^3	87m^3	181m^3
Additional Storage Volume Required	Nil	55m^3	94m^3

6.7.5 For this development it is proposed that the required volume of storage required to accommodate the peak flows including climate change will be stored below the car park in a stone blanket.

6.7.6 A copy of the hydraulic calculations are included in Appendix D.

6.7 Drawing

6.7.1 A copy of the surface water drainage strategy drawing for the development is included in Appendix C.

6.8 Volume Control

6.8.1 SuDS guidance advises that the run-off volume from the developed site for the 1 in 100 year 6-hour rainfall event should not exceed the greenfield run-off volume for the same event.

6.8.2 However, as detailed above, for this development a discharge rate of 3.5l/s has been used for design purposes.

6.8.3 Whilst the greenfield run-off rate will be marginally exceeded at times of peak flow, it is considered that such a small discharge rate will not have any detrimental effect on the drainage network or other parties downstream of the development.

6.8.4 The impact on the receiving watercourse is therefore considered to be acceptable.

6.9 Pollution Control

6.9.1 It is a requirement to ensure that the quality of any receiving body is not adversely affected by the development.

6.9.2 Adequate pollution control measures will consequently need to be incorporated in the detailed design of the drainage network.

6.9.3 Investigations have revealed that the development site overlays a Secondary B Aquifer and lies within a Groundwater Vulnerability Zone classified as 'Medium-High'.

6.9.4 Run-off from roof areas will be to the watercourse via the stone blanket below the car park.

6.9.5 The car park is to be of permeable construction and will therefore adequately reduce the risk from pollutants entering the watercourse.

6.9.6 On this basis, it is considered that the risk of pollutants being discharged to the watercourse has been adequately addressed.

6.10 Designing for Exceedance

6.10.1 Flood risk from overland exceedance flows from the new surface water drainage network and from off-site sources should be mitigated to a large extent by the new surface water drainage system.

6.10.2 The existing overland flow routes should generally be maintained within the final layout of the development site without increasing the flood risk to off-site parties.

6.10.3 The ground floor construction level of the building will be raised above external ground level, which will be designed to shed water away from the building.

6.10.4 Drawings showing the existing and anticipated overland surface water exceedance flood routing resulting from the development are included in Appendix E.

6.11 Highways Drainage

6.11.1 The development does not incorporate any formal highway drainage.

7.0 OPERATION AND MAINTENANCE

7.1 The drainage pipework is designed with self-cleansing gradients and consequently the network should require little or no maintenance.

7.2 All road gullies or drainage channel systems serving areas of hardstanding will need to be regularly inspected to ensure the system remains operable. See Table 2 below.

7.3 The inspection chamber to discharge to the should be regularly inspected to ensure the system is free-flowing. See Table 2 below.

Table 2: Operation and Maintenance Requirements for Silt Traps/Trapped Gullies (Based on CIRIA C753 Table 14.2)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	6 monthly
	Inspect filter media and establish appropriate replacement frequencies	6 monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

7.4 The operation and maintenance requirements for the vortex flow control should be maintained as set out in Table 3 below.

Table 3: Operation and Maintenance Requirements for Vortex Flow Control Device (Based on Manufacturer's recommendations)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Monthly during the first three months, then every 6 months
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months

7.5 If pervious paving is provided, then the operation and maintenance requirements should be carried out in accordance with Table 4 below

Table 4: Operation and Maintenance Requirements for pervious paving (Based on CIRIA C753 Table 20.15)

Maintenance schedule	Required action	Typical frequency*
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required

Remedial actions (cont'd)	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

7.6 Operation and maintenance requirements of the drainage components, as listed above, should be undertaken in accordance with Chapter 32 of the CIRIA SuDS Manual, along with the relevant tables and any relevant manufacturer's recommendations. See also BS 8582:2013 Code of Practice for Surface Water Management for Development Sites Section 11 and Susdrain Fact Sheet on SuDS Maintenance and Adoption Options (England) dated September 2015.

7.7 The personnel undertaking the maintenance should have appropriate experience of SuDS and drainage maintenance and should be capable of keeping sufficiently detailed records of any inspections. An example of a checklist for SuDS maintenance can be found within Appendix B of the CIRIA C753 SuDS Manual v2. If personnel do not have appropriate experience, then specific inspection visits may be necessary. During the first year of operations of SuDS, inspections should usually be carried out at monthly intervals (and after significant storm events).

7.8 The responsibility for the operation and maintenance of the drainage and SuDS will lie with Hotham Hall Estate Ltd, or any subsequent landowner of the site.

8.0 SUMMARY

8.1 This report has been prepared to assess the drainage requirements for a development at Hotham Hall, Hotham, East Yorkshire which will provide a new function room, accommodation and a new spa complex.

8.2 This report demonstrates that the site can be suitably drained, with the drainage network serving the development designed and constructed to the required standards in compliance with local and national planning policies.

8.3 Surface water run-off from the main development will be discharged to an existing watercourse. The discharge will be restricted to an agreed rate of discharge and the required volume of storage to accommodate the peak flows including climate change will be provided within a stone blanket below the car park.

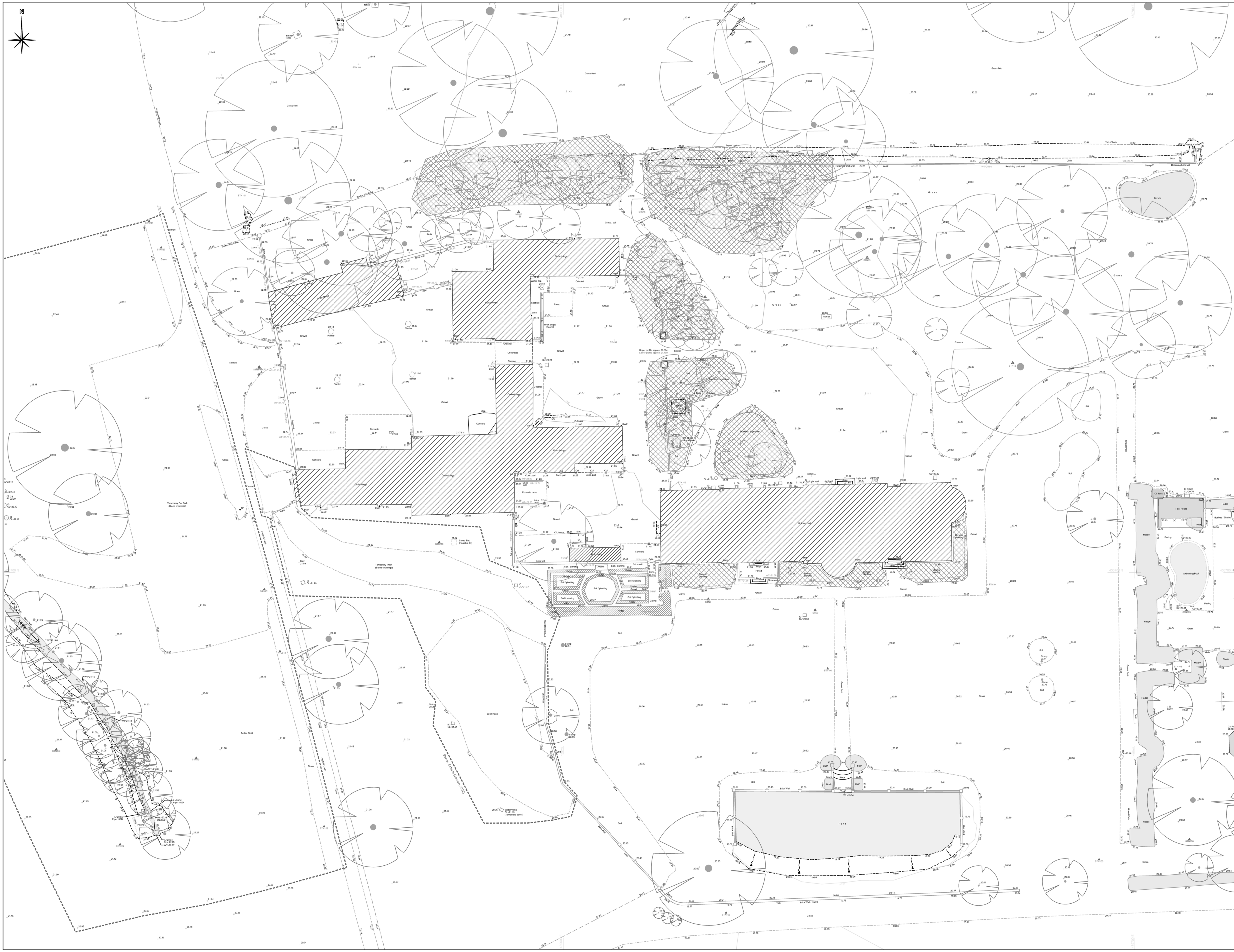
8.4 The sewers will be designed and constructed to meet the requirements of the Building Regulations.

8.5 Foul water run-off from the development will be discharged to the existing foul water drainage network serving the Hotham Hall Estate.

8.6 Based on the details incorporated within our report, it is considered that planning consent for the proposed development can be granted in terms of the drainage aspects of the project.

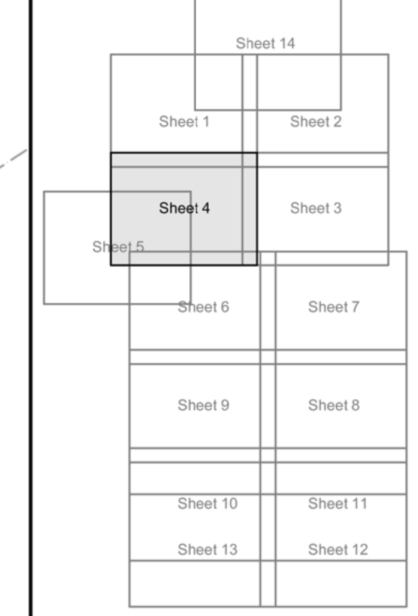
APPENDIX A

Topographic Survey Drawing



Topographical Survey Legend

Sheet Layout (not to scale)



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STN202	489591.239	433915.917	23.559
STN203	489627.036	433921.747	23.576
STN204	489643.461	433939.524	23.298
STN205	489682.407	433930.300	21.885
STN206	489734.577	433946.241	21.115
STN207	489769.278	433956.781	21.059
STN208	489797.464	433965.220	20.911
STN209	489820.827	433977.282	22.328
STN210	489774.253	433935.710	21.356
STN211	489567.971	433977.499	23.708
STN212	489658.314	433987.208	22.587
STN213	489765.828	433986.686	21.502
STN214	489522.377	433840.719	23.769
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STN217	489541.602	433629.572	20.687
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STN220	489700.747	433210.932	18.039
STN221	489664.222	433216.046	18.124
STN222	489641.633	433222.205	17.789

SURVEY STATIONS - RevB			
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STN152	489522.478	433652.450	21.089
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STN154	489488.566	433695.396	21.785
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STN157	489612.060	433410.672	19.159
STN158	489592.932	433333.203	18.793
STN159	489596.383	433294.070	18.602
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STN170	489723.772	433197.443	17.718
STN171	489711.345	433202.335	18.038
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STN175	489637.606	433223.205	17.681
STN176	489632.084	433227.165	- - -
STN177	489625.342	433225.338	- - -

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STN105	489693.749	433649.800	20.533
STN106	489709.550	433653.338	20.616
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STN150	489779.525	433773.680	20.336

Levels related to Ordnance Survey Datum (OSGM15) using GPS

Coordinates related to Ordnance Survey grid (OSBG36) using GPS

This Topographical Survey has been produced using an orthographic coordinate grid, site centred around STN 1

Please note due to obstructions such as parked cars & vegetation First Point Surveys cannot guarantee all pertinent information has been surveyed.

FIRST POINT SURVEYS
LAND, BUILDING & UNDERGROUND UTILITY SURVEYORS
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TITLE

Topographical Survey overlaid to OS
Sheet 4 of 5
Hotham Hall
Main Street
Hotham
YO43 4UA

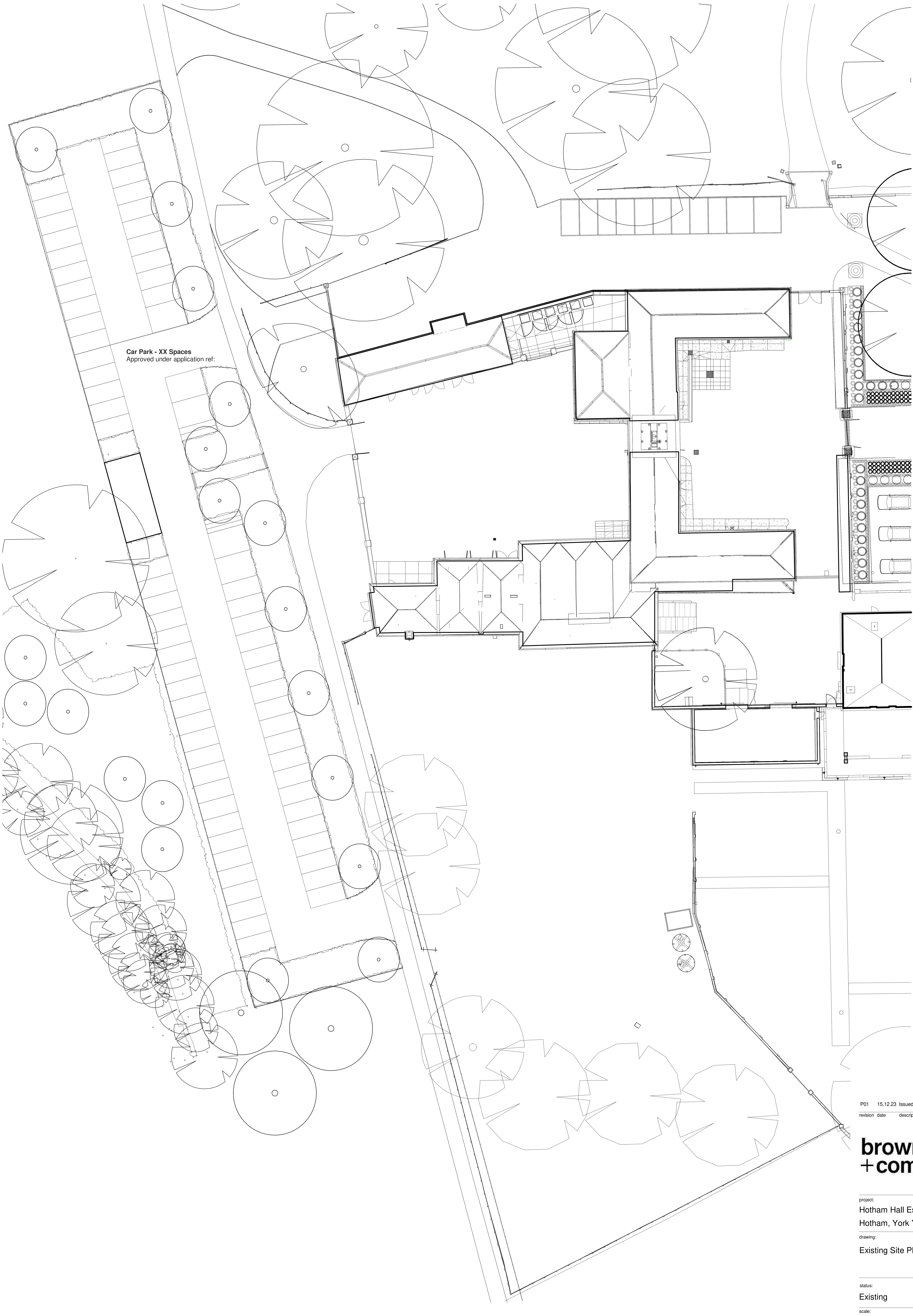
DATE	DRAWN BY	CHKD. BY
December 2020	SRH / PDC	MIH

DRG NO	PLOT SCALE
6679 / 04	1: 200 @ A0

REV	AMENDMENT	DATE	BY	CHKD.
A	Additional survey - Area known as The Island	Jan 2021	PDC	MIH
B	Additional survey - Rural land in the south and the area known as The Cat Tail	Mar 2021	PDC	MIH
C	Additional survey - Woodland and Harrybeck Ln to the north and updates including temporary works to the west of the main house and trees in the area known as The Cat Tail.	Jan 2022	PDC	MIH

APPENDIX B

Site Layout Drawings



Existing Site Plan

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revision	date	description	drwn by	ck'd
P01	15.12.23	Issued for planning	RM	NB

brown
+company

project:
Hotham Hall Estate
Hotham, York YO43 4UA

drawing:
Existing Site Plan

status:
Existing

scale: 1:250

Sheet size: A1

10 20 25

job number	orig	zone	level	type	role	drawing number	rev
23039-	BC-	ZZ-	XX-	DR-	A-	03-002	P01

Note

Refer to SBA design drawings for landscape design

revision	date	description	drwn by	ck'd
P01	15.12.23	Issued for planning	RM	NB

brown +company

project:
Hotham Hall Estate
Hotham, York YO43 4UA

drawing:
Proposed Site Plan

status:
Planning

scale: 1:250

Sheet size: A1

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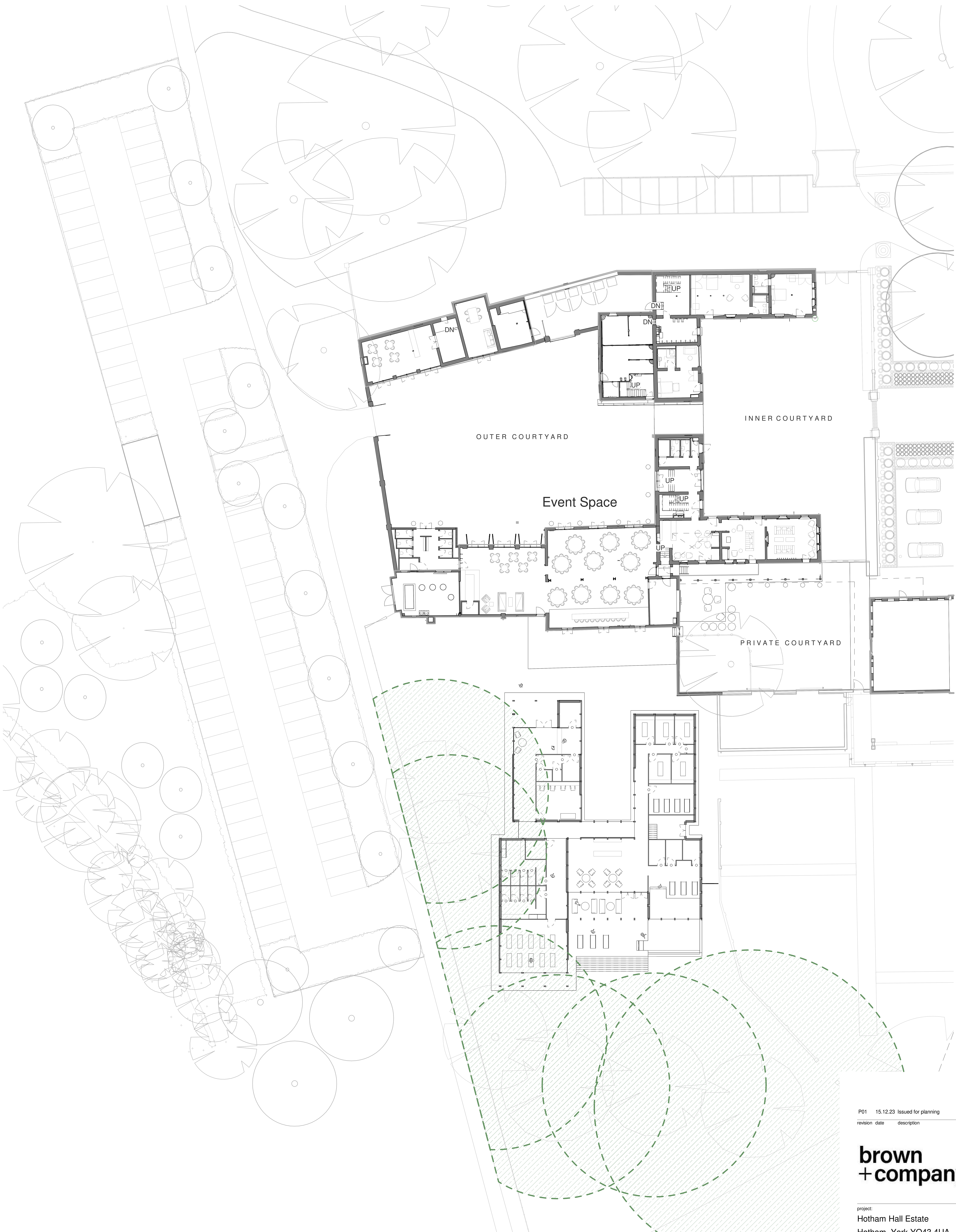

Notes

Root Protection Area - refer to Arboriculturalist report

Refer to SBA design drawings for landscape design.

revision	date	description	drwn by	ck'd
P01	15.12.23	Issued for planning	RM	NB

brown
+company

project:
Hotham Hall Estate
Hotham, York YO43 4UA

drawing:
Proposed Site Plan - Level 00

status:
Planning

scale:
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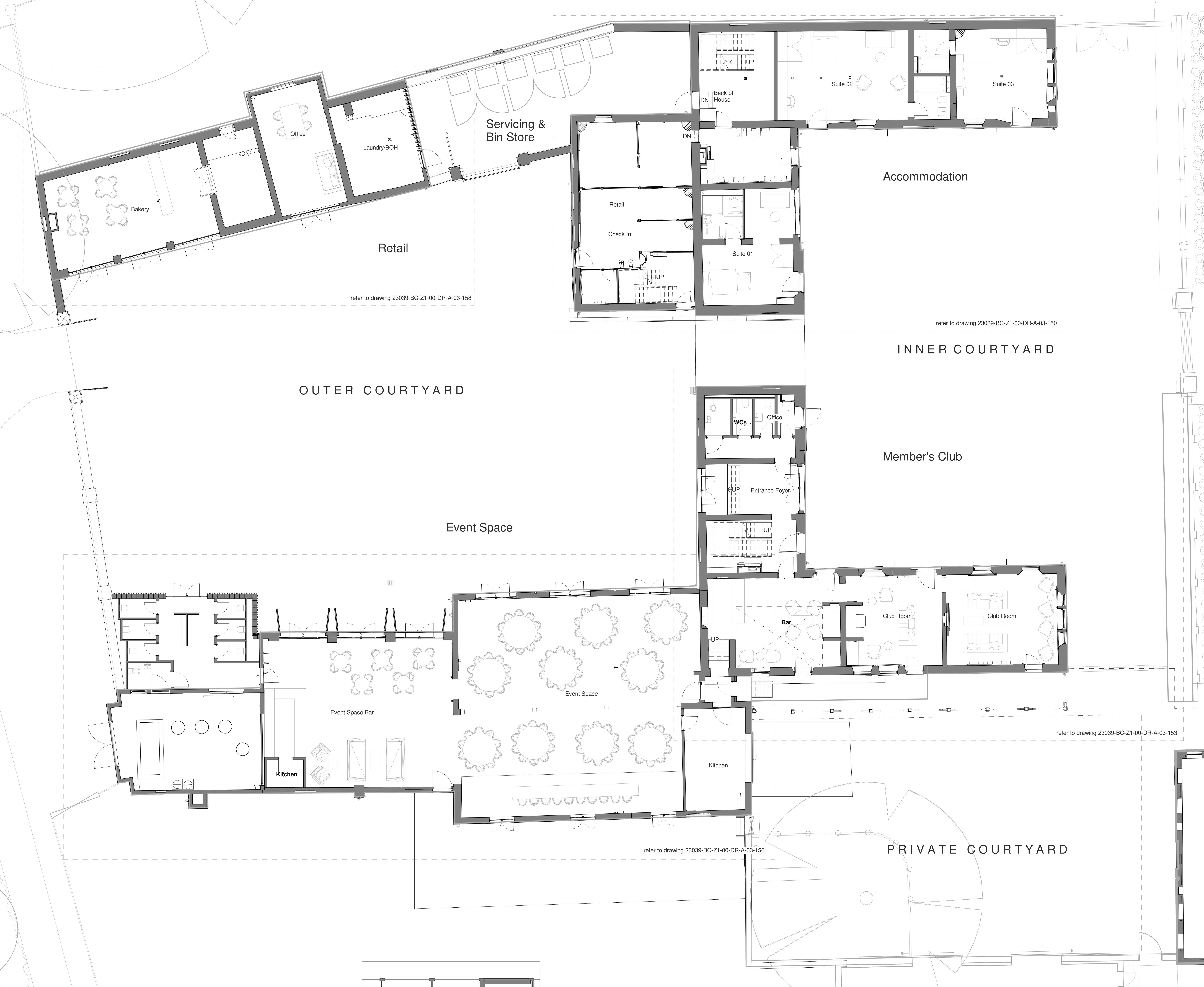

All courtyards to recieve new landscaping. Refer to SBA design for more details

revision	date	description	drawn	checked
P01	15.12.23	Issued for planning	RM	NB

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project:

Hotham Hall Estate

Hotham, York YO43 4UA

drawing:

Stable Block - Proposed Ground Floor Plan

status:

Planning

scale:

1:100

Sheet size:

A1

2 4 6 8 10

job number	author	zone	level	type	role	drawing number	revision
23039 -	BC -	Z1 -	00 -	DR -	A -	03-004	P01

Proposed Spa - Level 00

1 : 100

Notes

Root Protection Area - refer to Arboriculturalist report

Refer to SBA design drawings for landscape design.

revision	date	description	drawn	checked
P01	15.12.23	Issued for Planning	RM	EC

brown
+company

project:
Hotham Hall Estate
Hotham, York YO43 4UA

drawing:
Spa - Proposed Level 00

status:
Planning

scale: 1:100

Sheet size: A1

2 4 6 8 10

job number	author	zone	level	type	role	drawing number	revision
23039 -	BC -	Z2 -	00 -	DR -	A -	03-101	P01

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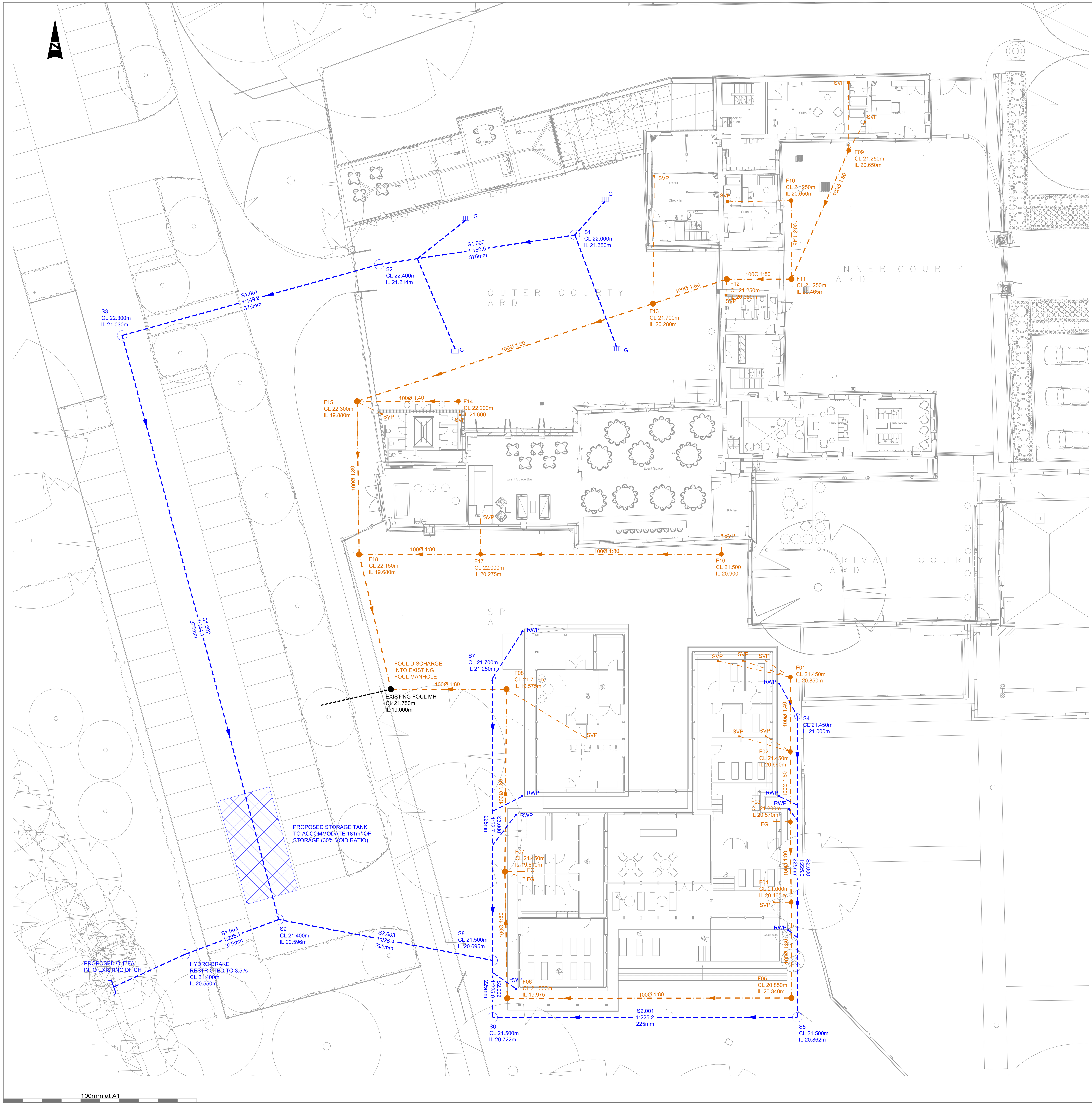
APPENDIX C

Drainage Strategy Drawing



NOTES:

1. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.
3. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.
4. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

DRAINAGE LEGEND:

(orange dashed line)	FOUL WATER PIPEWORK
(orange circle)	FOUL WATER MANHOLE
(blue dashed line)	SURFACE WATER PIPEWORK
(blue circle)	SURFACE WATER MANHOLE
(black dashed line)	SURFACE WATER PIPEWORK
(black circle)	SURFACE WATER MANHOLE
RWP	RAIN WATER PIPE
G	GULLY
FG	FLOOR GULLY
SVP	SOIL VENT PIPE

Rev	Description	Date	By	Chk	App
P1	FIRST ISSUE	18.12.23	HD	AD	--

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Project: Hotham Hall Estate,The Park, Hotham, East Yorkshire

Client: Hotham Hall Estate Ltd

Drawing: Proposed Drainage Strategy

Role: Civil Engineer

Drawing Status: FOR APPROVAL

Suitability Code: -

Job. no. 49932

Scale@ A1: 1:200

Rev. P1

Project	Originator	Volume	Level	Type	Role	Number
SBH	AWP	ZZ	XX	DR	C	3300

SBH - AWP - ZZ - XX - DR - C - 3300

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APPENDIX D

Hydraulic Model Calculations

Alan Wood and Partners		Page 1
341 Beverley Road Hull HU5 1LD	Hotham Hall	
Date 18/12/2023 File Drawnet 1.0.MDX	Designed by HD Checked by AD	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	20.464	0.136	150.5	0.065	1.00	0.0	0.600		o	225	Pipe/Conduit	
S1.001	27.591	0.184	150.0	0.015	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.002	62.543	0.920	68.0	0.181	0.00	0.0		0.017	→|↓|→		Porous Car Park	
S2.000	31.115	0.138	225.0	0.020	1.00	0.0	0.600		o	225	Pipe/Conduit	
S2.001	31.524	0.140	225.2	0.029	0.00	0.0	0.600		o	225	Pipe/Conduit	
S2.002	5.898	0.026	225.0	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.000	29.211	0.554	52.7	0.035	1.00	0.0	0.600		o	225	Pipe/Conduit	
S2.003	22.539	0.100	225.4	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	1.32	21.350	0.065	0.0	0.0	0.0	1.06	42.3	8.8
S1.001	50.00	1.75	21.214	0.080	0.0	0.0	0.0	1.07	42.4	10.8
S1.002	50.00	2.20	20.955	0.261	0.0	0.0	0.0	2.33	15119.7	35.4
S2.000	50.00	1.60	21.000	0.020	0.0	0.0	0.0	0.87	34.5	2.7
S2.001	50.00	2.20	20.862	0.049	0.0	0.0	0.0	0.87	34.5	6.6
S2.002	50.00	2.32	20.722	0.049	0.0	0.0	0.0	0.87	34.5	6.6
S3.000	50.00	1.27	21.250	0.035	0.0	0.0	0.0	1.81	71.8	4.7
S2.003	50.00	2.75	20.696	0.084	0.0	0.0	0.0	0.87	34.5	11.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.003	10.354	0.046	225.1	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.004	8.024	0.036	225.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.003	50.00	2.95	20.596	0.345	0.0	0.0	0.0	0.87	34.5«	46.7
S1.004	50.00	3.08	20.475	0.345	0.0	0.0	0.0	1.04	73.8	46.7

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	S	21.400	20.439	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S5, DS/PN: S1.004, Volume (m³): 1.4

Unit Reference	MD-SHE-0089-3500-1000-3500
Design Head (m)	1.000
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	20.550
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.000	3.5
Flush-Flo™	0.300	3.5
Kick-Flo®	0.632	2.8
Mean Flow over Head Range	-	3.1

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	2.7	1.200	3.8	3.000	5.8	7.000	8.7
0.200	3.4	1.400	4.1	3.500	6.2	7.500	9.0
0.300	3.5	1.600	4.3	4.000	6.7	8.000	9.2
0.400	3.4	1.800	4.6	4.500	7.0	8.500	9.5
0.500	3.3	2.000	4.8	5.000	7.4	9.000	9.8
0.600	3.0	2.200	5.0	5.500	7.7	9.500	10.0
0.800	3.1	2.400	5.2	6.000	8.1		
1.000	3.5	2.600	5.4	6.500	8.4		

Storage Structures for Storm

Porous Car Park Pipe: S1.002

Manning's N	0.017	Width (m)	16.0
Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	62.5
Membrane Percolation (mm/hr)	1000	Slope (1:X)	68.0
Max Percolation (l/s)	278.0	Depression Storage (mm)	5
Safety Factor	2.0	Evaporation (mm/day)	3
Porosity	0.30	Membrane Depth (mm)	0
Invert Level (m)	20.955		

Under Drain Details

Depth above Invert Level (m)	0.050	Number of Pipes	1
Diameter (m)	0.225	Manning's N	0.009

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	1	+0%	100/15 Summer				21.446
S1.001	S2	15 Summer	1	+0%	100/15 Summer				21.312
S1.002	S3	15 Summer	1	+0%					20.976
S2.000	S4	15 Summer	1	+0%					21.055
S2.001	S5	15 Summer	1	+0%	100/15 Summer				20.930
S2.002	S6	15 Summer	1	+0%	100/15 Summer				20.803
S3.000	S7	15 Summer	1	+0%					21.301
S2.003	S7	15 Summer	1	+0%	100/15 Summer				20.788
S1.003	S4	960 Winter	1	+0%	30/360 Winter				20.637
S1.004	S5	960 Winter	1	+0%	30/120 Winter				20.617

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.129	0.000	0.32			12.4	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S2	-0.127	0.000	0.38			14.9	OK	
S1.002	S3	-1.324	0.000	0.00		4	33.3	OK	
S2.000	S4	-0.170	0.000	0.11			3.7	OK	
S2.001	S5	-0.157	0.000	0.19			6.3	OK	
S2.002	S6	-0.144	0.000	0.25			6.5	OK	
S3.000	S7	-0.174	0.000	0.10			6.9	OK	
S2.003	S7	-0.133	0.000	0.35			10.9	OK	
S1.003	S4	-0.184	0.000	0.06			1.7	OK	
S1.004	S5	-0.158	0.000	0.03			1.7	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	30	+0%	100/15 Summer				21.522
S1.001	S2	15 Summer	30	+0%	100/15 Summer				21.389
S1.002	S3	15 Summer	30	+0%					21.004
S2.000	S4	15 Summer	30	+0%					21.090
S2.001	S5	15 Summer	30	+0%	100/15 Summer				20.985
S2.002	S6	15 Summer	30	+0%	100/15 Summer				20.878
S3.000	S7	15 Summer	30	+0%					21.332
S2.003	S7	15 Summer	30	+0%	100/15 Summer				20.864
S1.003	S4	480 Winter	30	+0%	30/360 Winter				20.828
S1.004	S5	480 Winter	30	+0%	30/120 Winter				20.824

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.053	0.000	0.80			30.5	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S2	-0.050	0.000	0.94			36.8	OK	
S1.002	S3	-1.296	0.000	0.01		4	72.3	OK	
S2.000	S4	-0.135	0.000	0.28			8.9	OK	
S2.001	S5	-0.102	0.000	0.56			18.0	OK	
S2.002	S6	-0.068	0.000	0.71			18.5	OK	
S3.000	S7	-0.143	0.000	0.25			17.0	OK	
S2.003	S7	-0.057	0.000	0.89			28.1	OK	
S1.003	S4	0.007	0.000	0.12			3.5	SURCHARGED	
S1.004	S5	0.049	0.000	0.06			3.5	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	100	+40%	100/15 Summer				21.940
S1.001	S2	15 Summer	100	+40%	100/15 Summer				21.666
S1.002	S3	480 Winter	100	+40%					21.180
S2.000	S4	15 Winter	100	+40%					21.194
S2.001	S5	480 Winter	100	+40%	100/15 Summer				21.183
S2.002	S6	480 Winter	100	+40%	100/15 Summer				21.182
S3.000	S7	15 Summer	100	+40%					21.366
S2.003	S7	480 Winter	100	+40%	100/15 Summer				21.182
S1.003	S4	480 Winter	100	+40%	30/360 Winter				21.180
S1.004	S5	480 Winter	100	+40%	30/120 Winter				21.176

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.365	0.000	1.29			49.4	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S2	0.227	0.000	1.45			56.9	SURCHARGED	
S1.002	S3	-1.120	0.000	0.00		132	4.5	OK	
S2.000	S4	-0.031	0.000	0.43			13.9	FLOOD RISK	
S2.001	S5	0.097	0.000	0.10			3.2	SURCHARGED	
S2.002	S6	0.235	0.000	0.11			2.9	SURCHARGED	
S3.000	S7	-0.109	0.000	0.46			31.1	OK	
S2.003	S7	0.261	0.000	0.16			4.9	SURCHARGED	
S1.003	S4	0.359	0.000	0.13			3.6	FLOOD RISK	
S1.004	S5	0.401	0.000	0.06			3.5	FLOOD RISK	

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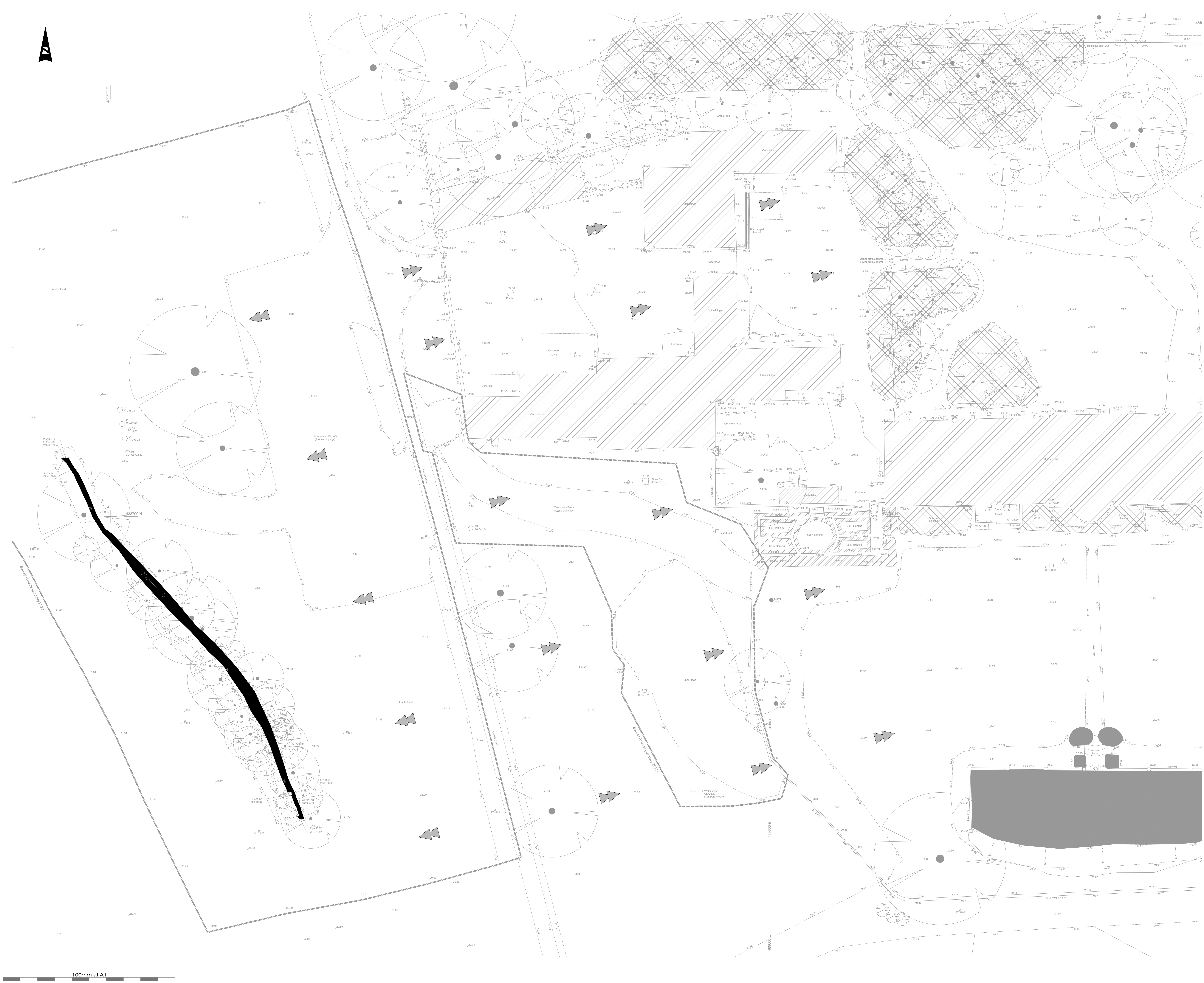
APPENDIX E

Surface Water Exceedance Flood Routing Drawings



NOTES:

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KEY

= EXISTING SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

Rev	Description	Date	By	Chk	App
P1	FIRST ISSUE	18.12.23	HD	AD	--

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Project: Stable Block, Hotham Hall Estate,The Park, Hotham, East Yorkshire

Client: Hotham Hall Estate Ltd

Drawing: Existing Surface Water Exceedance

Role: Civil Engineer

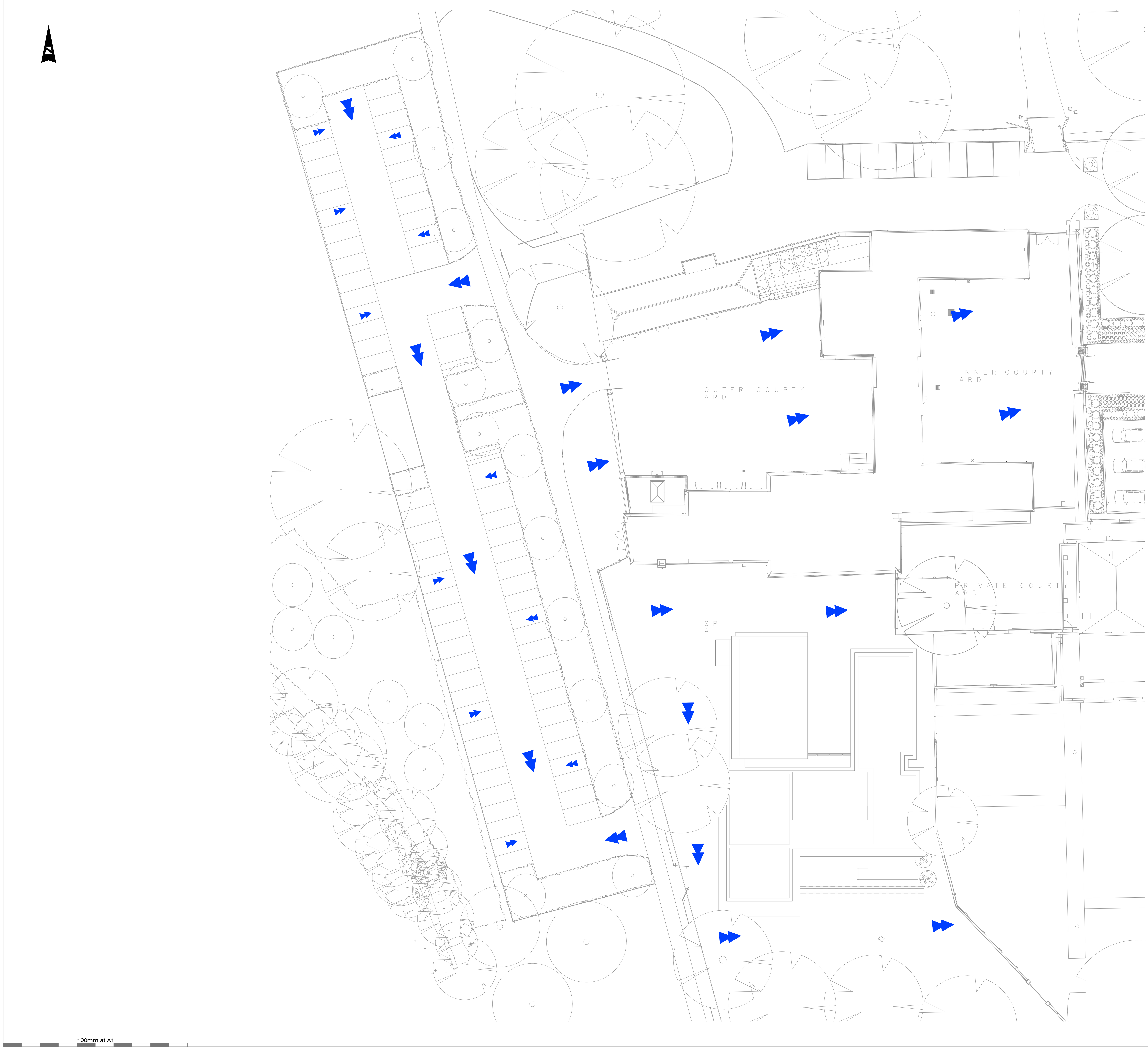
Drawing Status: FOR PPROVAL

Suitability Code: -

Job. no. 49932 | Scale@ A1: N.T.S | Rev. P1

Project	Originator	Volume	Level	Type	Role	Number
SBH	AWP	ZZ	XX	DR	C	3400

SBH - AWP - ZZ - XX - DR - C - 3400



NOTES:

1. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.
3. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.
4. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

KEY

▲ = PROPOSED SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

Rev	Description	Date	By	Chk	App
P1	FIRST ISSUE	18.12.23	HD	AD	--

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Project: Stable Block, Hotham Hall Estate,The Park, Hotham, East Yorkshire

Client: Hotham Hall Estate Ltd

Drawing: Proposed Surface Water Exceedance

Role: Civil Engineer

Drawing Status: FOR PPROVAL

Suitability Code: -

Job. no. 49932

Scale@ A1: N.T.S

Rev. P1

Project	Originator	Volume	Level	Type	Role	Number
SBH	AWP	ZZ	XX	DR	C	3401

SBH - AWP - ZZ - XX - DR - C - 3401

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