

Surface Water Drainage Technical Note

April 2026

Prepared for:

Amy Chalker

Location:

1 Wythe Cottages

Muddlers Lane

Twyford

RG10 9PR

Our reference:

96815-Chalker-MuddlersLn



Document Issue Record

Project Details	
Project:	Surface Water Drainage Technical Note
Prepared for:	Amy Chalker
Application:	Proposed erection of a two storey side extension and the installation of external cladding with changes to fenestration
Location:	1 Wythe Cottages, Muddlers Lane, Twyford, RG10 9PR
Our reference:	96815-Chalker-MuddlersLn
Issue no.:	v1.0
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1. Introduction

- 1.1. This Surface Water Drainage Technical Note has been prepared by Unda Consulting Limited on behalf of Amy Chalker, to address Condition 3 of a planning application.
- 1.2. The planning application relates to the proposed erection of a two storey side extension and the installation of external cladding with changes to fenestration. These works are proposed to be undertaken at 1 Wythe Cottages, Muddlers Lane, Twyford, RG10 9PR.
- 1.3. Post development the newly introduced roof area of the proposed extension will cover approximately 37m².
- 1.4. This report assesses the surface water drainage arrangement for the proposed development, which forms Condition 3 of a planning application. Condition 3 states the following:

Condition 3:

Prior to the commencement of development, a detailed surface water drainage strategy shall be submitted to and approved in writing by the Local Planning Authority. The strategy shall include the following:

- a) A Conceptual SuDS Strategy, outlining specific Sustainable Drainage Systems (SuDS) measures to manage on-site runoff. This shall consider the site's sandy loam soil and high groundwater susceptibility (between 0.025 and 0.5 metres below ground level). If infiltration is not feasible, appropriate attenuation methods shall be proposed.*
- b) Details of the existing drainage capacity, including confirmation of the current drainage arrangements (e.g. sewer, soakaway) and their ability to accommodate additional runoff from the development.*
- c) Evidence of runoff impact, including appropriate calculations to demonstrate that the proposed development would not result in significant additional surface water runoff. This shall have regard to the site's location within areas identified as being at risk from surface water flooding, including the 1 in 100-year, 1 in 1000-year, and 1 in 100-year plus 40% climate change flood extents.*

The development shall be carried out in full accordance with the approved drainage strategy and maintained thereafter.

Reason: This is to prevent increased flood risk from surface water run-off. Relevant policy: NPPF Section 14 (Meeting the Challenge of Climate Change, Flooding and Coastal Change), Core Strategy policy CP1 and Managing Development Delivery Local Plan policies CC09 and CC10.

- 1.5. This Technical Note provides the information required to address planning application Condition 3.

2. Existing Site

- 2.1. The site is an existing residential property (semi-detached house). The site is understood to have lawful planning permission for residential use.
- 2.2. The surrounding area is characterised by residential dwellings and agricultural land.
- 2.3. Existing plans are provided in the report Appendix.



Figure 1: Aerial view of the site and surrounding area (Source: Google Earth)

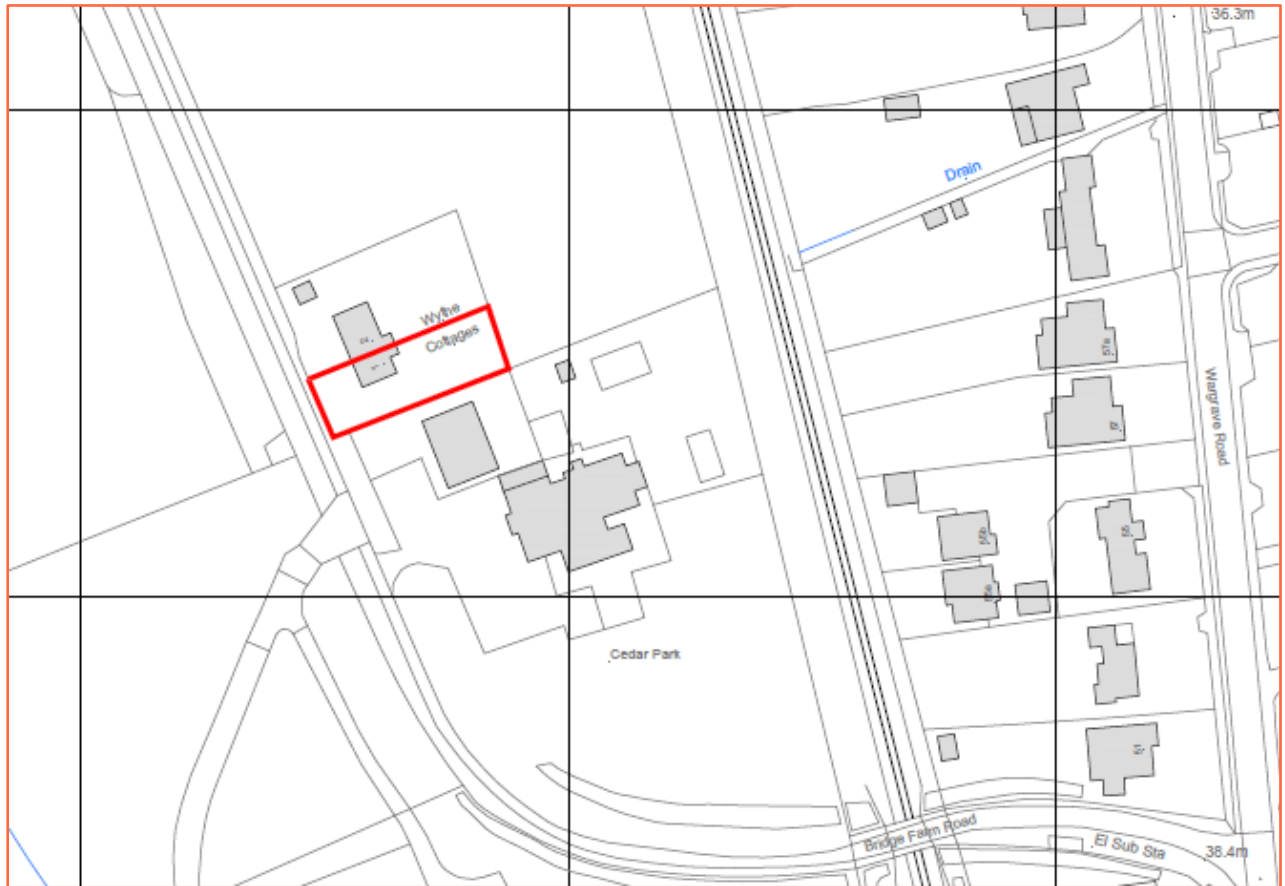


Figure 2: Site location plan (Source: Applicant)

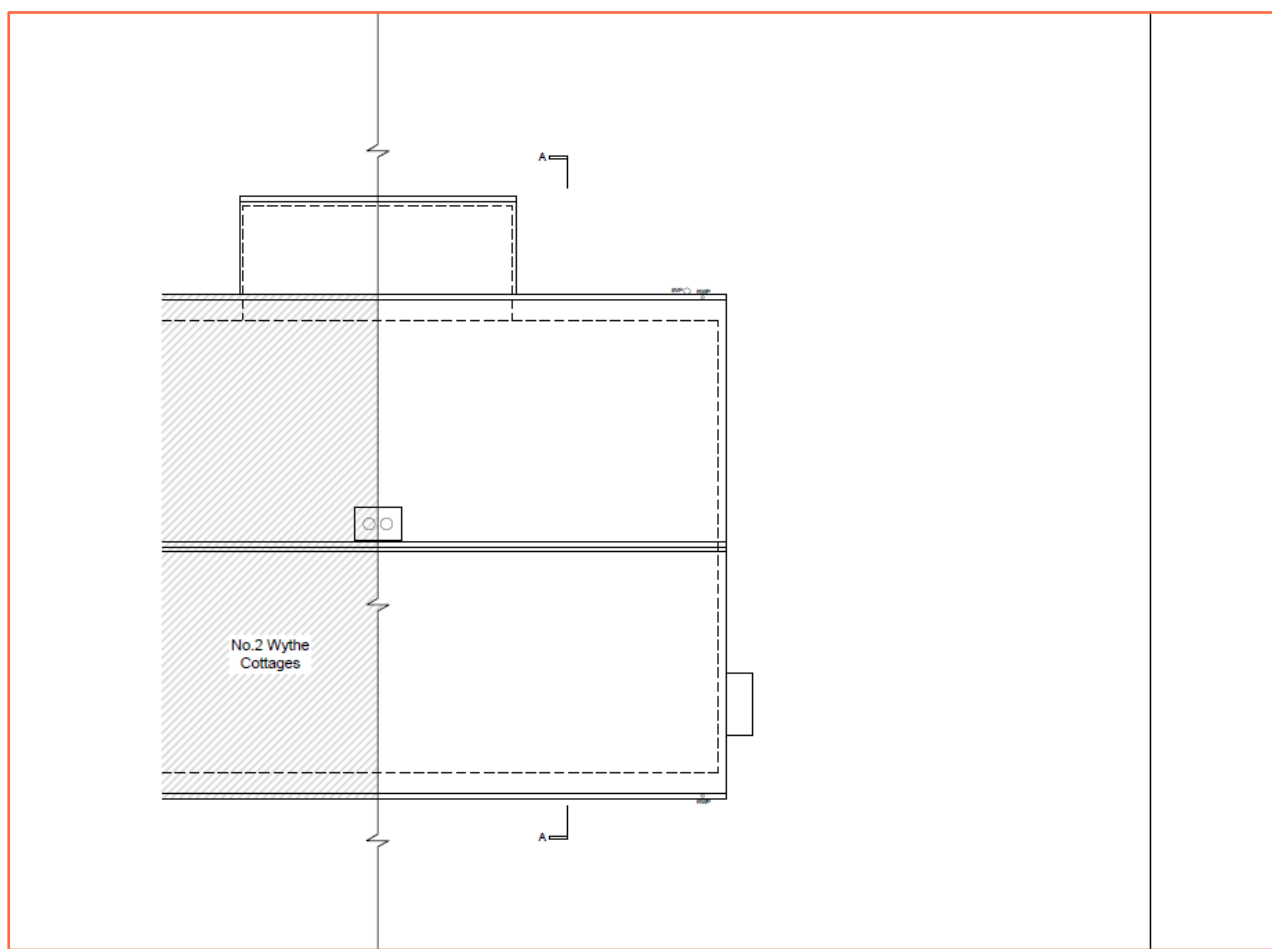


Figure 3: Existing roof plan (Source: Applicant)

Site Topography:

- 2.4. Environment Agency LiDAR has been used to assess the topography across the site and wider area. Light Detection and Ranging (LiDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground surface. Up to 100,000 measurements per second are made of the ground, allowing highly detailed terrain models to be generated at high spatial resolutions. The EA's LiDAR data archive contains digital elevation data derived from surveys carried out by the EA's specialist remote sensing team. Accurate elevation data is available for over 70% of England. The LiDAR technique records an elevation accurate to +/-5cm to 15cm with spatial resolutions ranging from 25cm to 2 metres. This dataset is derived from a combination of the full dataset which has been merged and re-sampled to give the best possible coverage. The dataset can be supplied as a Digital Surface Model (DSM) produced from the signal returned to the LiDAR (which includes heights of objects, such as vehicles, buildings and vegetation, as well as the terrain surface) or as a Digital Terrain Model (DTM) produced by removing objects from the Digital Surface Model. 1.0m horizontal resolution DTM LiDAR data has been used for the purposes of this study.
- 2.5. LiDAR remotely sensed digital elevation data suggests that the ground topography on site ranges between 34.81mAOD to 34.99mAOD.

Existing Ground Conditions:

- 2.6. The British Geological Survey (BGS) Map indicates that the bedrock underlying the site is Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) – Chalk, with superficial deposits of Kempton Park Gravel Member – Sand and Gravel.

- 2.7. The soil type in the area taken from the UKSO Website is relatively deep soils of River Terrace Sand / Gravel soil parent material, with a sand to sandy loam soil texture.
- 2.8. Ground investigations conducted in February 2026 by KRP indicated groundwater at a minimum depth of 300mm below ground level.
- 2.9. The published Environment Agency Groundwater Source Protection Zone map shows the site is located within a Zone II – Outer Protection Zone Groundwater Source Protection Zone.

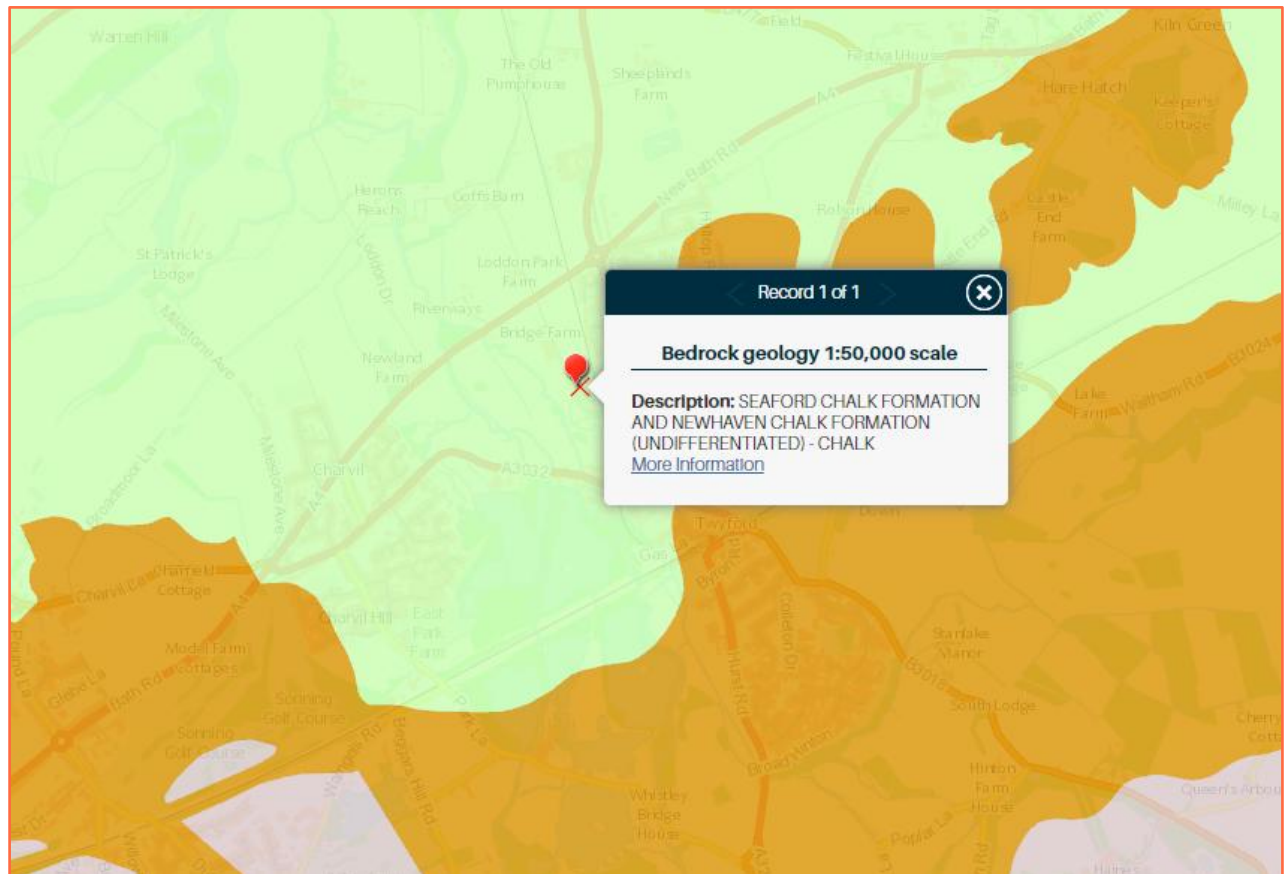


Figure 4: BGS Bedrock Geology (Source: BGS)

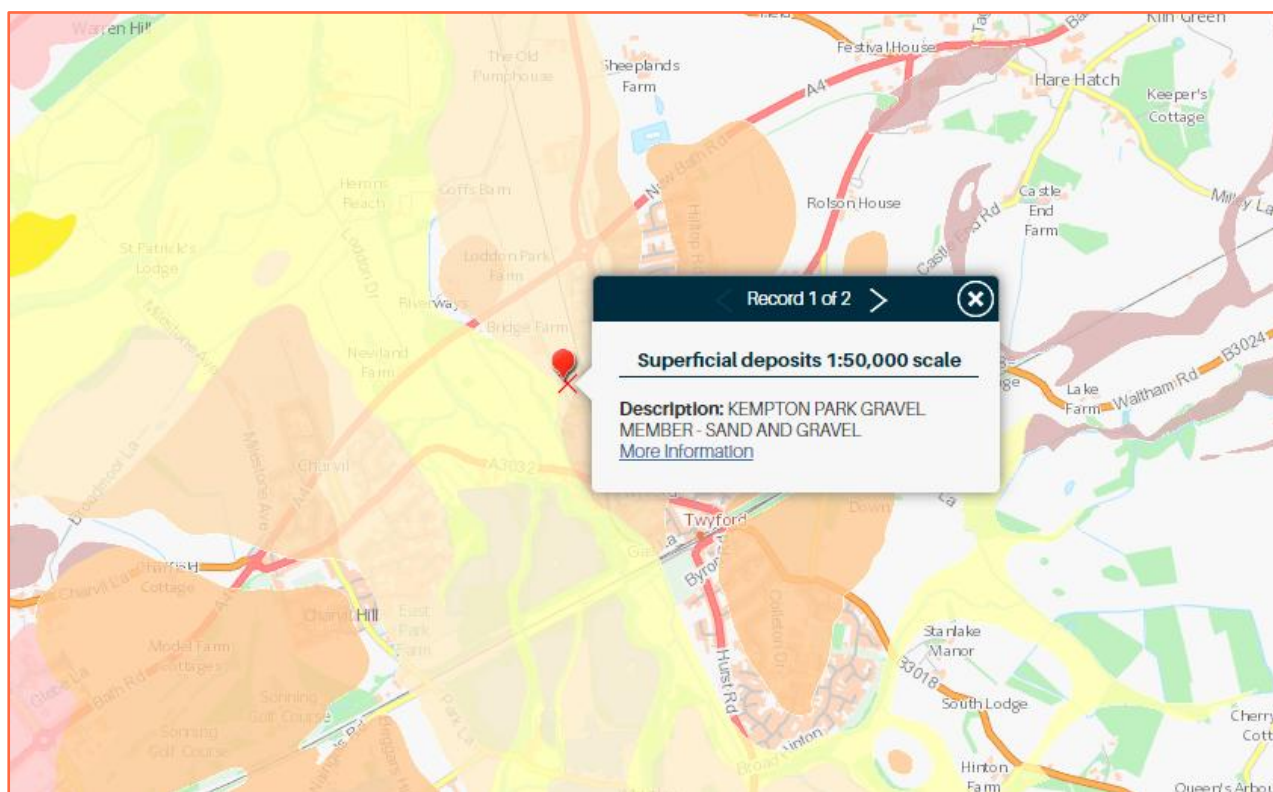


Figure 5: BGS superficial deposits (Source: BGS)

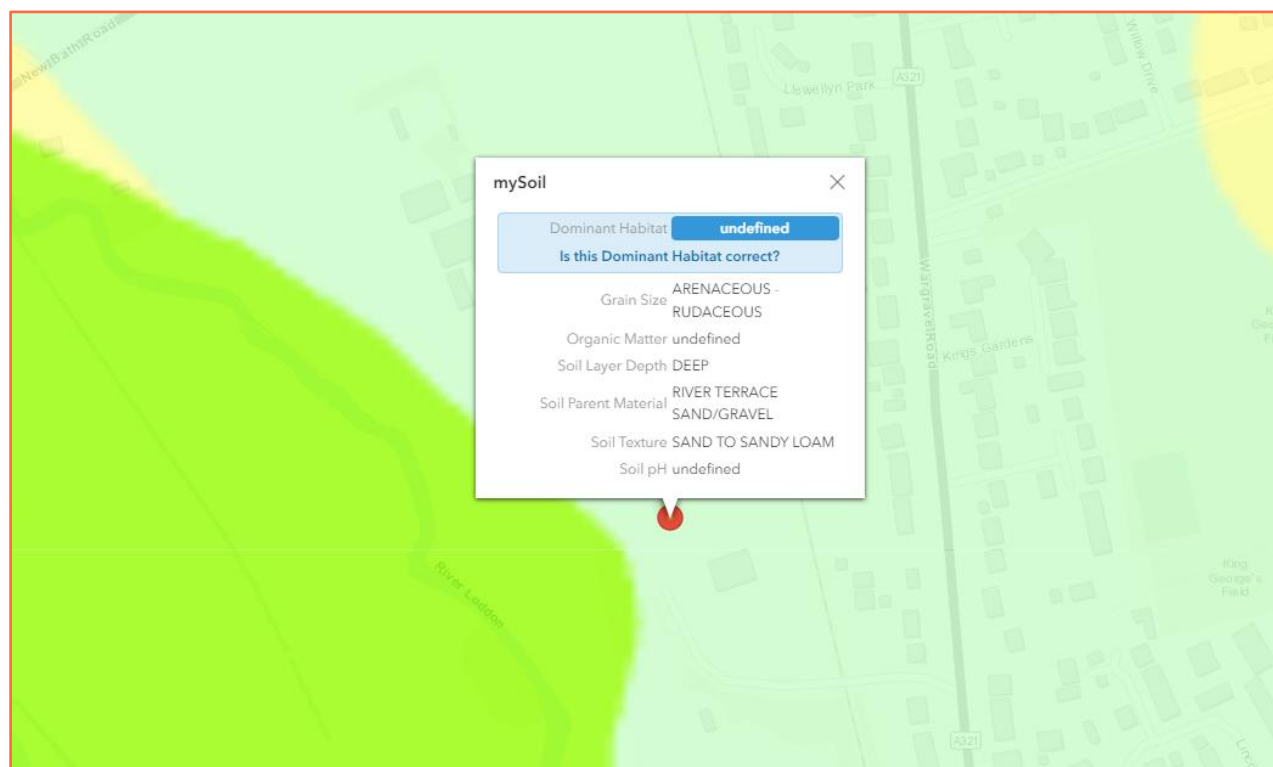


Figure 6: Soil map (Source: UK Soils, BGS)

Nearby Watercourses / Drainage Features:

- 2.10. The nearest watercourse to the site is the River Loddon approximately 112m to the west of the site. A drainage ditch is located within neighbouring land.

3. Development Proposal

- 3.1. Discharge of Surface Water Planning Condition 3 is for the proposed erection of a two storey side extension and the installation of external cladding with changes to fenestration at 1 Wythe Cottages, Muddlers Lane, Twyford, RG10 9PR.
- 3.2. Post development the newly introduced roof area of the proposed extension will cover approximately 37m².
- 3.3. Proposed plans are provided in the report Appendix.

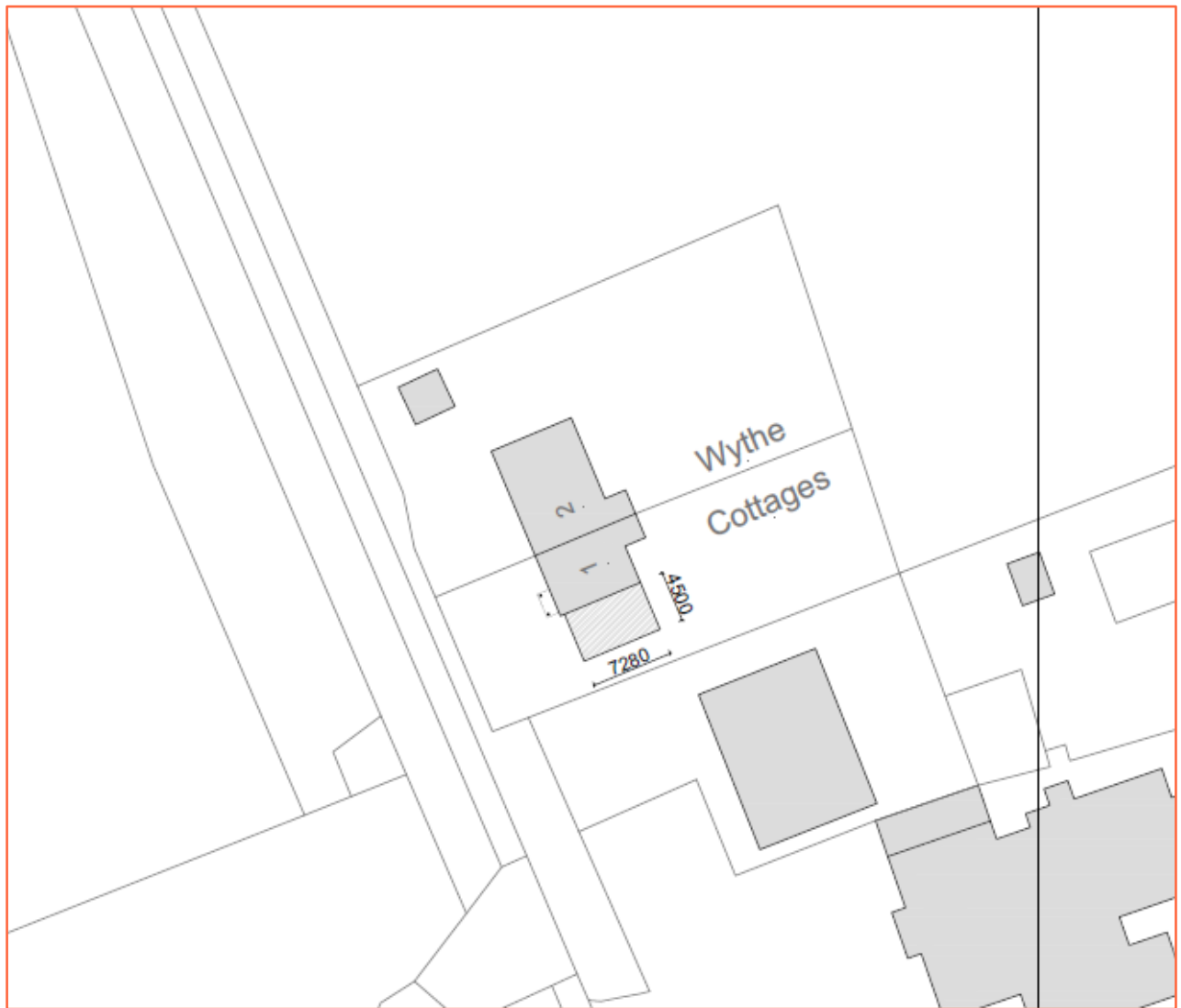


Figure 7: Proposed site block plan (Source: Applicant)

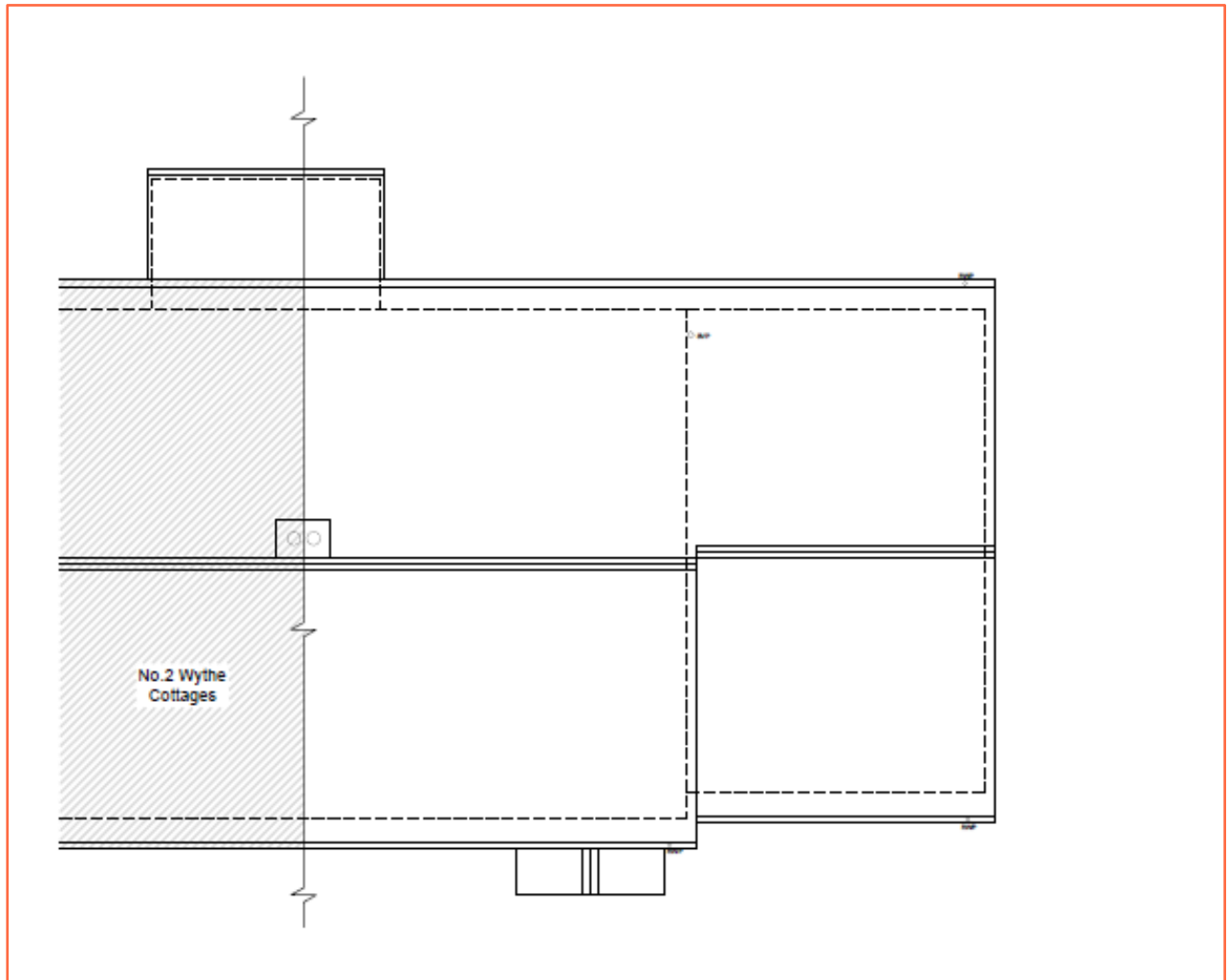


Figure 8: Proposed roof plan (Source: Applicant)

4. Surface Water Drainage Strategy

Drainage Hierarchy:

- 4.1. In order to mitigate flood risk posed by post development runoff, adequate control measures will need to be considered within the site. This will ensure that surface water runoff is dealt with at source and flood risk is not increased elsewhere.
- 4.2. The drainage strategy for the site has been prepared according to the drainage discharge hierarchy from CIRIA C753 The SuDS Manual, as follows:
 1. Infiltration to the maximum extent that is practical;
 2. Discharge to surface waters;
 3. Discharge to surface water sewer;
 4. Discharge to combined sewer.

Infiltration Potential:

- 4.3. The British Geological Survey (BGS) Map indicates that the bedrock underlying the site is Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) – Chalk, with superficial deposits of Kempton Park Gravel Member – Sand and Gravel. The soil type in the area taken from the UKSO Website is relatively deep soils of River Terrace Sand / Gravel soil parent material, with a sand to sandy loam soil texture.
- 4.4. However, ground investigations conducted in February 2026 by KRP indicated groundwater at a minimum depth of 300mm below ground level.

Proposed Discharge Rate and Location:

- 4.5. The greenfield runoff rate for the area of the site being attenuated has been calculated as 0.0 l/s for the 1:1 annual runoff event, 0.0 l/s for the 1:30 year event and 0.0 l/s for the 1:100 year event. Refer to calculations in Appendix.
- 4.6. Runoff from the roof area of the proposed extension will be directed into the partially below-ground raingarden located adjacent to the dwelling.
- 4.7. From the raingarden, runoff will then discharge to sewer at an attenuated rate of 0.1 l/s via an orifice plate. An overflow will be provided on the raingarden to allow discharge of runoff should the orifice become obstructed.
- 4.8. The Applicant has confirmed that the drainage ditch is not within their ownership and is instead on neighbouring land.
- 4.9. The remainder of the site will continue to utilise its existing drainage arrangements.

Raingarden:

- 4.10. The roof area of that will be directed into the partially below-ground raingarden amounts to approximately 37m². The attenuation within the raingarden will be provided by cellular storage crates located beneath the topsoil.
- 4.11. In order to comply with CIRIA C753 The SuDS Manual, a 10% allowance will be added to the impermeable areas to take into account future urban creep. Applying a 10% allowance to the area being attenuated including the raingarden (totalling 44m²) gives a value of 48.4m². Therefore, all drainage calculations within this assessment have been made based on a total impermeable area of 48.4m².

- 4.12. Preliminary calculations indicate that cellular storage attenuation with dimensions of 7m² x 0.40m deep x 0.95 (voids) will be sufficient to accommodate all runoff from the roof area being attenuated arising from the critical 1:100 year + 40% climate change event.
- 4.13. Preliminary calculations indicated that some 2.66m³ of storage is required to attenuate the runoff for all storms up to and including the 1 in 100 year + 40% climate change event.
- 4.14. *Please note that the levels and locations of the cellular storage within the Causeway calculations are arbitrary for modelling purposes.*
- 4.15. All preliminary surface water drainage calculations have been undertaken using Causeway software. Refer to Appendix.

Water Quality:

- 4.16. Roof water will contain negligible contaminant concentrations and does not warrant treatment. Nevertheless, it is suggested to include debris / sediment traps on any new drainage.

Design Exceedance:

- 4.17. Should the onsite drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. In the event of the drainage system failure, the runoff flow can be managed through detailing the new external levels to direct water away from structures.

Adoption and Maintenance:

- 4.18. It is proposed that all SuDS facilities will be maintained privately by the end users.
- 4.19. A draft Maintenance Schedule is outlined below.
- 4.20. In addition, it is recommended that all drainage elements are inspected following the first storm event and monthly for the first 3 months following commissioning.

Cellular Storage:

- 4.21. It is not envisaged that silt build up within the cellular crate systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits and inspection chambers on a regular basis. Notwithstanding this, a suitable maintenance regime is outlined in the table below.

Maintenance Schedule	Action	Frequency
Routine Maintenance	• Remove silt build-up from system.	Action as required.
	• Remove debris from catchment surface if it may cause risks to performance.	Action as required.
Remedial Actions	• Repair inlets, outlets and overflows.	Action as required.
Monitoring	• CCTV inspection of crates for silt build-up to establish silt removal frequencies.	Following first storm event and every five years thereafter.
	• Inspection of inlet, outlet and overflow pipework for silt accumulation to establish silt removal frequencies.	Monthly for first 3 months and annually thereafter.
	• Inspection of inlets, outlets and overflows to ensure they are functioning correctly.	Annually.

Table 1: Suggested maintenance regime for cellular storage

- 4.22. Inspection and maintenance access can be gained via inspection chambers and inlet pipework.
- 4.23. Jetting should be undertaken in accordance with current jetting guidelines, particularly the Sewer Jetting Code of Practice published by The Water Research Centre. Jetting at 150 bar at 300 l/min should be more than adequate in removing any build-up of material. However, unlike regular jetting which relies heavily on high pressure to remove hardened deposits on the inner bore of pipes, effective cleansing of a crate system relies more on the delivery flow rate to flush solids back through the system.
- 4.24. A standard jet head with rear facing nozzles should be used. The head should be fed to the far end of the crate tunnel via the nearest inspection chamber, activated and retracted. As the nozzle is removed, debris will be swept back into the inspection chamber where it can then be removed with the use of a standard gully sucker. This method will ensure the effective removal of gross solids (carrier bags, cans, leaf litter etc.) from the system. Whilst 100% removal cannot be guaranteed, it has been shown that this jetting method will also remove an element of finer material which would otherwise be 'lost' within the system.

Raingarden:

- 4.25. The cellular storage crates providing attenuation storage within the raingardens should be maintained in accordance with the cellular storage maintenance schedule as detailed above.
- 4.26. Additional maintenance requirements related to the remainder of the raingarden structure are outlined in the table below.

Maintenance Schedule	Action	Frequency
Routine Maintenance	- Remove debris and sediment build-up on soil. - Clean sediment build-up from downpipe inlet.	Action as required.
	- Provide additional water to plants. - Add mulch to soil.	Until plants are established.
Remedial Actions	- Replace plants. - Manually remove weeds. - Prune plants. - Repair raingarden outer structure.	Action as required.
Monitoring	Ensure raingarden is draining correctly.	Following storm event.
	Inspect plants	Monthly.

Table 2: Suggested maintenance regime for raingarden

Pipework, Inspection Chambers, Catchpits and Flow Controls:

- 4.27. It is not envisaged that silt build up within the pipework systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems is outlined in the table below.

Maintenance Schedule	Action	Frequency
Routine Maintenance	- Remove silt and debris from inspection chambers, catchpits and flow controls. - Cleaning of gutters and downpipe filters.	Annually or as required.
	Remove root ingress.	Action as required.
Monitoring	Inspect for silt and debris.	Every three months.
	CCTV survey of drainage system to identify alignment issues, cracked pipes or leaking joints.	Every 10 years.

Table 3: Suggested maintenance regime for pipework, inspection chambers, catchpits and flow controls

5. Discussion and Conclusion

- 5.1. This Surface Water Drainage Technical Note has been prepared by Unda Consulting Limited on behalf of Amy Chalker, to address Condition 3 of a planning application.
- 5.2. The planning application relates to the proposed erection of a two storey side extension and the installation of external cladding with changes to fenestration. These works are proposed to be undertaken at 1 Wythe Cottages, Muddlers Lane, Twyford, RG10 9PR.
- 5.3. Post development the newly introduced roof area of the proposed extension will cover approximately 37m².
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Condition 3:

Prior to the commencement of development, a detailed surface water drainage strategy shall be submitted to and approved in writing by the Local Planning Authority. The strategy shall include the following:

- d) *A Conceptual SuDS Strategy, outlining specific Sustainable Drainage Systems (SuDS) measures to manage on-site runoff. This shall consider the site's sandy loam soil and high groundwater susceptibility (between 0.025 and 0.5 metres below ground level). If infiltration is not feasible, appropriate attenuation methods shall be proposed.*
- e) *Details of the existing drainage capacity, including confirmation of the current drainage arrangements (e.g. sewer, soakaway) and their ability to accommodate additional runoff from the development.*
- f) *Evidence of runoff impact, including appropriate calculations to demonstrate that the proposed development would not result in significant additional surface water runoff. This shall have regard to the site's location within areas identified as being at risk from surface water flooding, including the 1 in 100-year, 1 in 1000-year, and 1 in 100-year plus 40% climate change flood extents.*

The development shall be carried out in full accordance with the approved drainage strategy and maintained thereafter.

Reason: This is to prevent increased flood risk from surface water run-off. Relevant policy: NPPF Section 14 (Meeting the Challenge of Climate Change, Flooding and Coastal Change), Core Strategy policy CP1 and Managing Development Delivery Local Plan policies CC09 and CC10.

- 5.5. This Technical Note provides the information required to address planning application Condition 3.
- 5.6. The site is an existing residential property (semi-detached house). The site is understood to have lawful planning permission for residential use. The surrounding area is characterised by residential dwellings and agricultural land.
- 5.7. LiDAR remotely sensed digital elevation data suggests that the ground topography on site ranges between 34.81mAOD to 34.99mAOD.
- 5.8. The British Geological Survey (BGS) Map indicates that the bedrock underlying the site is Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) – Chalk, with superficial deposits of Kempton Park Gravel Member – Sand and Gravel.
- 5.9. The soil type in the area taken from the UKSO Website is relatively deep soils of River Terrace Sand / Gravel soil parent material, with a sand to sandy loam soil texture.

- 5.10. Ground investigations conducted in February 2026 by KRP indicated groundwater at a minimum depth of 300mm below ground level.
- 5.11. The published Environment Agency Groundwater Source Protection Zone map shows the site is located within a Zone II – Outer Protection Zone Groundwater Source Protection Zone.
- 5.12. The nearest watercourse to the site is the River Loddon approximately 112m to the west of the site. A drainage ditch is located within neighbouring land.
- 5.13. The British Geological Survey (BGS) Map indicates that the bedrock underlying the site is Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) – Chalk, with superficial deposits of Kempton Park Gravel Member – Sand and Gravel. The soil type in the area taken from the UKSO Website is relatively deep soils of River Terrace Sand / Gravel soil parent material, with a sand to sandy loam soil texture.
- 5.14. However, ground investigations conducted in February 2026 by KRP indicated groundwater at a minimum depth of 300mm below ground level.
- 5.15. The greenfield runoff rate for the area of the site being attenuated has been calculated as 0.0 l/s for the 1:1 annual runoff event, 0.0 l/s for the 1:30 year event and 0.0 l/s for the 1:100 year event. Refer to calculations in Appendix.
- 5.16. Runoff from the roof area of the proposed extension will be directed into the partially below-ground raingarden located adjacent to the dwelling.
- 5.17. From the raingarden, runoff will then discharge to sewer at an attenuated rate of 0.1 l/s via an orifice plate. An overflow will be provided on the raingarden to allow discharge of runoff should the orifice become obstructed.
- 5.18. The Applicant has confirmed that the drainage ditch is not within their ownership and is instead on neighbouring land.
- 5.19. The remainder of the site will continue to utilise its existing drainage arrangements.
- 5.20. The roof area of that will be directed into the partially below-ground raingarden amounts to approximately 37m². The attenuation within the raingarden will be provided by cellular storage crates located beneath the topsoil.
- 5.21. In order to comply with CIRIA C753 The SuDS Manual, a 10% allowance will be added to the impermeable areas to take into account future urban creep. Applying a 10% allowance to the area being attenuated including the raingarden (totalling 44m²) gives a value of 48.4m². Therefore, all drainage calculations within this assessment have been made based on a total impermeable area of 48.4m².
- 5.22. Preliminary calculations indicate that cellular storage attenuation with dimensions of 7m² x 0.40m deep x 0.95 (voids) will be sufficient to accommodate all runoff from the roof area being attenuated arising from the critical 1:100 year + 40% climate change event.
- 5.23. Preliminary calculations indicated that some 2.66m³ of storage is required to attenuate the runoff for all storms up to and including the 1 in 100 year + 40% climate change event.
- 5.24. Roof water will contain negligible contaminant concentrations and does not warrant treatment. Nevertheless, it is suggested to include debris / sediment traps on any new drainage.
- 5.25. It is proposed that all SuDS facilities will be maintained privately by the end users. A draft Maintenance Schedule is outlined within the report.

- 5.26. Should the onsite drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. In the event of the drainage system failure, the runoff flow can be managed through detailing the new external levels to direct water away from structures.

This drainage strategy has been undertaken in accordance with the principles set out in NPPF. We can conclude that providing the development adheres to the conditions advised above, the said development proposals can be accommodated without increasing flood risk within the locality in accordance with objectives set by Central Government and the EA.

**Unda Consulting Limited
April 2026**

Appendix

A – Development Plans:

- Site location, existing and proposed plans – Applicant.

B – Site Investigations:

- Site Investigations – KRP.

C – Causeway Calculations:

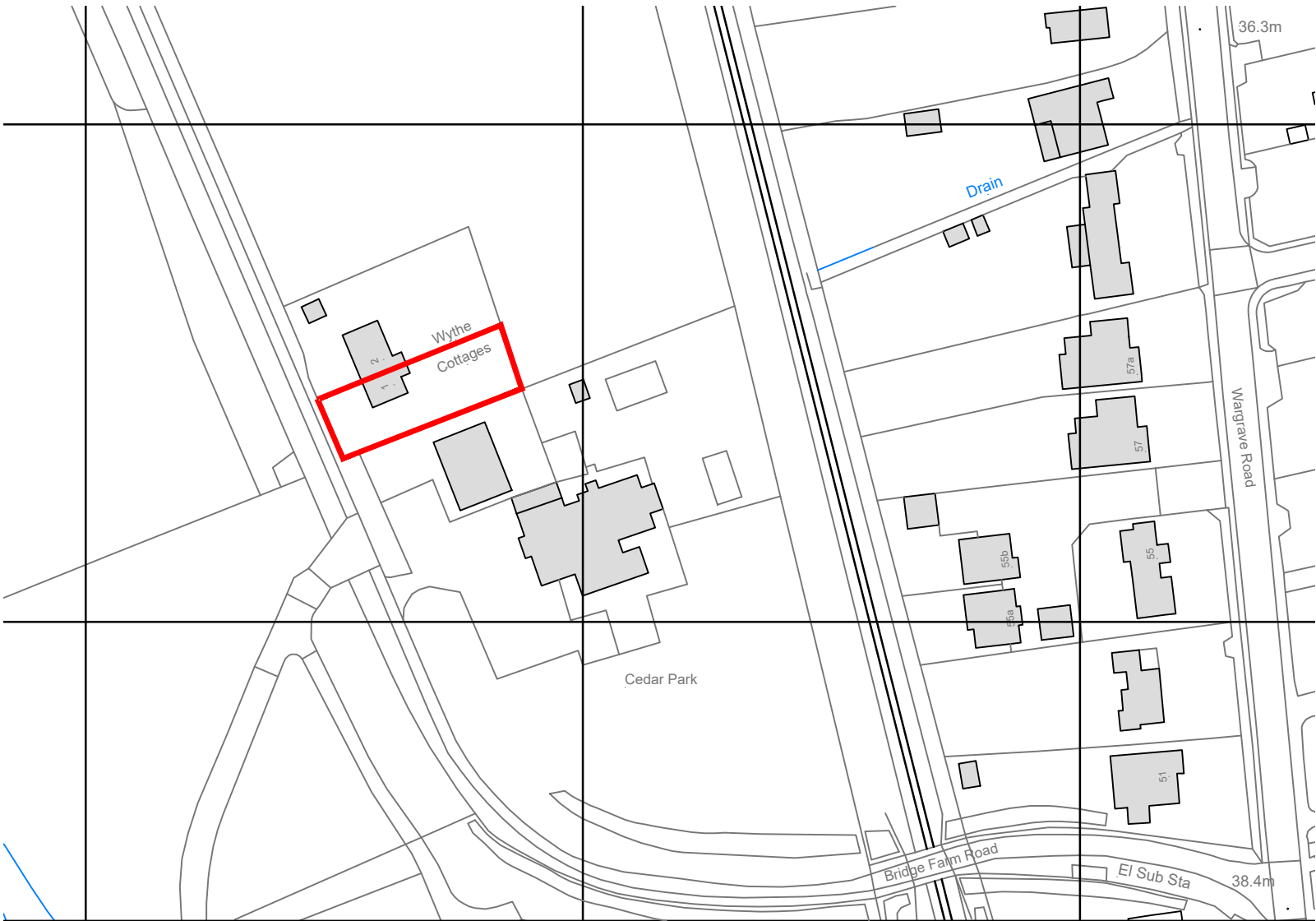
- IH124 Pre-Development Greenfield Runoff Calculations for the area of the site being attenuated;
- Cellular Storage (Depth/Area/Inf Area Storage Structure) Calculations.

D – Drainage Layout Plans:

- Proposed Drainage Layout [96815-01].

Appendix A

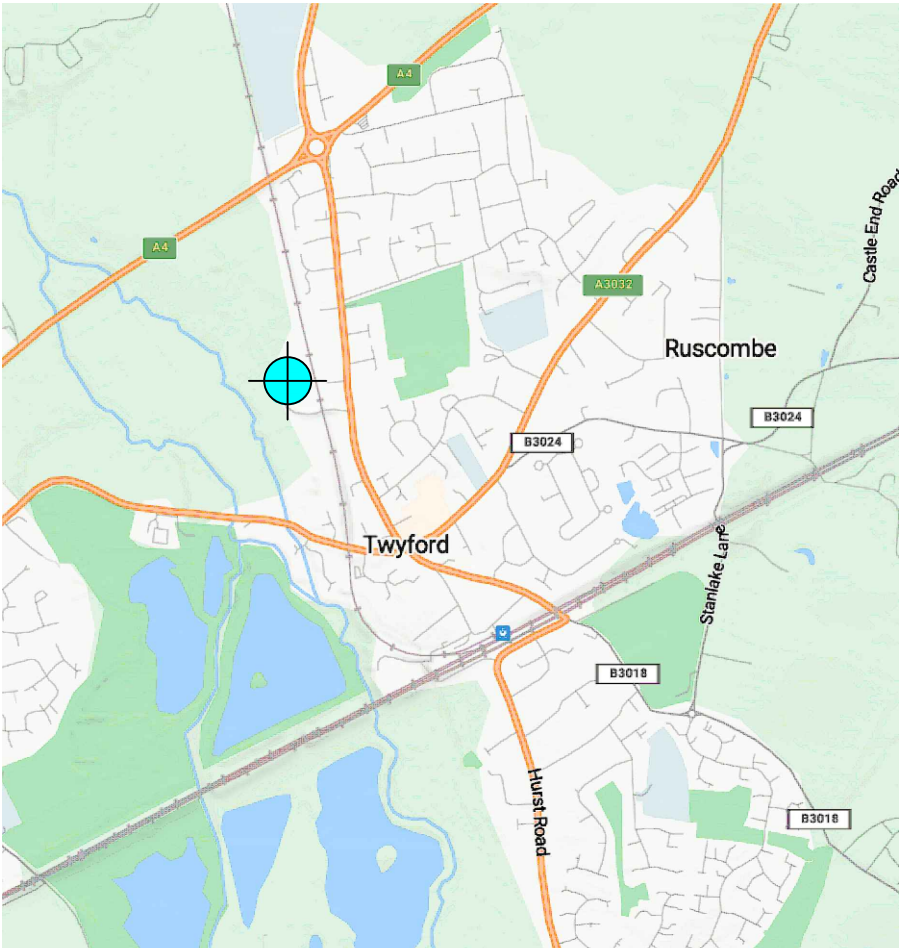
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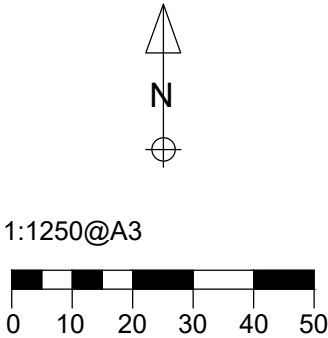
Location Plan

Scale 1:1250



Orientation Plan

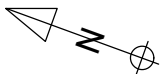
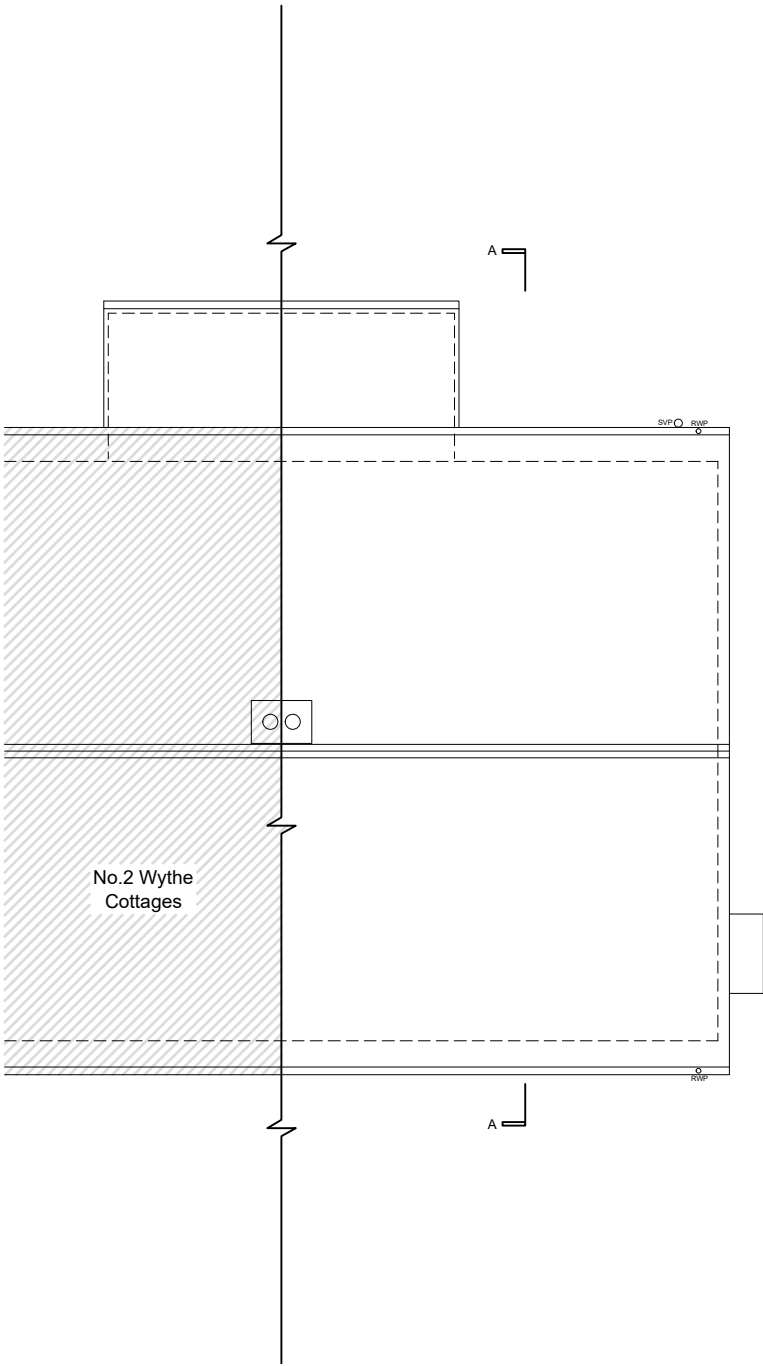
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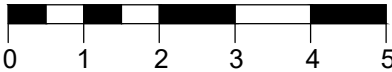
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Drawing Title: Location and Orientation Plans		
Project: 1 Wythe Cottages, Muddlers Lane Twyford RG10 9PR	Scale: 1:1250@A3	Date: Sept 24
	Revision: A	
Drawing No.: 1 S01		

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Existing Roof Plan
Scale 1:100



1:100@A3

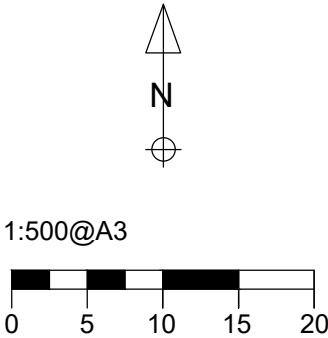


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Rev	Description	Date
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Ms A Chalker		
Drawing Title:		
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Project:	1 Wythe Cottages, Muddlers Lane Twyford RG10 9PR	Scale:
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		Date:
		Sept 24
Drawing No.:	Revision:	
1 S04		B

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Site Plan
Scale 1:500

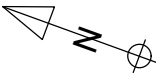
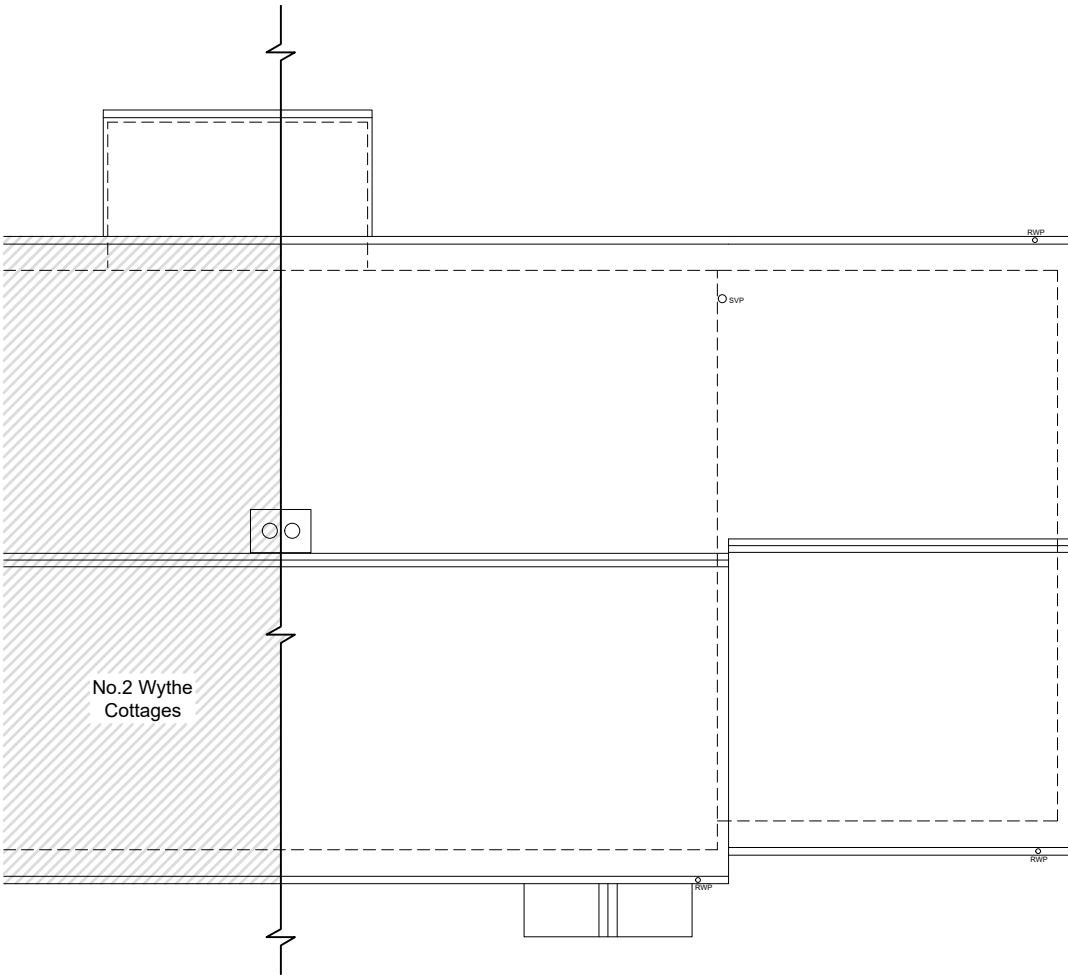


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Rev	Description	Date
Client: Ms A Chalker		
Drawing Title: Proposed site plan		
Project: 1 Wythe Cottages, Muddlers Lane Twyford RG10 9PR	Scale:	1:500@A3
	Date:	Feb 25
Drawing No.: 1 P01		Revision: A

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Client:		
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Drawing Title:		
Proposed Roof Plan		
Project:	1 Wythe Cottages, Muddlers Lane Twyford RG10 9PR	Scale:
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		Date:
		Feb 25
Drawing No.:		Revision:
1 P03		A

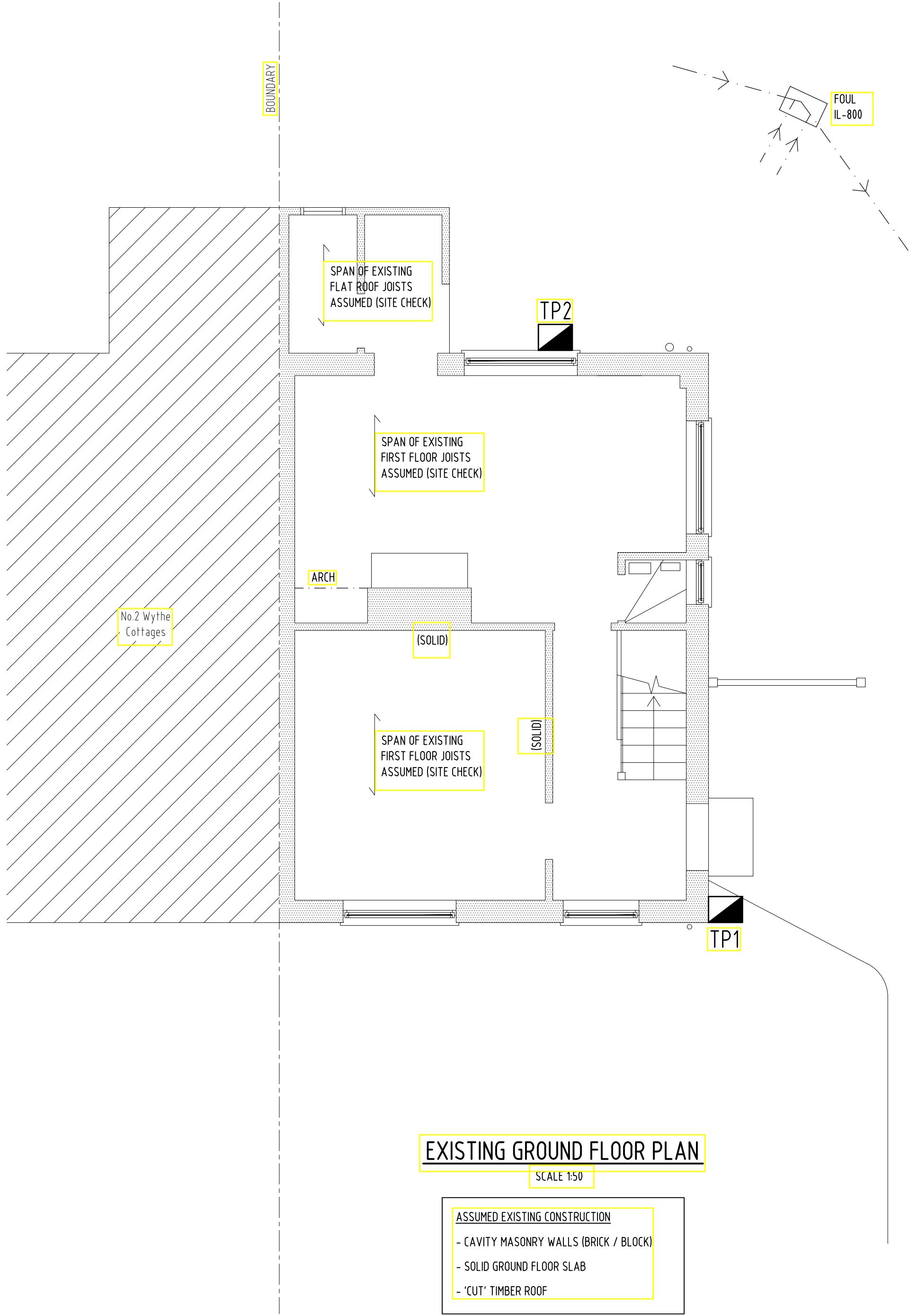
Proposed Roof Plan
Scale 1:100



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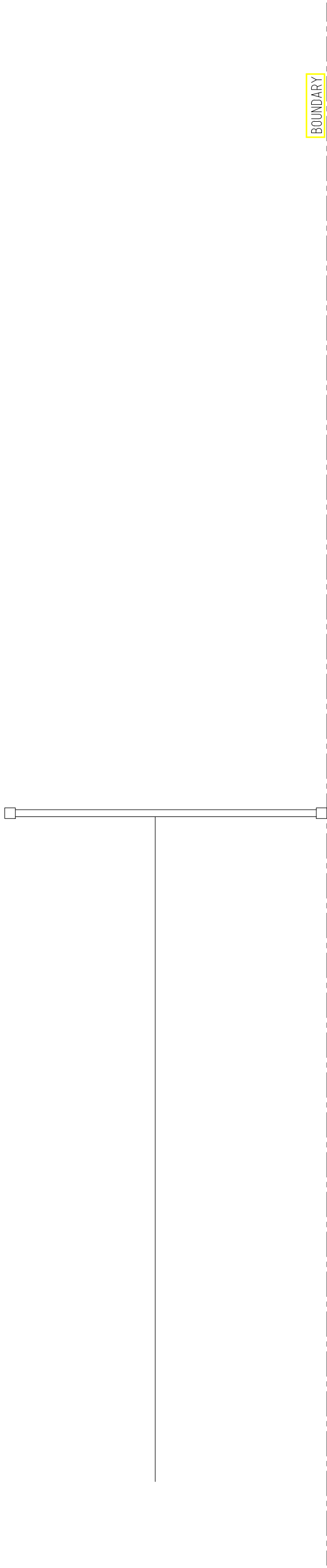
Appendix B



EXISTING GROUND FLOOR PLAN

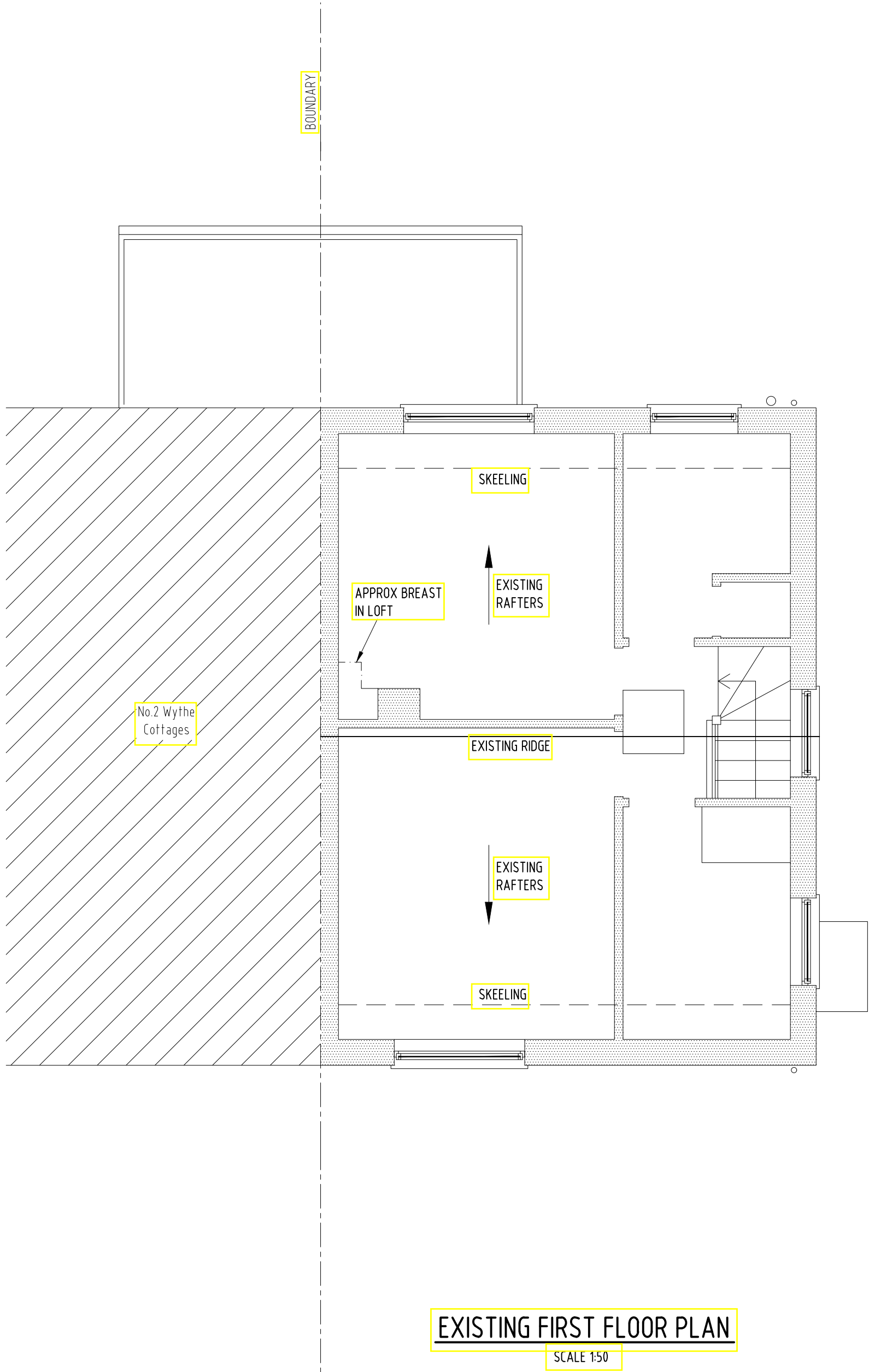
SCALE 1:50

ASSUMED EXISTING CONSTRUCTION
- CAVITY MASONRY WALLS (BRICK / BLOCK)
- SOLID GROUND FLOOR SLAB
- 'CUT' TIMBER ROOF



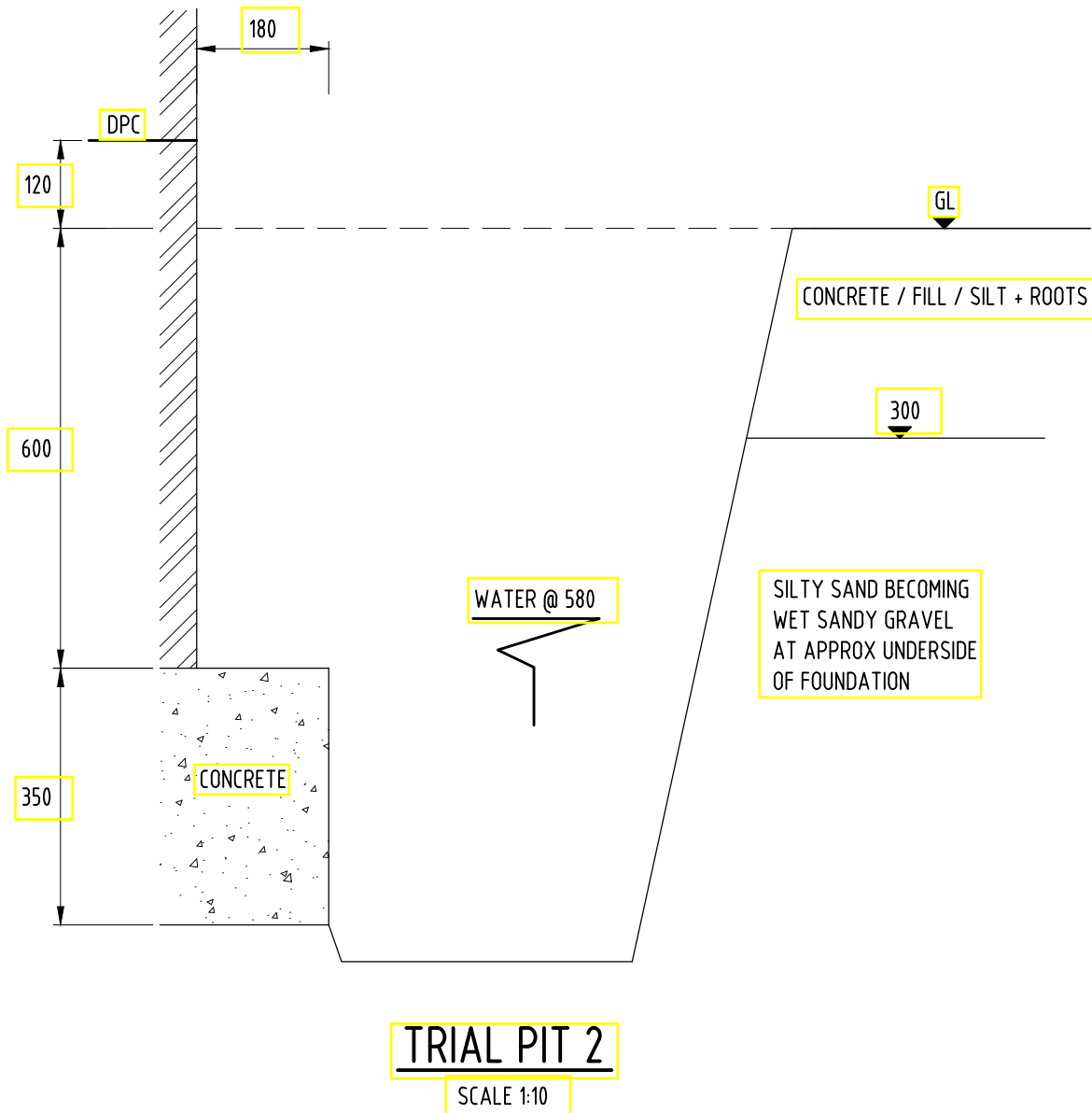
TRIAL PIT 1

SCALE 1:10



EXISTING FIRST FLOOR PLAN

SCALE 1:50



TRIAL PIT 2

SCALE 1:10

NOTES

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ARCHITECT'S DRAWINGS.
2. DETAILS SHOWN ARE INDICATIVE & MUST BE VERIFIED ON SITE BY THE CONTRACTOR.

THE CONTRACTOR IS TO BE RESPONSIBLE FOR PROVIDING ALL NECESSARY HEALTH & SAFETY REQUIREMENTS, INCLUDING ALL NECESSARY PERSONAL PROTECTIVE EQUIPMENT, SITE SECURITY, SCAFFOLDING, ACCESS LADDERS, MATERIAL, HOISTS, TEMPORARY PROTECTION AND WORKING PLATFORMS, ETC., WHICH ARE TO BE ERECTED, MAINTAINED, CERTIFICATED, DISMANTLED AND REMOVED BY SUITABLY QUALIFIED AND INSURED SPECIALISTS. THE CONTRACTOR IS REMINDED OF THEIR LIABILITY TO ENSURE DUE CARE, ATTENTION AND CONSIDERATION IS GIVEN IN REGARD TO SAFE PRACTICE IN COMPLIANCE WITH THE HEALTH & SAFETY AT WORK ACT 1974, WITH ANY SUBSEQUENT REVISIONS.

Rev	Date	Amendment
Issue		
Client		
MS. A. CHALKER		
Job title		
WYTHE COTTAGES MUDDLERS LANE TWYFORD RG10 9PR		
Drawing Title		
PROPOSED EXTENSION & ALTERATIONS SITE INVESTIGATION		
Scale	1:50, 1:20, 1:10	Date FEB 2026
Drawn By	BJP	Checked By KRP
Drwg No.	2611 / SI	Rev.

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Appendix C



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
MH1	0.005	5.00	10.000	100.000	100.000	0.401	9.599

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	1 year (l/s)	0.0
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	0.0
Summer CV	0.750	Additional Storage (m³/ha)	0.0	100 year (l/s)	0.0
Winter CV	0.840	Starting Level (m)		Check Discharge Volume	x
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.004	Betterment (%)	0
SAAR (mm)	648	QBar	0.0
Soil Index	2	Q 1 year (l/s)	0.0
SPR	0.30	Q 30 year (l/s)	0.0
Region	6	Q 100 year (l/s)	0.0
Growth Factor 1 year	0.85		

Node MH1 Online Orifice Control

Flap Valve	x	Invert Level (m)	9.599	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.010		

Node MH1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	9.599
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	7.0	0.0	0.400	7.0	0.0	0.401	0.0	0.0



Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
180 minute winter	MH1	152	9.993	0.394	0.8	2.6221	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
180 minute winter	MH1	Orifice	0.1	2.4



Results for 100 year +40% CC 15 minute summer. 255 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	MH1	19	9.805	0.206	3.3	1.3677	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute summer	MH1	Orifice	0.1	1.1



Results for 100 year +40% CC 15 minute winter. 255 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	MH1	19	9.829	0.230	3.5	1.5318	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
15 minute winter	MH1	Orifice	0.1	1.1



Results for 100 year +40% CC 30 minute summer. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
30 minute summer	MH1	33	9.864	0.265	3.0	1.7622	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
30 minute summer	MH1	Orifice	0.1	1.3



Results for 100 year +40% CC 30 minute winter. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
30 minute winter	MH1	33	9.897	0.298	2.7	1.9793	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
30 minute winter	MH1	Orifice	0.1	1.4



Results for 100 year +40% CC 60 minute summer. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute summer	MH1	62	9.911	0.312	2.2	2.0738	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
60 minute summer	MH1	Orifice	0.1	1.6



Results for 100 year +40% CC 60 minute winter. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	MH1	61	9.952	0.353	1.8	2.3462	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
60 minute winter	MH1	Orifice	0.1	1.7



Results for 100 year +40% CC 120 minute summer. 360 minute analysis at 2 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
120 minute summer	MH1	110	9.944	0.345	1.4	2.2928	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
120 minute summer	MH1	Orifice	0.1	1.9



Results for 100 year +40% CC 120 minute winter. 360 minute analysis at 2 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
120 minute winter	MH1	118	9.989	0.390	1.1	2.5935	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
120 minute winter	MH1	Orifice	0.1	2.1



Results for 100 year +40% CC 180 minute summer. 420 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
180 minute summer	MH1	144	9.950	0.351	1.1	2.3363	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
180 minute summer	MH1	Orifice	0.1	2.2



Results for 100 year +40% CC 180 minute winter. 420 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
180 minute winter	MH1	152	9.993	0.394	0.8	2.6221	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
180 minute winter	MH1	Orifice	0.1	2.4



Results for 100 year +40% CC 240 minute summer. 480 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
240 minute summer	MH1	176	9.943	0.344	0.9	2.2869	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
240 minute summer	MH1	Orifice	0.1	2.5



Results for 100 year +40% CC 240 minute winter. 480 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
240 minute winter	MH1	188	9.983	0.384	0.7	2.5542	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
240 minute winter	MH1	Orifice	0.1	2.6



Results for 100 year +40% CC 360 minute summer. 600 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
360 minute summer	MH1	248	9.961	0.362	0.7	2.4070	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
360 minute summer	MH1	Orifice	0.1	3.2



Results for 100 year +40% CC 360 minute winter. 600 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
360 minute winter	MH1	264	9.978	0.379	0.5	2.5182	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
360 minute winter	MH1	Orifice	0.1	3.2



Results for 100 year +40% CC 480 minute summer. 720 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
480 minute summer	MH1	312	9.924	0.325	0.5	2.1608	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
480 minute summer	MH1	Orifice	0.1	3.3



Results for 100 year +40% CC 480 minute winter. 720 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
480 minute winter	MH1	336	9.978	0.379	0.4	2.5179	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
480 minute winter	MH1	Orifice	0.1	3.8



Results for 100 year +40% CC 600 minute summer. 840 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
600 minute summer	MH1	390	9.918	0.319	0.4	2.1236	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
600 minute summer	MH1	Orifice	0.1	3.4



Results for 100 year +40% CC 600 minute winter. 840 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
600 minute winter	MH1	420	9.955	0.356	0.3	2.3686	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
600 minute winter	MH1	Orifice	0.1	4.2



Results for 100 year +40% CC 720 minute summer. 960 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
720 minute summer	MH1	450	9.895	0.296	0.4	1.9699	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
720 minute summer	MH1	Orifice	0.1	3.4



Results for 100 year +40% CC 720 minute winter. 960 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
720 minute winter	MH1	480	9.925	0.326	0.3	2.1711	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
720 minute winter	MH1	Orifice	0.1	4.0



Results for 100 year +40% CC 960 minute summer. 1200 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
960 minute summer	MH1	570	9.854	0.255	0.3	1.6935	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
960 minute summer	MH1	Orifice	0.1	3.4



Results for 100 year +40% CC 960 minute winter. 1200 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
960 minute winter	MH1	600	9.885	0.286	0.2	1.9043	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
960 minute winter	MH1	Orifice	0.1	4.1



Results for 100 year +40% CC 1440 minute summer. 1680 minute analysis at 30 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
1440 minute summer	MH1	930	9.817	0.218	0.2	1.4478	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
1440 minute summer	MH1	Orifice	0.1	3.2



Results for 100 year +40% CC 1440 minute winter. 1680 minute analysis at 30 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
1440 minute winter	MH1	1020	9.776	0.177	0.1	1.1752	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
1440 minute winter	MH1	Orifice	0.1	3.6



Results for 100 year +40% CC 2160 minute summer. 2400 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
2160 minute summer	MH1	1320	9.756	0.157	0.1	1.0455	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
2160 minute summer	MH1	Orifice	0.1	2.9



Results for 100 year +40% CC 2160 minute winter. 2400 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
2160 minute winter	MH1	1440	9.787	0.188	0.1	1.2500	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
2160 minute winter	MH1	Orifice	0.1	4.3



Results for 100 year +40% CC 2880 minute summer. 3120 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
2880 minute summer	MH1	1680	9.756	0.157	0.1	1.0455	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
2880 minute summer	MH1	Orifice	0.1	2.9



Results for 100 year +40% CC 2880 minute winter. 3120 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
2880 minute winter	MH1	1800	9.787	0.188	0.1	1.2500	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
2880 minute winter	MH1	Orifice	0.1	4.3



Results for 100 year +40% CC 4320 minute summer. 4560 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
4320 minute summer	MH1	2400	9.756	0.157	0.1	1.0455	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
4320 minute summer	MH1	Orifice	0.1	2.9



Results for 100 year +40% CC 4320 minute winter. 4560 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
4320 minute winter	MH1	2400	9.756	0.157	0.1	1.0455	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
4320 minute winter	MH1	Orifice	0.1	2.9



Results for 100 year +40% CC 5760 minute summer. 6000 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
5760 minute summer	MH1	3060	9.733	0.134	0.1	0.8900	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
5760 minute summer	MH1	Orifice	0.1	2.2



Results for 100 year +40% CC 5760 minute winter. 6000 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
5760 minute winter	MH1	60	9.599	0.000	0.0	0.0000	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
5760 minute winter	MH1	Orifice	0.0	0.0



Results for 100 year +40% CC 7200 minute summer. 7440 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
7200 minute summer	MH1	3720	9.655	0.056	0.1	0.3707	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
7200 minute summer	MH1	Orifice	0.0	0.7



Results for 100 year +40% CC 7200 minute winter. 7440 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
7200 minute winter	MH1	60	9.599	0.000	0.0	0.0000	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
7200 minute winter	MH1	Orifice	0.0	0.0



Results for 100 year +40% CC 8640 minute summer. 8880 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
8640 minute summer	MH1	60	9.599	0.000	0.0	0.0000	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
8640 minute summer	MH1	Orifice	0.0	0.0



Results for 100 year +40% CC 8640 minute winter. 8880 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
8640 minute winter	MH1	60	9.599	0.000	0.0	0.0000	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
8640 minute winter	MH1	Orifice	0.0	0.0

Results for 100 year +40% CC 10080 minute summer. 10320 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
10080 minute summer	MH1	60	9.599	0.000	0.0	0.0000	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
10080 minute summer	MH1	Orifice	0.0	0.0

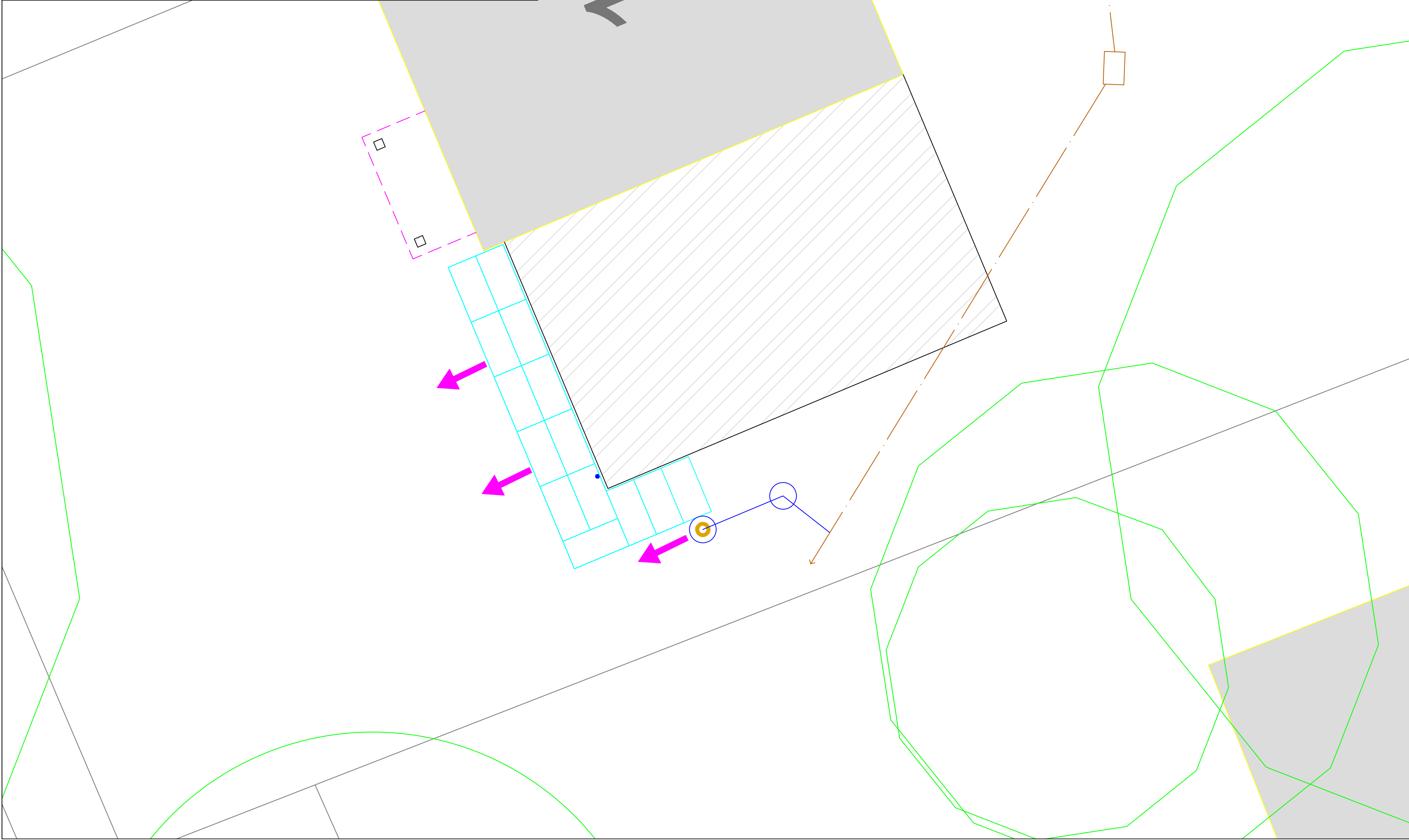
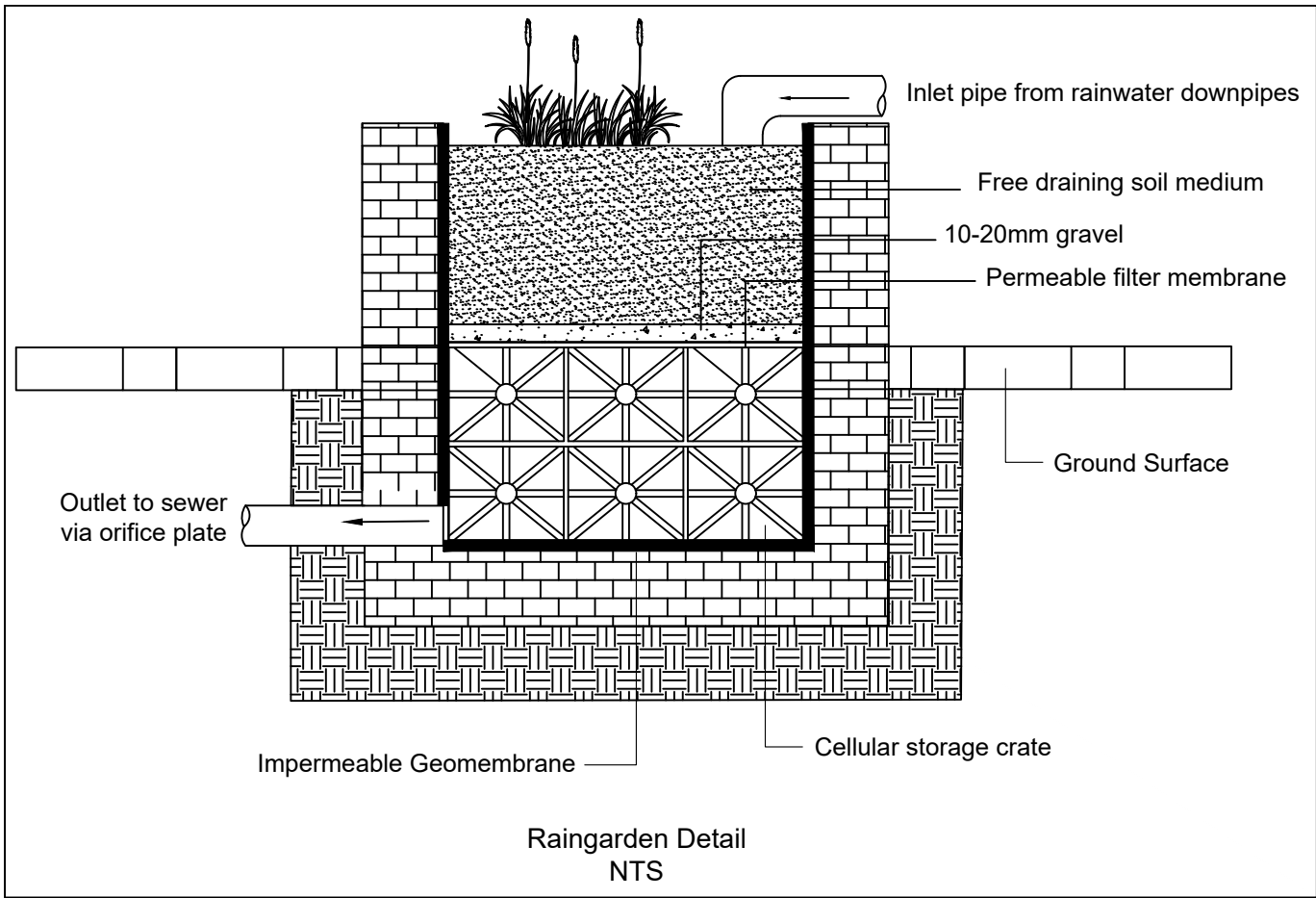


Results for 100 year +40% CC 10080 minute winter. 10320 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
10080 minute winter	MH1	60	9.599	0.000	0.0	0.0000	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
10080 minute winter	MH1	Orifice	0.0	0.0

Appendix D



Notes:

1. Discharge of surface water via raingarden. Preliminary calculations indicate that sufficient storage required to attenuate runoff arising from the roof area of the proposed extension, during the critical 1 in 100 year + 40% Climate Change event, can be provided within cellular storage of dimensions 7m² x 0.40m deep x 0.95 (voids).

Legend

- Proposed Raingarden
- Proposed Surface Water Downpipe
- Proposed Surface Water Manhole
- Proposed Surface Water Pipework
- Proposed Orifice Plate
- Existing Foul Manhole
- Existing Foul Sewer
- Root Protection Areas
- Design Exceedance Route



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Job Reference: 96815-Chalker-MuddlersLn	Date: 20-Apr-26
Drawing Number: 96815-01	Revision: 1.0

Designed by: EW	Drawn by: EW	Checked by: AR
Scale: 1:50@A2		Disclaimer: The drawings provided are for planning purposes only.