

DRAINAGE STRATEGY REPORT (DSR)

Land at Bramley,
Catsash Road,
Langstone,
NP18 2AN

Prepared for: Skerryvore Design Ltd.
Project Ref: 23616_DSR



DOCUMENT CONTROL

Project:	Land at Bramley, Catsash Road, Langstone, NP18 2AN
Client:	Skerryvore Design Ltd.
Vale Consultancy Ref:	23616

Issue	Prepared by	Approved by	Date	Status
01	Amy Hammonds BSc (Hons) Civil Engineering Technician	Paul Graham BSc (Hons), MSc, GMICE	09.04.2026	First issue



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1 INTRODUCTION

1.1 Site Location

Vale Consultancy has been instructed by Skerryvore Design Ltd. (the Client) to undertake a drainage strategy report (DSR) for the proposed development at land at Bramley, Catsash Road, Langstone, NP18 2AN (GR: 336978, 190066).

Refer to **Appendix A** – Existing Site Plans

The proposed development is located approximately 1.22km east of the village of Langstone. The site is set within a residential area, with the A449 to the north and the M4 to the south.

The proposed development site is undeveloped and is therefore classed as a **‘greenfield’** site. The following drainage strategy will cover the hydraulic design criteria of the surface water and foul drainage networks.



Figure 1: Site Location Satellite Plan

1.2 Proposed Development

The intention of the proposed project is to construct a single house residential development and associated driveway.

The total site area is approximately 0.237ha, the whole site is to be developed and as such the development/SAB boundary will also be 0.237ha.

Refer to **Appendix B** – Proposed Plans



1.3 Existing Geology

Infiltration testing to BRE365 standards was carried out by Rhys Melvin of Vale Consultancy in March 2026. One trial pit was dug in the southern area of the site. It failed to drain to 25% of its effective depth after 22 hours and 41 minutes, therefore infiltration is not considered a viable option for surface water drainage.

Refer to **Appendix C – Soakaway Report**

British Geological Survey records note that the site is listed to have the following:

Superficial deposits: None recorded.

Bedrock geology: Mercia Mudstone Group-Mudstone. These sedimentary rocks are fluvial, lacustrine and marine in origin. They are detrital, deposited in lagoons or shallow seas; where a hot, arid climate also leads to the precipitation of beds of evaporites. Formed during the Triassic age between 201.3 and 247.1 million years ago.

Cranfield University Soilscales note the area to have slightly acid loamy and clayey soils with impeded drainage.

Refer to **Appendix D – British Geological Survey record**

1.4 Flood Risk

Flood risk has been assessed using the NRW Flood Map for Planning. The site is located within Flood Zone 1, so is therefore considered to be at little or no risk of fluvial or tidal/coastal flooding. Furthermore, upon review of the detailed view map the site is outside of all flood zones meaning it has a less than 0.1% chance of flooding from all types including, sea, rivers, reservoirs, surface water and small watercourses. Further flood risk assessment is not considered necessary.

Refer to **Appendix D – Flood Map for Planning**



2 SURFACE WATER

2.1 Existing Drainage Systems

As the proposed scheme is situated on a greenfield site there is no existing drainage apparatus within the site. However, the DCWW map shows an existing foul water network located in the south-east of the site. There is a 150mm foul pipe running south-west and it is envisaged that foul water from the site will discharge into this existing system, subject to an agreement with DCWW.

There is an un-named watercourse located on the eastern boundary of the site that flows south. As infiltration is not a viable option, it is envisaged that surface water from the site will discharge to this existing watercourse.

2.2 Proposed Drainage Systems

2.2.1 **S1:** SuDS hierarchy of surface water discharge locations

The following receptors have been considered for surface water runoff on site, in order of SuDS preference. The aim of SuDS Standards is to ensure that the most effective drainage scheme is delivered with the most preferred levels of surface water destination, where the design can move to the next means of discharge only under exception criteria.

1. **Surface water collection for reuse.**
2. **Discharge by infiltration into ground**
3. **Discharge into open surface water body**
4. **Discharge into surface water sewer, highway drain, or other drainage system**
5. **Discharge into combined sewer.**

Priority Level 1 - Surface water collected for reuse:

Rainwater harvesting is not proposed due to the practicalities of such a system as well as there being no foreseeable demand for non-potable water within the development proposals throughout its design life. There is also no foreseeable need to harvest water as DCWW has not identified any potential stresses on the mains water supply.

The need for non-potable water is low and the cost for such a system is high therefore it is deemed not feasible. The costs for installing such a system for a residential property set against the money saving due to reduced usage of potable water from the water provider typically results in a 50–60-year return.

No solution, move to next Priority Level

Priority Level 2 – Discharge via infiltration:

As explained in section 1.3, infiltration testing has been undertaken by Vale Consultancy. The ground conditions, groundwater and infiltration testing confirm that the site is unsuitable for infiltration, therefore is not being considered as a viable solution.

Please refer to **Appendix C** for the infiltration reports.

No solution, move to next Priority Level



Priority Level 3 – Discharge into open surface water body:

The nearest watercourse is an un-named watercourse located on the eastern boundary of the site that flows in a southerly direction. It is intended that surface water from the site will outfall to the existing watercourse at a restricted greenfield discharge rate, subject to Ordinary Watercourse Consent.

Priority Level 3 solution, no requirement to investigate subsequent Priority Level solutions.

2.2.2 **S2:** Surface Water Runoff Hydraulic Control

Proposed SuDS drainage system

The proposed system ensures that the surface water from the proposed dwelling will be collected by rainwater pipes (RWP's) and conveyed to a raingarden via aco drainage channels at surface level before filtering through the proposed filter medium & soil layers to a perforated pipe within the stone layer. Underground piped drainage will then direct flows to the geo-cellular attenuation crate.

The geocellular attenuation crate will be 26m² (6.5m x 4m x 0.8m deep) and is sized to accommodate the critical Q100 + 40%CC return period event.

Surface water from the proposed driveway will percolate through permeable block paving and a minimum 150mm subbase. A perforated pipe sump drain will be located at the low point of the driveway. This will be conveyed to the geocellular attenuation crate via traditional piped drainage. Surface water will be discharged via a 32mm orifice flow control chamber to the existing watercourse at the greenfield runoff rate of 2.0l/s, subject to further CCTV surveying and an agreement with DCWW.

Refer to **Appendix E** for the proposed surface water drainage drawing illustrating how surface water is collected and conveyed towards its discharge location.

Hydraulic Control

The proposed SuDS drainage system will use a combination of SuDS features including bioretention raingardens, permeable paving and attenuation crates to collect, attenuate and filtrate surface water runoff. Attenuation will be designed such that no flooding will occur for a 1 in 100-year storm event plus 40% climate change and a 20mm orifice flow control device will be installed downstream of the attenuation systems to control discharge to its respective outfall location.

In accordance with best practice CIRIA C753: Chapter 24, the rate of run-off for the developed site should be no greater than the estimated peak runoff rate and runoff volumes from the site in its pre-developed state (Greenfield) to help ensure that the flood risk associated with the receiving surface water sewer is not increased by the development proposals. The approach for estimating runoff rates and volumes from the proposed impermeable catchment areas have been calculated using the FEH ReFH2 method. This method allows estimation of the amount of runoff likely to be generated from the development proposals from a range of storm returns. The proposal is to discharge the surface water runoff from the site at a managed greenfield rate to the existing watercourse that flows south along the eastern site boundary.

The Wallingford tool was used to calculate a greenfield runoff rate of 2.0l/s for the site.

Refer to **Appendix F** – Greenfield Runoff Rate Calculations

For hydraulic design of the drainage network refer to **Appendix G** – Design Calculations.



Interception of runoff

With reference to the Welsh Government's document statutory standards for sustainable drainage systems, it confirms that raingardens have the potential to provide a compliant level of interception.

Surface water runoff from the proposed roof will be conveyed to a raingarden at surface level whilst the proposed driveway will convey via the permeable paving to the geocellular attenuation crate. Interception of runoff will be provided by both of these SuDS features. The raingarden and permeable paving are impermeably lined due to their proximity to the proposed property, poor infiltration rates and the high groundwater table, thus interception of runoff has been maximised as far as practically possible given the site constraints.

Exceedance Event Analysis & Management

It is necessary to assess the risk and consequence of flooding for exceedance events. This is to determine the likely flood volumes and water flow paths that would be caused by a storm event that exceeds the critical 1 in 100-year + 40% climate change allowance that the surface water drainage system is designed for.

Given the existing/proposed site levels, surface water from the site will follow the natural contours of the site flowing from the north to the south.

Refer to **Appendix H** – Flow Exceedance Plan

2.2.3 **S3:** Water Quality

To assess that the water quality being provided by the proposed SuDS solution is sufficient, the simple index approach as per section 26.7.1 of the CIRIA SuDS Manual 2015 is applied.

To deliver adequate water quality treatment the total SuDS mitigation index must be more than or equal to the pollution hazard index for each contaminant type. The pollution hazard and mitigation indices have been taken from tables 26.2 and 26.3 of the CIRIA SuDS Manual 2015.

The proposed dwelling and driveway are considered to be of very low & low pollution hazard indices, see table 1 below.

Water quality - Simple Index Approach

Land Use	Pollution Hazard Level	Pollution hazard index			SuDS Components for land use	Mitigation Index			Mitigation hazard index > Pollution hazard index (for each contaminant type)
		Total Suspended Solids (TSS)	Metals	Hydro-carbons		Total Suspended Solids (TSS)	Metals	Hydro-carbons	
Residential roof	Very Low	0.2	0.2	0.05	Raingarden	0.8	0.8	0.8	Yes
Individual property driveway	Low	0.5	0.4	0.4	Permeable paving	0.7	0.6	0.7	Yes



As evidenced above, adequate treatment of surface water runoff will be provided for the proposed development.

2.2.4 **S4:** Amenity

A raingarden has been incorporated to boost the amenity benefits to the site and surrounding area. The design aims to keep surface water as close to the ground surface as possible without over complicating the SuDS solution.

Given the scale of the development proposals, the proposed SuDS solution maximises amenity benefits by providing attractive open areas used for drainage that can incorporate planting and biodiversity benefits, it aims to keep surface water on or as close to the ground surface as possible. The proposed SuDS features will incorporate areas of planting and soft landscaping in an environment that would traditionally be dominated by hardstanding ground.

2.2.5 **S5:** Biodiversity

In urban areas, it is of particular importance to provide biodiversity. As these areas can be generally inhabitable for wildlife. By providing small biodiverse areas across larger urban environments wildlife can start to link areas and create networks, providing habitat as well as improving biodiversity and sustainability.

The use of raingardens can help to provide a new quality habitat for wildlife, having a positive contribution to biodiversity in the area. The use of planting native species can support local biodiversity by providing habitat and food for invertebrates and birds. A list of plants species suitable to the bioretention raingarden will be provided at the detailed design stage.

2.2.6 **S6:** Operation and Maintenance Requirements

The construction management plan and construction phasing plan will be developed by the appointed contractor, as the SuDS scheme requires coordination with all other elements of the development that will be constructed as part of the scheme, including plot strip/trench fill foundations, plot/boundary walls, foul drainage. We understand that the construction management plan and construction phasing plan can be conditioned to the SAB approval.

To ensure SuDS components continue to operate reliably, regular inspection and maintenance should be carried out. In most cases, appropriate information should be provided by the relevant manufacturer on what has been installed, how it works, when to inspect it and whether maintenance will be required. CIRIA C753 The SuDS Manual also provides information on the operation and maintenance requirements for various SuDS components.

An inspection and maintenance plan has been produced for the site proposals, providing the site owner, who is responsible for the maintenance, guidance on the types and frequency of inspections and maintenance work that is required for the proposed SuDS element. It also provides a cost estimate for the inspection and maintenance requirements over the development's lifetime.

Refer to **Appendix I – Management & Maintenance Plan**.



3 CONCLUSIONS

The site area/development boundary is of circa 2370 m² (0.237ha). The proposed development consists of a single house residential development and associated driveway.

Infiltration testing to BRE365 standards was carried out by Rhys Melvin of Vale Consultancy in March 2026. One trial pit was dug in the southern area of the site. It failed to drain to 25% of its effective depth after 22 hours and 41 minutes, therefore infiltration is not considered a viable option for surface water drainage.

The proposed system ensures that the surface water from the proposed dwelling will be collected by rainwater pipes (RWP's) and conveyed to a raingarden via aco drainage channels at surface level before filtering through the proposed filter medium & soil layers to a perforated pipe within the stone layer. Underground piped drainage will then direct flows to the geo-cellular attenuation crate.

The geocellular attenuation crate will be 26m² (6.5m x 4m x 0.8m deep) and is sized to accommodate the critical Q100 + 40%CC return period event.

Surface water from the proposed driveway will percolate through permeable block paving and a minimum 150mm subbase. A perforated pipe sump drain will be located at the low point of the driveway. This will be conveyed to the geocellular attenuation crate via traditional piped drainage. Surface water will be discharged via a 32mm orifice flow control chamber to the existing watercourse at the greenfield runoff rate of 2.0l/s, subject to further CCTV surveying and an agreement with DCWW.

The scheme seeks to be cost effective, easily maintainable and improve amenity and biodiversity where possible.



APPENDIX A: Existing Site Plans



Abbreviations:

B/RW	brick retaining wall
BB	Belisha beacon
BI	bollard (illuminated)
BL	bollard
BT	telecom inspection cover
BU	bush or shrub
BW	brick wall
C/RW	concrete retaining wall
CATV	cable television cover
CB	close boarded
CM	corrugated metal
conc.	concrete
CP/BW	concrete post & barbed wire
CP/CL	concrete post & chain link
CP/CP	concrete post & panel
CP/W	concrete post & wire mesh
CPS	concrete paving slabs
DCS	drainage channel
DK	drop kerb
DR	drain
EP	electricity pole
ER	earthing rod
FB	flower bed
FFL	finished floor level
FS	flagstaff
C/W	gabion wall
GP	gate post
GV	gas valve
HR	handrail
HY	fire hydrant
IC	inspection cover (general)
IR	metal railings
Iwn	interwoven wood slat
JB	junction box
KO	kerb outlet
LP	lamp post
MH	manhole
MK	marker
MM	metal mesh
NB	name board
O/H	overhead
OB	open boarded
OHC	overhead cable/wire
OSBM	Ordnance Survey bench mark
P/C	post & chain fence
PA	paling
PO	post
RE	roading eye
RG	road gully
RP	reflector post
RS	road sign
RSJ	rolled steel joint
RWP	rain water pipe
S/RW	stone retaining wall
sap.	sapling
SP	sign post
SPS	stone paving slabs
stay	stay wire
STN	survey control station
SV	water stop valve
SVP	soil vent pipe
tact.	tactile paving
TCB	telephone call box
THL	threshold level
TL	traffic light
TP	telephone pole
VP	vent pipe
WL	water level
Wap	wood lap
WM	water meter
WP/BW	wood post & barbed wire
WP/R	wood post & rail
WP/W	wood post & wire
ht	height (of feature)
	arrow indicates up (unless otherwise stated)

Drainage features:

CL	cover level
ID	invert depth
IL	invert level
FWS	foul water sewer
SWS	storm water sewer
CWS	combined water sewer
UTL	unable to lift
Ø	pipe diameter (mm)
SL	soffit level
←	arrow indicates direction of flow

Key:

 Ordnance Survey data
circa 2012

ALS Survey data

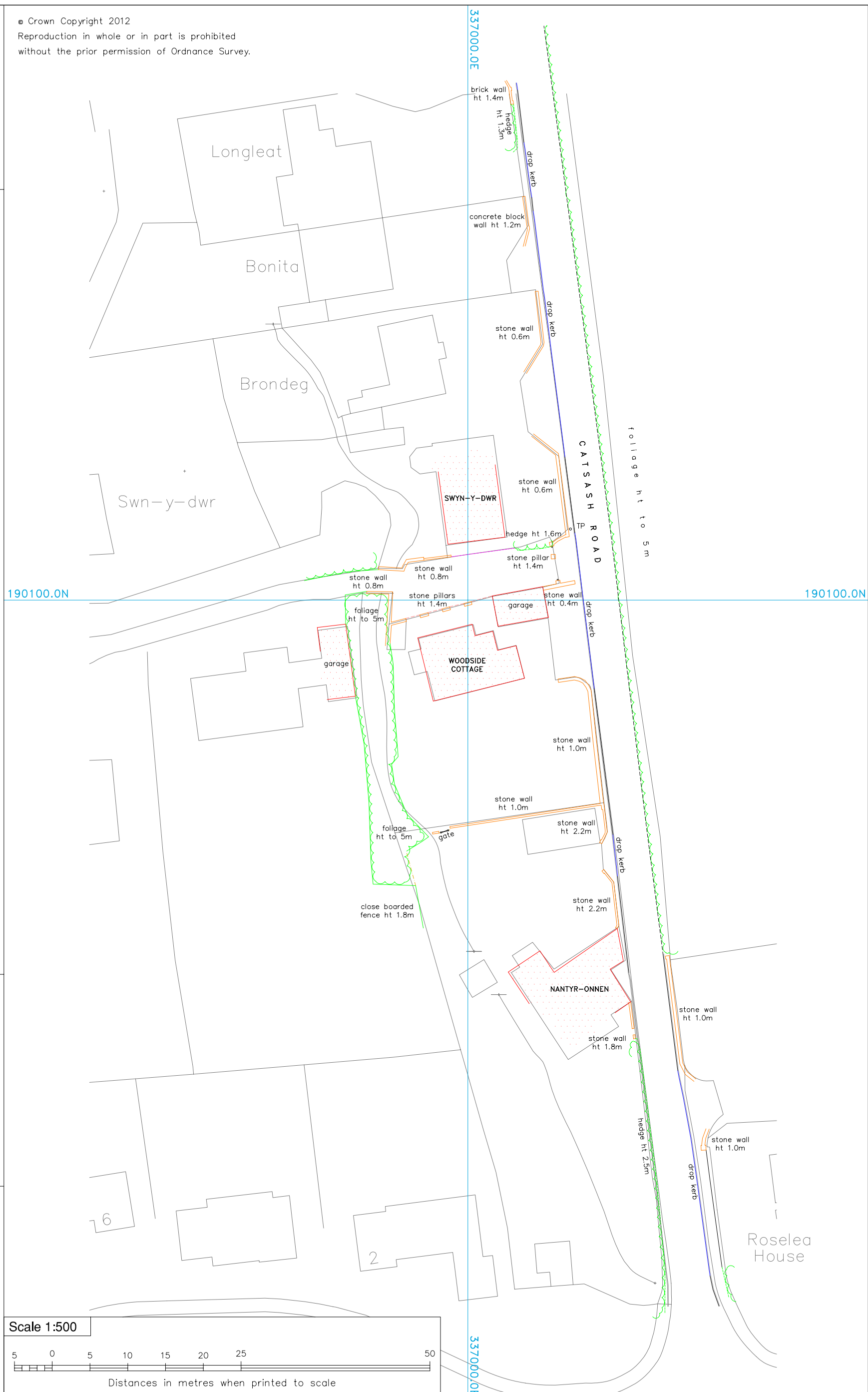
Notes:

Survey Grid:

Best graphical fit to Ordnance Survey data.

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AZIMUTH GEO DATA-AZIMUTH LAND SURVEYS



○ ↑ 🔗 ✕ ~ 🏠 📶 ↗ Ⓐ ☁)(☒ ⚡

Planning maps – Vector mapping – Historical mapping – Aerial imagery



Drawn: RW Sep.2012

Checked:
RW

Catsash Road, Newport

Boundary Survey

Client

Skerryvore Designs

Grid

See notes

Datum

N/A



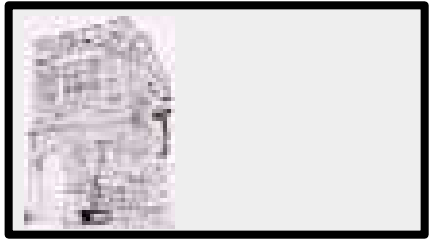
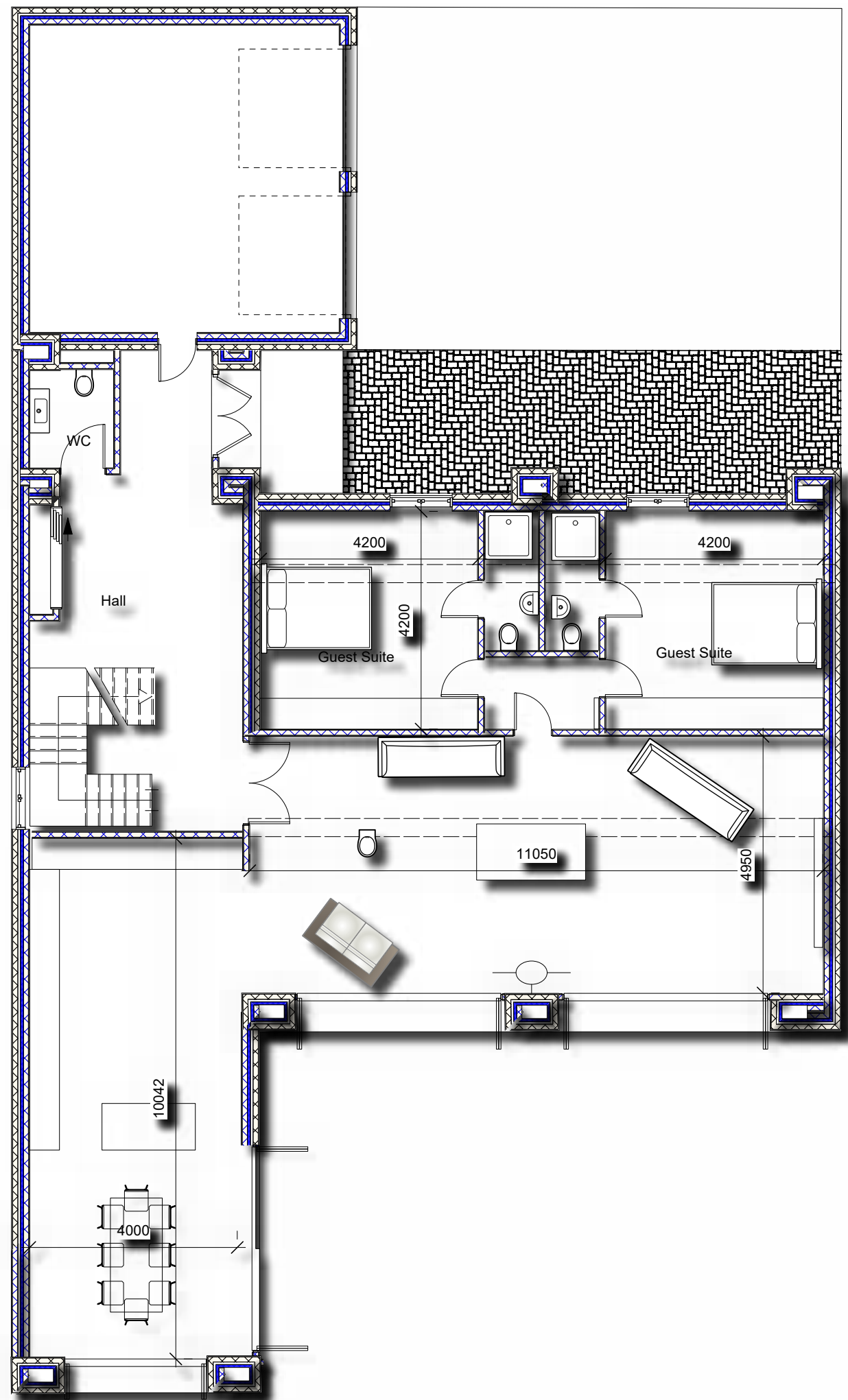
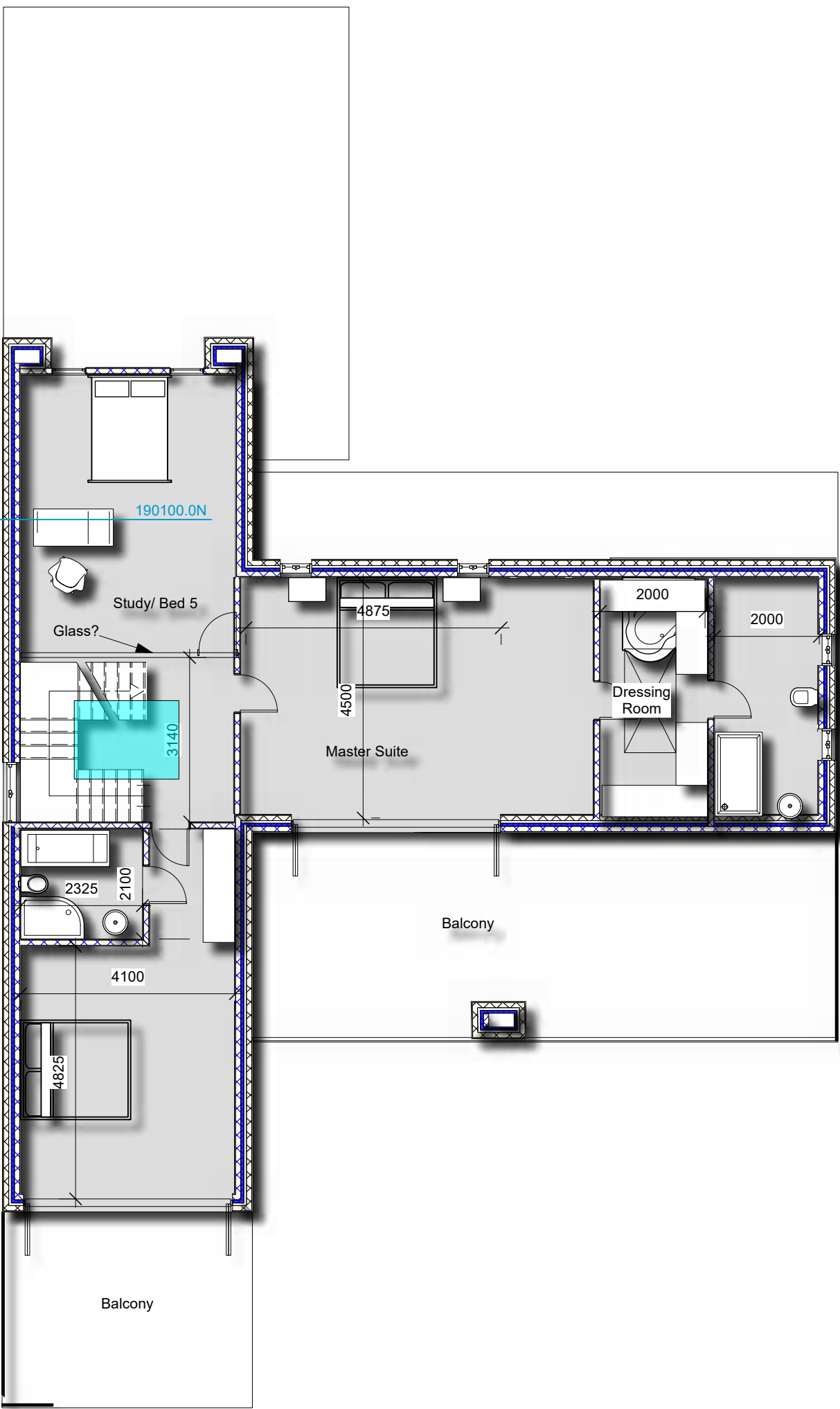
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APPENDIX B:
Proposed Site Plans



JOB	Bramley
TITLE	Cats Ash Road
	Langstone
	NP9 8EE

DRAWING TITLE Sketch Design
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DRAWING No.	SD903 01
SCALE	1/500 and 1/100
DATE	December 2023



APPENDIX C:
Infiltration Testing Report

SOAKAWAY REPORT

Bramley
Catsash Road
Langstone
NP18 2AN

Prepared for: Robert Peterson
Project Ref: 23616



DOCUMENT CONTROL

Project:	Bramley, Catsash Road, Langstone, NP18 2AN
Client:	Robert Peterson
Vale Consultancy Ref:	23616

Issue	Prepared by	Approved by	Date	Status
01	Rhys Melvin <i>HNC</i> Assistant Engineer	Jack Price <i>BSc (Hons)</i> Principal Engineer	04.03.2026	First issue



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1 INTRODUCTION

1.1 Brief

Vale Consultancy has been instructed by Robert Peterson (the Client) to provide a soil infiltration test report to the BRE Digest 365 standard for the infiltration test undertaken at the site of land at Bramley, Catsash Lane, Langstone, Newport, NP18 2AN.



Figure 1 – Site Location Satellite Image

The purpose of the infiltration testing is to determine the local geology and permeation rates of the underlying strata to establish the suitability of draining surface water via infiltration. One trial pit had been excavated with dimensions: 2.5m length X 1.3m width X 1.5m deep at approximately 15m from the Southern boundary.

1.2 Site Investigations

The site consists of a currently disused parcel of grassed land directly behind the existing property Bramley, which used to serve as a residential plot but has since been demolished. The proposal is to construct a single detached residential dwelling in the approximate location of the previous dwelling. Access to the proposed plot is provided from the existing access lane to the North of the site. Other works to enable the development include minor landscaping and earthworks and provision of appropriate SuDs features to serve as surface water management. The site itself is located on the outskirts of Langstone, off Catsash Road and is situated approximately 960m North-East from Coldra roundabout (M4 junction 24). The soakaway test has been undertaken to inform the drainage design for the proposed development and assess the viability of infiltration as a method of surface water disposal. One trial pit was excavated on site and its approximate location is indicated on the trial pit location plan, refer to Appendix A. Rhys Melvin of Vale Consultancy attended the site in March 2026 to undertake the infiltration testing in accordance with BRE Digest 365.



2 SITE FINDINGS

2.1 British Geological Records

A desktop search of the British Geological Survey (BGS) online records shows the site to have the following superficial soils and bedrock:

Superficial deposits: None recorded.

Bedrock geology: Mercia Mudstone Group-Mudstone. These sedimentary rocks are fluvial, lacustrine and marine in origin. They are detrital, deposited in lagoons or shallow seas; where a hot, arid climate also leads to the precipitation of beds of evaporites. Formed during the Triassic age between 201.3 and 247.1 million years ago.

Cranfield University Soilscales note the area to have slightly acid loamy and clayey soils with impeded drainage.

This coincides with site findings.

2.2 Method of testing

The trial pit was excavated by the client the day before infiltration testing was undertaken, with water available on-site. It was noted by the engineer that groundwater had ingressed into the trial pit overnight, however testing continued to confirm the non-viability of infiltration at the site. The trial pit was rapidly filled with water to 390mm deep, due to water entering an apparent void to one of the sides above this level which may be due to the presence of a land drain. Due to the slow infiltration of water within this pit, only one test was undertaken. Once the pit filled to 390mm, regular measurements of the water depth were taken over the course of the day.

2.3 Trial pit soil conditions

The trial pit was excavated on site and its location is shown in **Appendix A**. Pictures of the trial pits and their arisings can be found in **Appendix B**.

The dimensions of the trial pits were as follows.

Trial Pit 1: W 1.3m, L 2.5m, D 1.5m.

Ground water was encountered prior to the test commencing. Soils encountered were logged at the following approximate depths:

<i>Trial Pit 1</i>	<i>Depth BGL (m)</i>	<i>Description</i>
<i>Topsoil</i>	<i>0 – 0.3</i>	Brown, medium-dense clayey loam with occasional angular cobbles and frequent rootlets
<i>Superficial soils</i>	<i>0.3 – 1.5</i>	Brown slightly reddish dense clayey loam with frequent small angular to subangular cobbles with subangular gravel.
<i>Bedrock</i>	<i>Not encountered</i>	
<i>Groundwater</i>	<i>Approximately 1.4m</i>	<i>Ground water had filled the pit overnight prior to testing</i>

Refer to **Appendix B** – trial pit photos.



2.4 Test results

The first test within the trial pit confirmed the non-viability of infiltration as a method of surface water disposal, as the depth of water had not reached 25% of the initial water depth after 22 hours and 41 minutes (1361minutes). On the day of testing, the water in the trial pit had drained to 247mm deep after 4.5 hours after beginning testing. As a result of these findings, it was deemed that two further tests could not be undertaken within the 24 hour window stipulated by BRE365.

Refer to **Appendix C** – Infiltration test results.

3 GROUNDWATER TESTING

It was noted by the engineer who attended the infiltration testing that water had ingressed into the pit overnight prior to soakaway testing commencing, indicating high groundwater. To confirm the non-viability of infiltration, testing continued. The engineer returned to the trial pit the next morning where the water depth within the pit being 146mm.

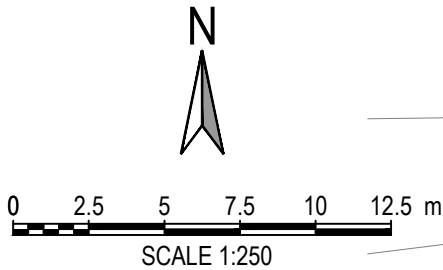
Please see images of the groundwater testing pit below in **Appendix B – Trial Pit Photos**

4 CONCLUSIONS

As a result of the poor infiltration and presence of groundwater identified by the engineer, infiltration has been deemed to be unviable as a method of surface water disposal, thus other options in the Wales SuDs hierarchy must be explored.



Appendix A:
Site Test Location Plan



LEGEND



LOCATION OF TRIAL PIT

- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 - ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
 - DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
 - ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
 - THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
 - EXISTING SERVICES HAVE NOT BEEN SHOWN BUT ARE PRESENT - THE CONTRACTOR IS TO LIAISE WITH ALL STATUTORY AUTHORITIES PRIOR TO THE COMMENCEMENT OF ANY WORKS.

01	RM	JP	04.03.26	SKETCH
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rev.	drawn	chkd.	apprvd.	date	description
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Client
ROBERT PETERSON

Project
BRAMLEY
CATSASH ROAD
NP18 2AN

Title
TRIAL PIT LOCATION PLAN

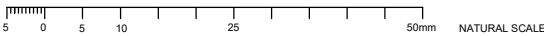


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date	drawn	checked	approved
04.03.26	RM	JP	04.03.26

scale @ A3	project no.
1:250	23616

status	drg. no.	rev.
SK	23616_SK100	01





Appendix B: Trial Pit Photos







The two photos below were taken the next day at 10:35am





Appendix C: Infiltration Test Results

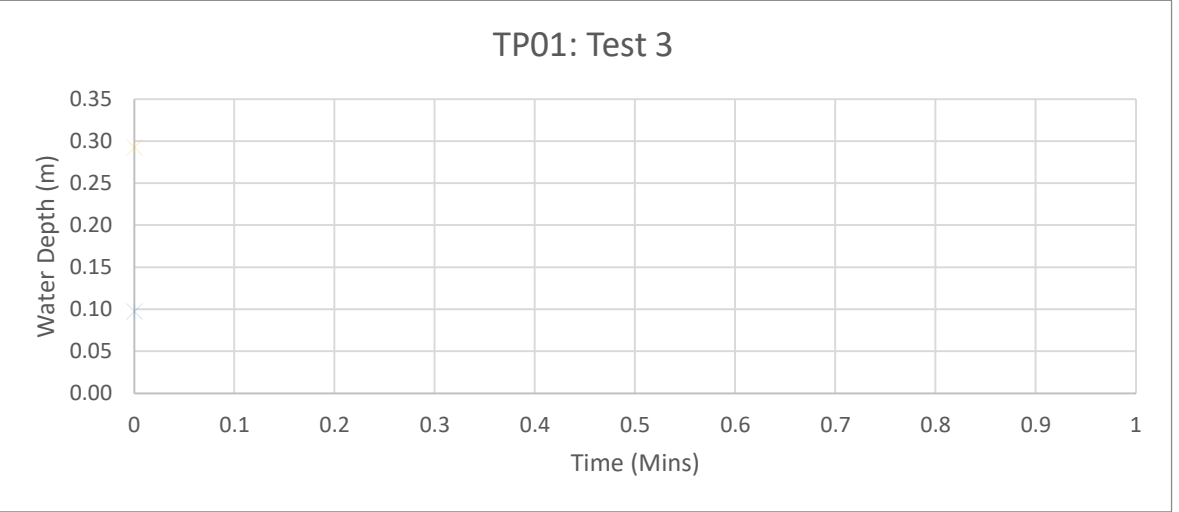
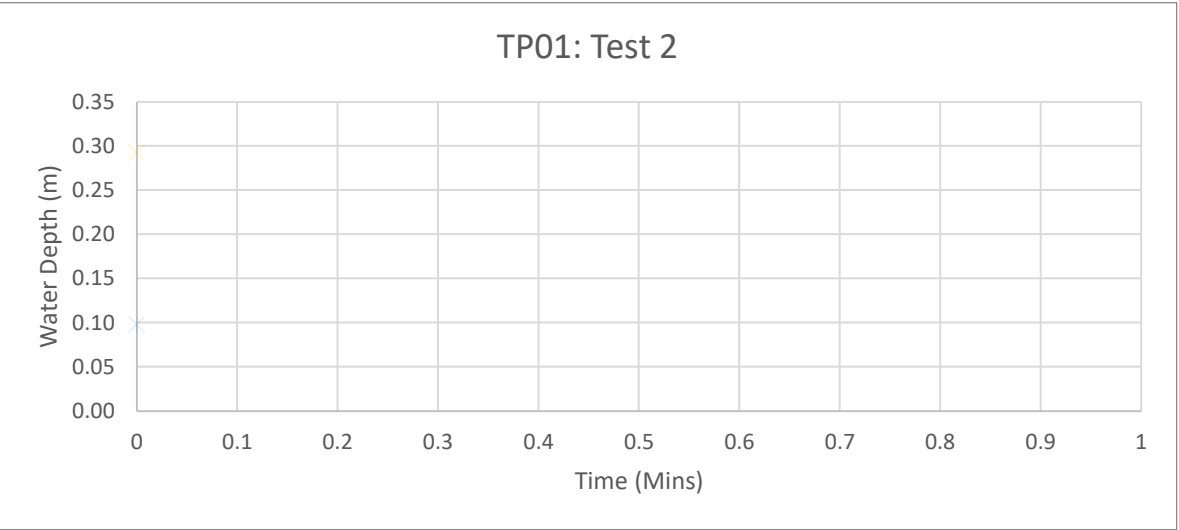
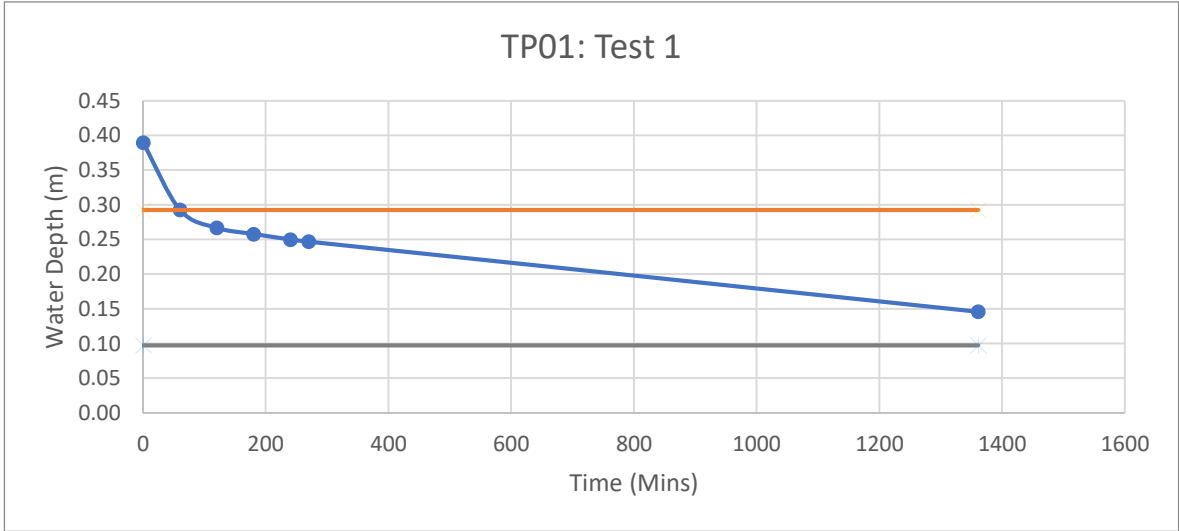


Soakaway Test Results: BRE Digest 365

Client: Robert Peterson
Project No: 23616
Project Title: Land at Bramley, Catsash Road, NP18 2AN

Trial Pit 01		Date:	Mar-26	
Dimensions	(m)	Weather:	Overcast	
Width	1.30	Topsoil:		
Length	2.50	Superficial soil:		
Depth of pit	1.50	Comments:		
Effective Depth of pit	0.39			
75% effective depth =				0.29
25% effective depth =				0.10

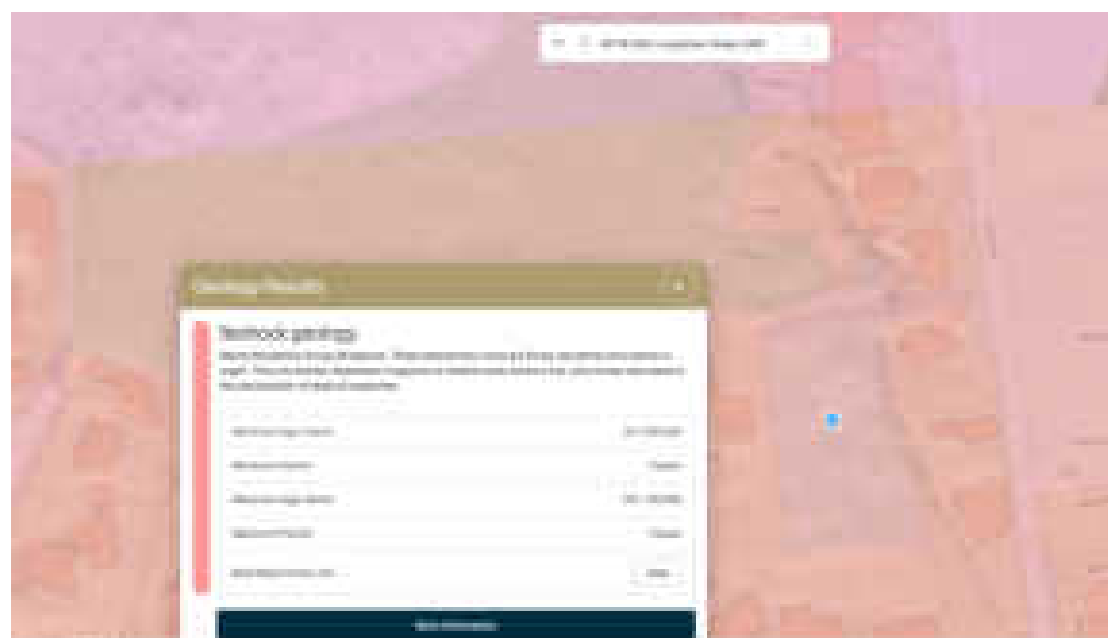
Test No.	Time (min)	Depth (m)			
1	0	0.39	Vp75-25 (m3) = 0.6338 As50 (m2) = 4.732 tp75-25 (hours) = #N/A f = #N/A m/hr f = #N/A m/s		
	60	0.29			
	120	0.27			
	180	0.26			
	240	0.25			
	270	0.25			
	1361	0.15			
2			Vp75-25 (m3) = 0.6338 As50 (m2) = 4.732 tp75-25 (hours) = #N/A f = #N/A m/hr f = #N/A m/s		
3			Vp75-25 (m3) = 0.6338 As50 (m2) = 4.732 tp75-25 (hours) = #N/A f = #N/A m/hr f = #N/A m/s		
Lowest infiltration rate =			#N/A	m/s	





APPENDIX D:

British Geological Survey Records, Natural Resource Wales Flood Map for Planning (FMFP)



Flood Map for Planning - Basic
Land at Bramley, Catsash Road

Legend

TAN15 Defended Zones

 Rivers

 Sea

 Rivers and Sea

Rivers and Sea

 Flood Zone 3

 Flood Zone 2

Surface Water and Small Watercourses

 Flood Zone 3

 Flood Zone 2

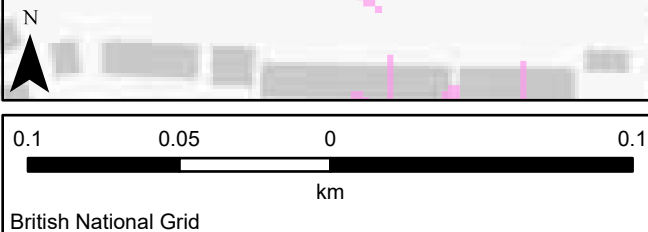
 Recorded Flood Extents



Contains OS data © Crown Copyright and database right 2020

Scale at A3: 1:2,500

Date: 09/04/2026

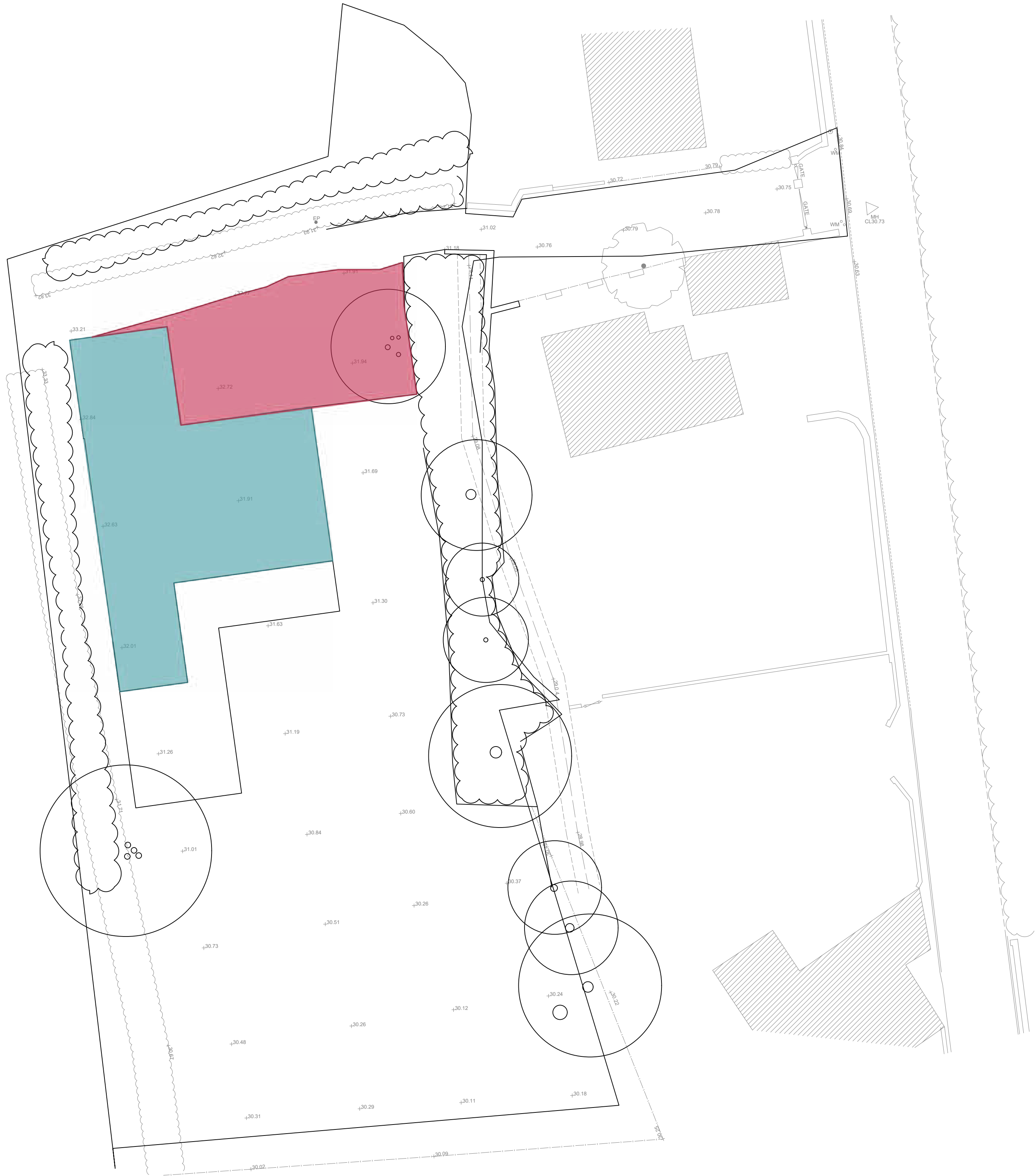
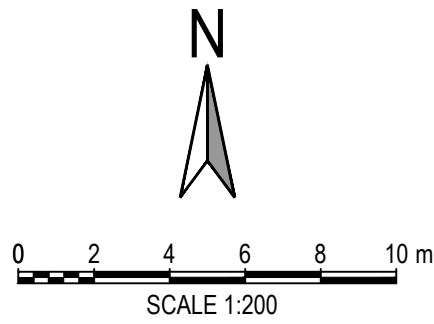


Disclaimer
<https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en>

© NRW/CNC. Some information derived from © UK Centre for Ecology & Hydrology © UKCEH, the Environment Agency © EA and Getmapping Plc and Bluesky International Limited, Defra, © Met Office and DARD Rivers Agency, © Cranfield University, © James Hutton Institute, © Ordnance Survey, © Land & Property Services. All rights reserved.



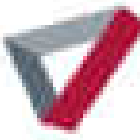
APPENDIX E:
Proposed Drainage Drawings

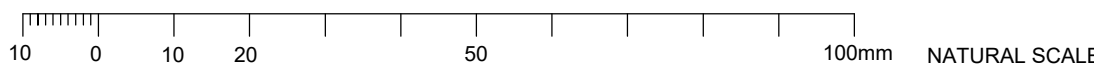


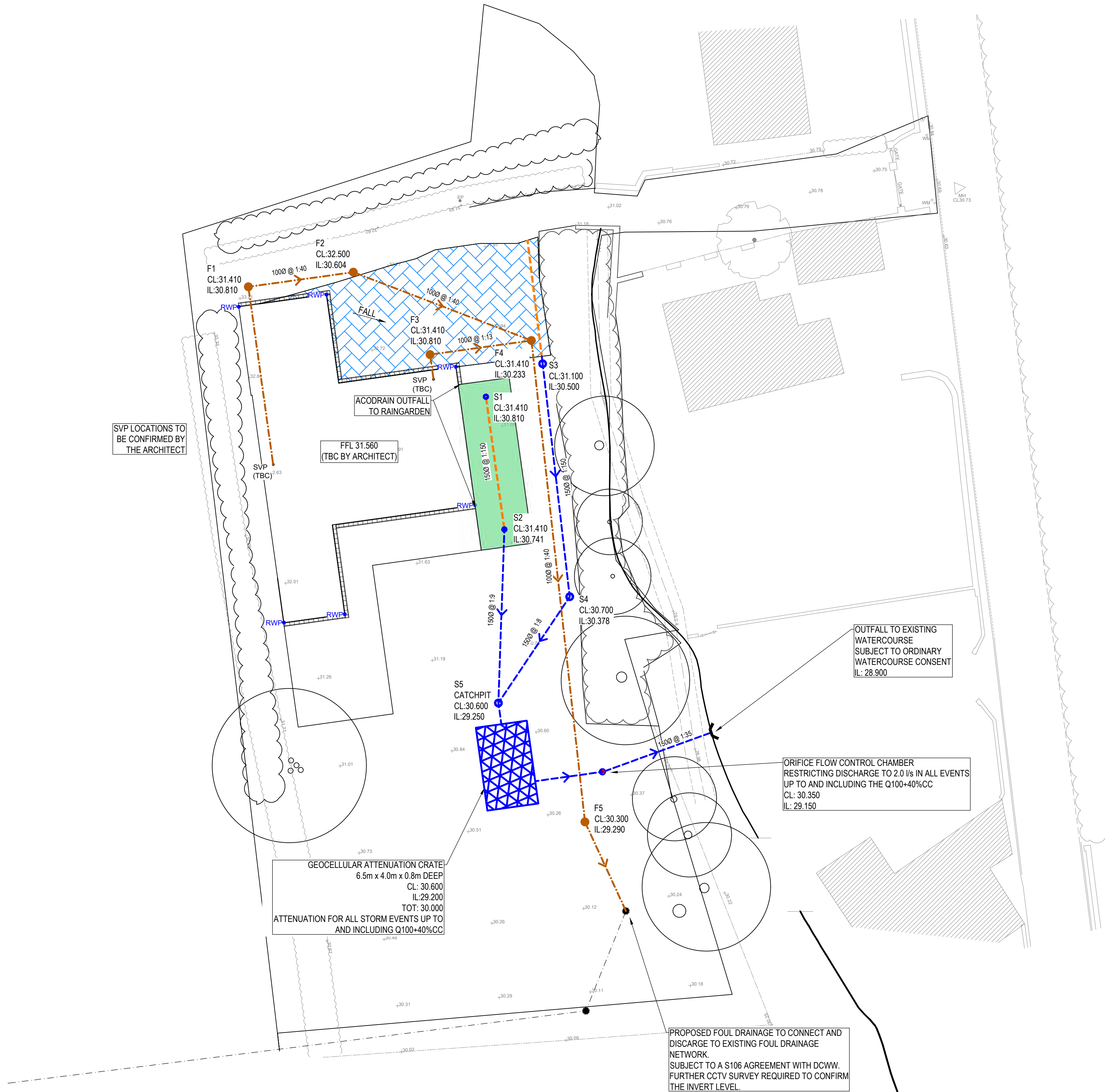
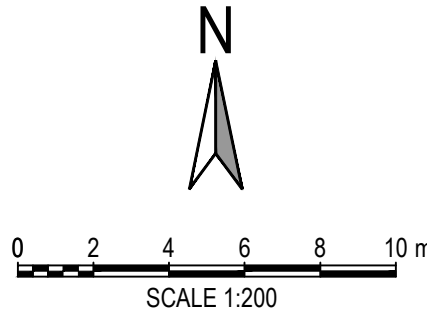
- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 2. ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
 3. DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
 4. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
 5. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
 6. EXISTING SERVICES HAVE NOT BEEN SHOWN BUT ARE PRESENT - THE CONTRACTOR IS TO LIAISE WITH ALL STATUTORY AUTHORITIES PRIOR TO THE COMMENCEMENT OF ANY WORKS.

LEGEND	
	CATCHMENT AREA A = 148m ²
	CATCHMENT AREA B = 255m ²
TOTAL AREA = 403m ²	

PRELIMINARY

01	AH	PG	08.04.26	SAB Pre-App submission	
rev.	drawn	chkd.	approved	date	description
client SKERRYVORE DESIGN LTD.					
project LAND AT BRAMLEY, CATSASH ROAD NP18 2AN					
title PROPOSED CATCHMENT PLAN					
 Vale Consultancy CONSULTANCY LIMITED (INCORPORATED IN ENGLAND) 29 Bocam Park, Old Field Road, Pencoed, Bridgend CF35 5LJ. Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk					
date	drawn	checked	approved		
APRIL 26	AH	PG 08.04.26	PG 08.04.26		
scale @ A1			project no.		
1:200			23616		
status	drg. no.				rev.
P	23616_509				01





ANY WORKS COMMENCING ON SITE PRIOR TO PLANNING, HIGHWAY & DRAINAGE APPROVALS BEING GRANTED IS UNDERTAKEN AT THE DEVELOPER'S OWN RISK.

TOPOGRAPHICAL SURVEY INFORMATION TAKEN FROM 'TOPO' DWG RECEIVED FROM USK LAND SURVEY ON 23.03.2026.

- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 - ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
 - DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
 - ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
 - THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
 - EXISTING SERVICES HAVE NOT BEEN SHOWN BUT ARE PRESENT - THE CONTRACTOR IS TO LIAISE WITH ALL STATUTORY AUTHORITIES PRIOR TO THE COMMENCEMENT OF ANY WORKS.

DRAINAGE LEGEND

- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED FOUL WATER DRAINAGE
- EXISTING FOUL WATER DRAINAGE
- PROPOSED RAINWATER PIPE
- PROPOSED SOIL & VENT PIPE
- ORIFICE FLOW CONTROL CHAMBER
- PROPOSED PERFORATED PIPE
- PROPOSED ACO MD100 DRAINAGE CHANNEL
- PROPOSED HEADWALL
- GEO-CELLULAR ATTENUATION CRATE 1 IN 100 YEAR EVENT WITH ACCESS POINTS
- EXISTING WATERCOURSE
- BIORETENTION RAINGARDEN
- PERMEABLE PAVING

PRELIMINARY

01 AH PG PG SAB Pre-App submission

rev. drawn chkd. approved date description

Client
SKERRYVORE DESIGN LTD.

Project
LAND AT BRAMLEY,
CATSASH ROAD
NP18 2AN

Title
PROPOSED DRAINAGE LAYOUT

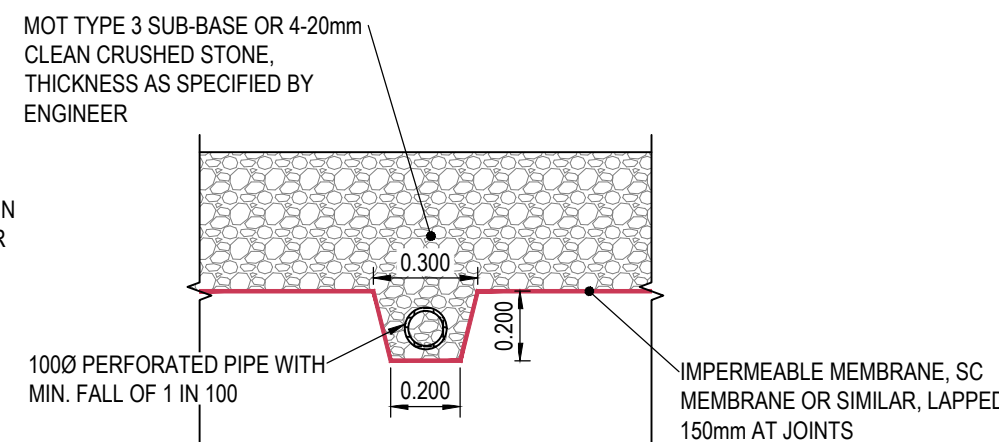


29 Bocam Park, Old Field Road, Pencoed, Bridgend, CF35 5LJ.
Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk

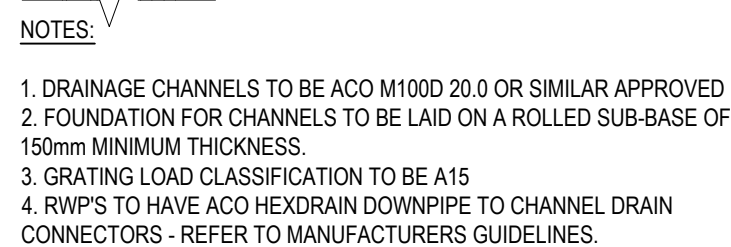
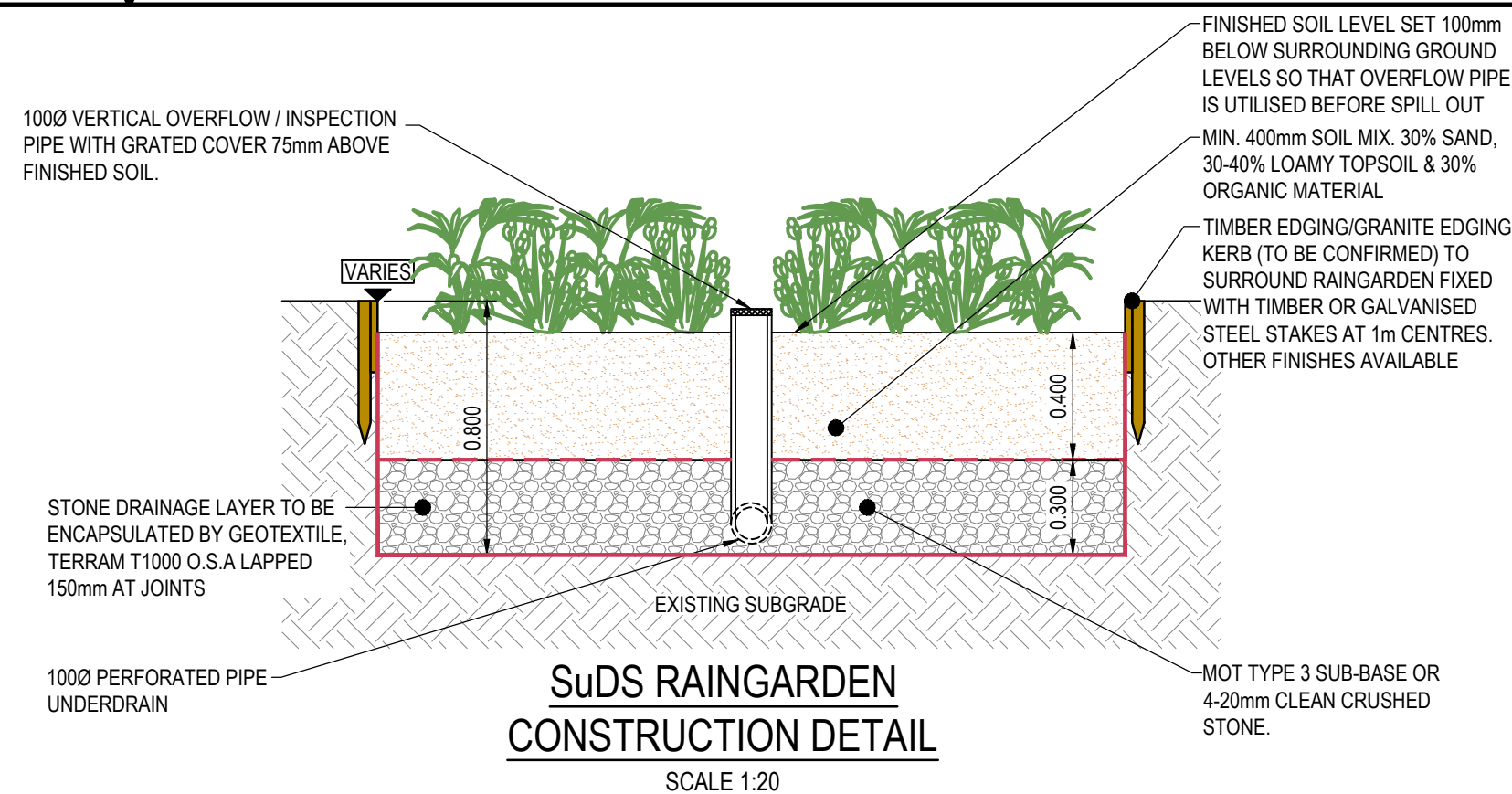
date drawn checked approved
APRIL 26 AH PG 10.04.26 PG 10.04.26

scale @ A1 project no.
1:200 23616

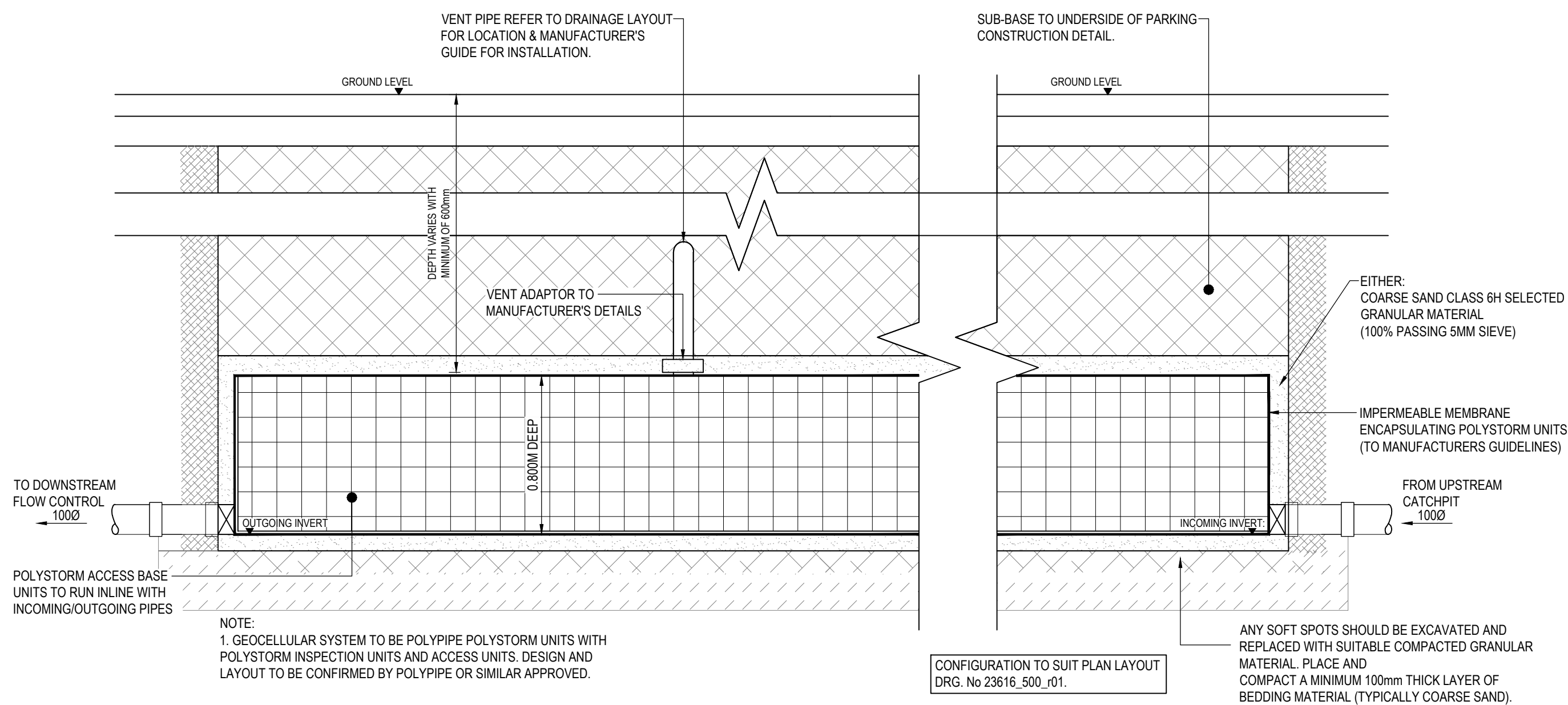
status drg. no. rev.
P 23616_500 01



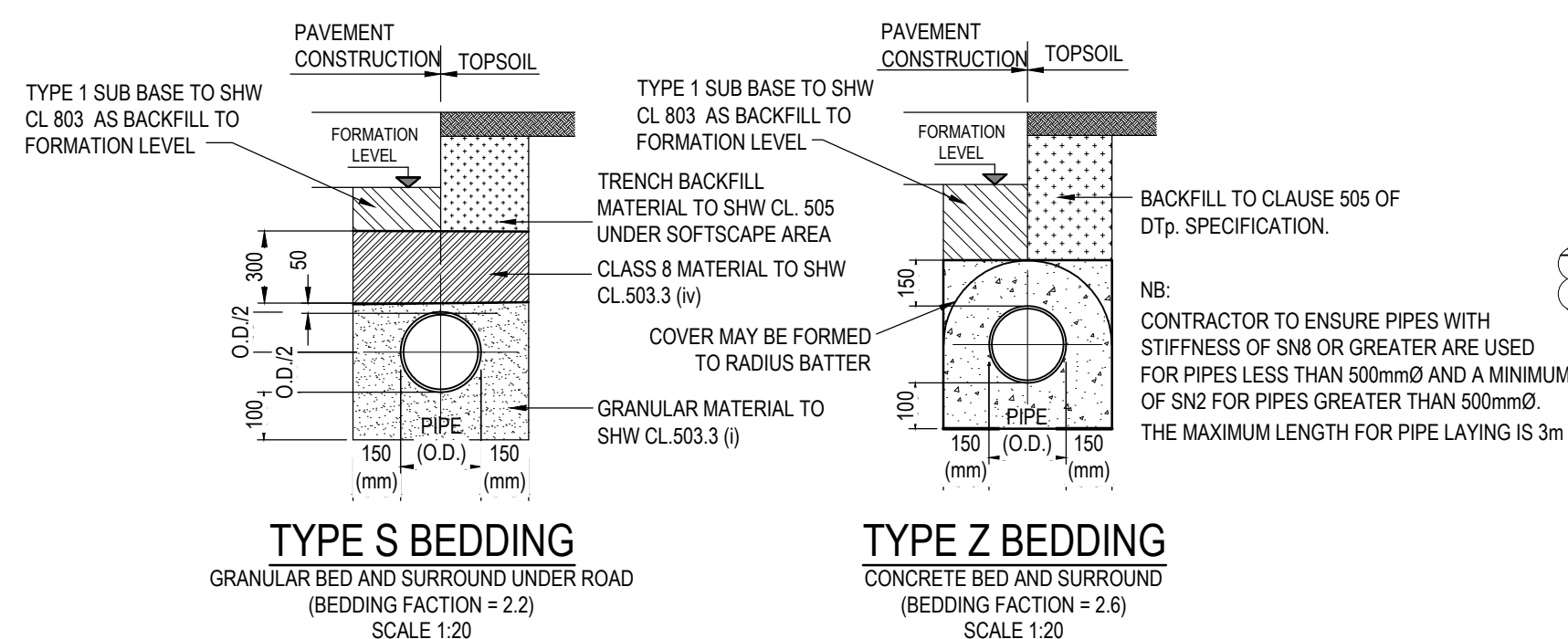
DRAINAGE SUB-BASE
SUMP DETAIL
SCALE 1:20



ACO M100D 20.0 CHANNEL DETAIL



ATTENUATION DETAIL



TYPE Z BEDDING ELEVATION

BEDDING DETAIL NOTES:

1. REFER TO SHW TABLE S/3 AND SHW TABLE 6/1
2. BEDDING BENEATH AND AT SIDES OF THE PIPE TO BE WELL COMPACTED IN ACCORDANCE WITH CL 505.
3. CONCRETE CRAILES AND ARCHES MAY BE EXTENDED TO THE SIDES OF THE TRENCH.
4. GEOTEXTILES MAY BE USED WHERE DIRECTED OR APPROVED BY THE ENGINEER TO CONTAIN BEDDING MATERIAL IN CERTAIN SOILS E.G. SAND
5. IN VERY WET CONDITIONS, WHERE DIRECTED OR APPROVED BY THE ENGINEER A TEMPORARY LAND DRAIN MAY BE LAID WITHIN THE GRANULAR BED.

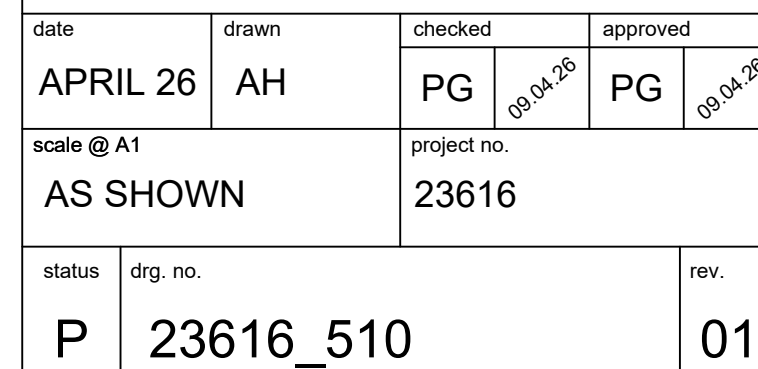
(TYPE 2 ONLY)

6. WHERE PIPES WITH FLEXIBLE JOINTS ARE USED, THE CONCRETE PROTECTION IS TO BE INTERRUPTED OVER ITS FULL CROSS SECTION AT INTERVALS NOT EXCEEDING 5 METRES (OR AS DIRECTED BY THE ENGINEER) BY A SHAPED FORMER OF BITUMEN MINIMUM 10mm COMPRESSIBLE FILLER. THESE INTERRUPTIONS SHALL COINCIDE WITH PIPE JOINTS. (SEE TABLE 5 IN SFA 76 EDITION.
7. CONCRETE TO BE FN4d WHERE FLEXIBLE PIPES ARE USED. CARE MUST BE TAKEN TO PREVENT THE PIPES FROM FLOATING.

PRELIMINARY

Client
SKERRYVORE DESIGN LTD.

Title	DRAINAGE DETAILS
-------	------------------



Δ1

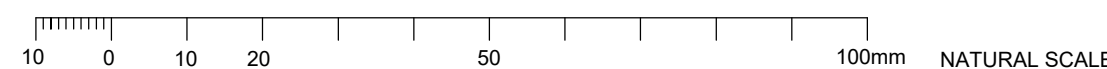


(REFER TO FIG. B.21 OF SEWERS FOR ADOPTION 7th ED) - SITED IN DRIVEWAYS/PAVED AREAS
(FLEXIBLE MATERIAL DETAIL)
SCALE 1:20



(REFER TO FIG. B.21 OF SEWERS FOR ADOPTION 7th ED) SITED IN DOMESTIC GARDENS
(FLEXIBLE MATERIAL DETAIL)

MAXIMUM DEPTH FROM COVER LEVEL TO
SOFFIT OF PIPE 2m, NON-ENTRY
PLASTIC CHAMBERS AND RINGS SHALL
COMPLY WITH BS EN 13598-1 AND BS EN
13598-2 OR HAVE EQUIVALENT
INDEPENDENT APPROVAL





APPENDIX F:
Greenfield Runoff Rate Calculation



Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (<https://www.uksuds.com/>)

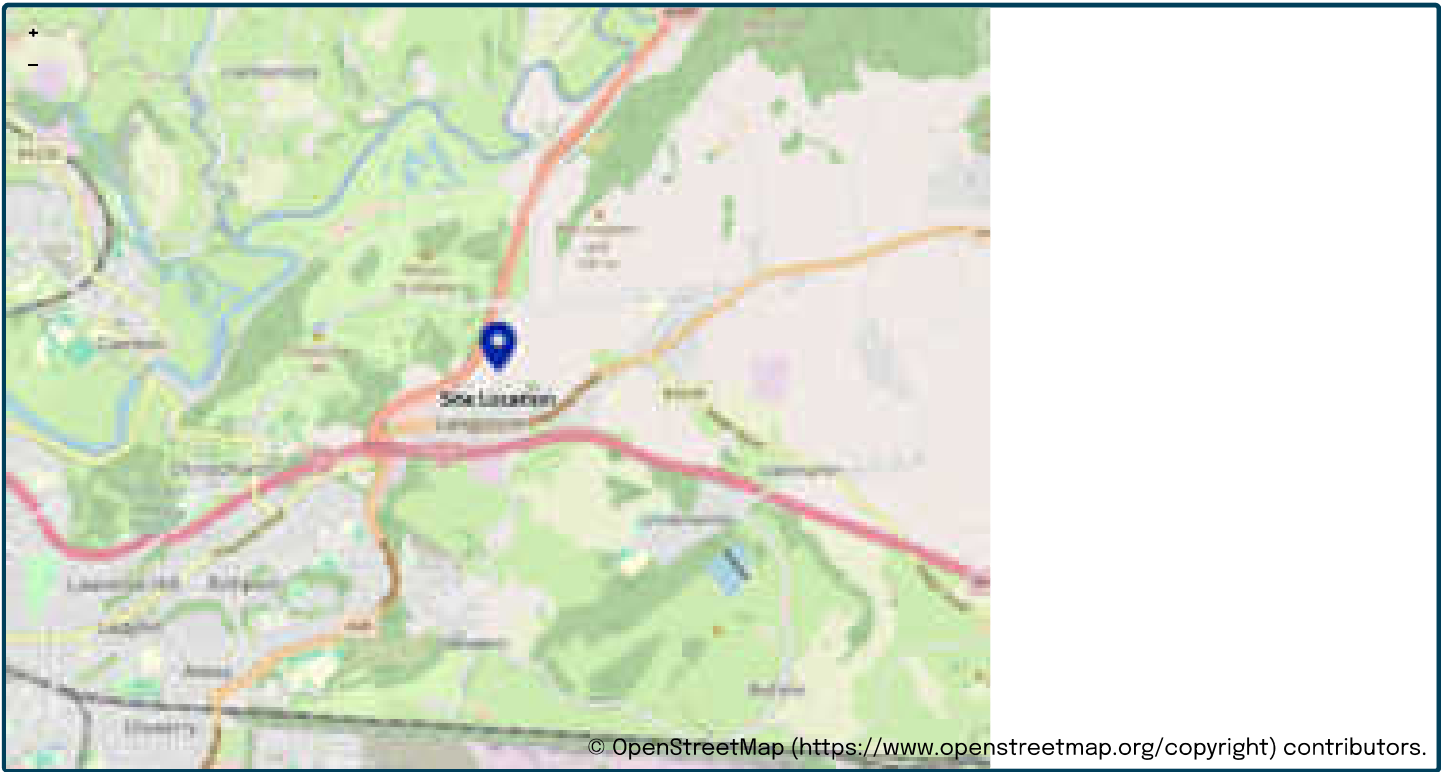
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	07/04/2026
Calculated by	AH
Reference	23616
Model version	2.2.3

Location

Site name	Land at Bramley, Catsash Road
Site location	Land at Bramley, Catsash Road



Site easting (British National Grid)	336978
Site northing (British National Grid)	190066

Site details

Total site area (ha)	0.237	ha
----------------------	------------------------------------	----

Greenfield runoff

Method

Method	FEH statistical (2025)
--------	-----------------------------------

FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	1062	mm
BFIHOST19scaled	0.427	
QMed-QBar conversion	1.075	1.075
QMed (l/s)	1.9	l/s
QBar (FEH statistical 2025) (l/s)	2	l/s

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	9	9
1 year growth factor	0.88	
2 year growth factor	0.93	
10 year growth factor	1.42	
30 year growth factor	1.78	
100 year growth factor	2.18	
200 year growth factor	2.46	

Results

Method	FEH statistical (2025)	
Flow rate 1 year (l/s)	1.8	l/s
Flow rate 2 year (l/s)	1.9	l/s
Flow rate 10 years (l/s)	2.9	l/s
Flow rate 30 years (l/s)	3.6	l/s
Flow rate 100 years (l/s)	4.4	l/s
Flow rate 200 years (l/s)	5.0	l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.



APPENDIX G:
Hydraulic Design Calculations

Vale Consultancy								Page 1
29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF35 5LJ								
Date 10/04/2026 13:22 File 23616 SW Network.SRCX		Designed by amy.hammonds Checked by						
Innovyze		Source Control 2020.1.3						
<u>Summary of Results for 100 year Return Period (+40%)</u>								
Half Drain Time : 102 minutes.								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
15 min Summer	29.659	0.459	0.0	1.5	1.5	11.3	O K	
30 min Summer	29.799	0.599	0.0	1.7	1.7	14.8	O K	
60 min Summer	29.918	0.718	0.0	1.9	1.9	17.7	O K	
120 min Summer	29.959	0.759	0.0	1.9	1.9	18.7	O K	
180 min Summer	29.975	0.775	0.0	1.9	1.9	19.1	O K	
240 min Summer	29.976	0.776	0.0	1.9	1.9	19.2	O K	
360 min Summer	29.954	0.754	0.0	1.9	1.9	18.6	O K	
480 min Summer	29.917	0.717	0.0	1.9	1.9	17.7	O K	
600 min Summer	29.876	0.676	0.0	1.8	1.8	16.7	O K	
720 min Summer	29.835	0.635	0.0	1.7	1.7	15.7	O K	
960 min Summer	29.759	0.559	0.0	1.6	1.6	13.8	O K	
1440 min Summer	29.636	0.436	0.0	1.5	1.5	10.8	O K	
2160 min Summer	29.512	0.312	0.0	1.3	1.3	7.7	O K	
2880 min Summer	29.434	0.234	0.0	1.1	1.1	5.8	O K	
4320 min Summer	29.348	0.148	0.0	0.9	0.9	3.7	O K	
5760 min Summer	29.302	0.102	0.0	0.8	0.8	2.5	O K	
7200 min Summer	29.276	0.076	0.0	0.7	0.7	1.9	O K	
8640 min Summer	29.259	0.059	0.0	0.7	0.7	1.5	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)				
15 min Summer	124.181	0.0	12.4	18				
30 min Summer	85.063	0.0	17.0	32				
60 min Summer	55.834	0.0	22.3	60				
120 min Summer	34.376	0.0	27.5	94				
180 min Summer	26.006	0.0	31.2	128				
240 min Summer	21.335	0.0	34.1	162				
360 min Summer	16.074	0.0	38.5	232				
480 min Summer	13.064	0.0	41.8	300				
600 min Summer	11.077	0.0	44.3	368				
720 min Summer	9.654	0.0	46.3	434				
960 min Summer	7.727	0.0	49.5	560				
1440 min Summer	5.598	0.0	53.7	810				
2160 min Summer	4.043	0.0	58.2	1172				
2880 min Summer	3.226	0.0	61.9	1528				
4320 min Summer	2.391	0.0	68.9	2248				
5760 min Summer	1.964	0.0	75.4	2952				
7200 min Summer	1.711	0.0	82.1	3680				
8640 min Summer	1.544	0.0	88.9	4408				
©1982-2020 Innovyze								

Vale Consultancy		Page 2					
29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF35 5LJ							
Date 10/04/2026 13:22 File 23616 SW Network.SRCX							
Designed by amy.hammonds Checked by							
Innovyze		Source Control 2020.1.3					
<u>Summary of Results for 100 year Return Period (+40%)</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	29.247	0.047	0.0	0.6	0.6	1.2	O K
15 min Winter	29.659	0.459	0.0	1.5	1.5	11.3	O K
30 min Winter	29.801	0.601	0.0	1.7	1.7	14.8	O K
60 min Winter	29.922	0.722	0.0	1.9	1.9	17.8	O K
120 min Winter	29.959	0.759	0.0	1.9	1.9	18.7	O K
180 min Winter	29.967	0.767	0.0	1.9	1.9	19.0	O K
240 min Winter	29.958	0.758	0.0	1.9	1.9	18.7	O K
360 min Winter	29.914	0.714	0.0	1.8	1.8	17.6	O K
480 min Winter	29.858	0.658	0.0	1.8	1.8	16.3	O K
600 min Winter	29.801	0.601	0.0	1.7	1.7	14.8	O K
720 min Winter	29.747	0.547	0.0	1.6	1.6	13.5	O K
960 min Winter	29.652	0.452	0.0	1.5	1.5	11.2	O K
1440 min Winter	29.514	0.314	0.0	1.3	1.3	7.7	O K
2160 min Winter	29.391	0.191	0.0	1.0	1.0	4.7	O K
2880 min Winter	29.324	0.124	0.0	0.9	0.9	3.1	O K
4320 min Winter	29.260	0.060	0.0	0.7	0.7	1.5	O K
5760 min Winter	29.231	0.031	0.0	0.5	0.5	0.8	O K
7200 min Winter	29.216	0.016	0.0	0.5	0.5	0.4	O K
8640 min Winter	29.207	0.007	0.0	0.4	0.4	0.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
10080 min Summer	1.426	0.0	95.8	5144			
15 min Winter	124.181	0.0	12.4	18			
30 min Winter	85.063	0.0	17.0	31			
60 min Winter	55.834	0.0	22.3	60			
120 min Winter	34.376	0.0	27.5	98			
180 min Winter	26.006	0.0	31.2	136			
240 min Winter	21.335	0.0	34.1	174			
360 min Winter	16.074	0.0	38.6	248			
480 min Winter	13.064	0.0	41.8	320			
600 min Winter	11.077	0.0	44.3	390			
720 min Winter	9.654	0.0	46.3	456			
960 min Winter	7.727	0.0	49.4	588			
1440 min Winter	5.598	0.0	53.7	838			
2160 min Winter	4.043	0.0	58.2	1192			
2880 min Winter	3.226	0.0	61.9	1556			
4320 min Winter	2.391	0.0	68.9	2248			
5760 min Winter	1.964	0.0	75.4	2944			
7200 min Winter	1.711	0.0	82.1	3672			
8640 min Winter	1.544	0.0	88.9	4408			
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Vale Consultancy		Page 4
29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF35 5LJ		
Date 10/04/2026 13:22 File 23616 SW Network.SRCX	Designed by amy.hammonds Checked by	
Innovyze		Source Control 2020.1.3

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 336978 190066 ST 36978 90066
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.040

Time (mins)	Area
From:	To: (ha)
0	4 0.040

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Vale Consultancy		Page 5
29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF35 5LJ		
Date 10/04/2026 13:22 File 23616 SW Network.SRCX	Designed by amy.hammonds Checked by	
Innovyze		Source Control 2020.1.3

Model Details

Storage is Online Cover Level (m) 30.600

Cellular Storage Structure

Invert Level (m) 29.200 Safety Factor 3.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	26.0	0.0	5.200	0.1	0.0
0.400	26.0	0.0	5.600	0.1	0.0
0.800	26.0	0.0	6.000	0.1	0.0
0.801	0.1	0.0	6.400	0.1	0.0
1.600	0.1	0.0	6.800	0.1	0.0
2.000	0.1	0.0	7.200	0.1	0.0
2.400	0.1	0.0	7.600	0.1	0.0
2.800	0.1	0.0	8.000	0.1	0.0
3.200	0.1	0.0	8.400	0.1	0.0
3.600	0.1	0.0	8.800	0.1	0.0
4.000	0.1	0.0	9.200	0.1	0.0
4.400	0.1	0.0	9.600	0.1	0.0
4.800	0.1	0.0	10.000	0.1	0.0

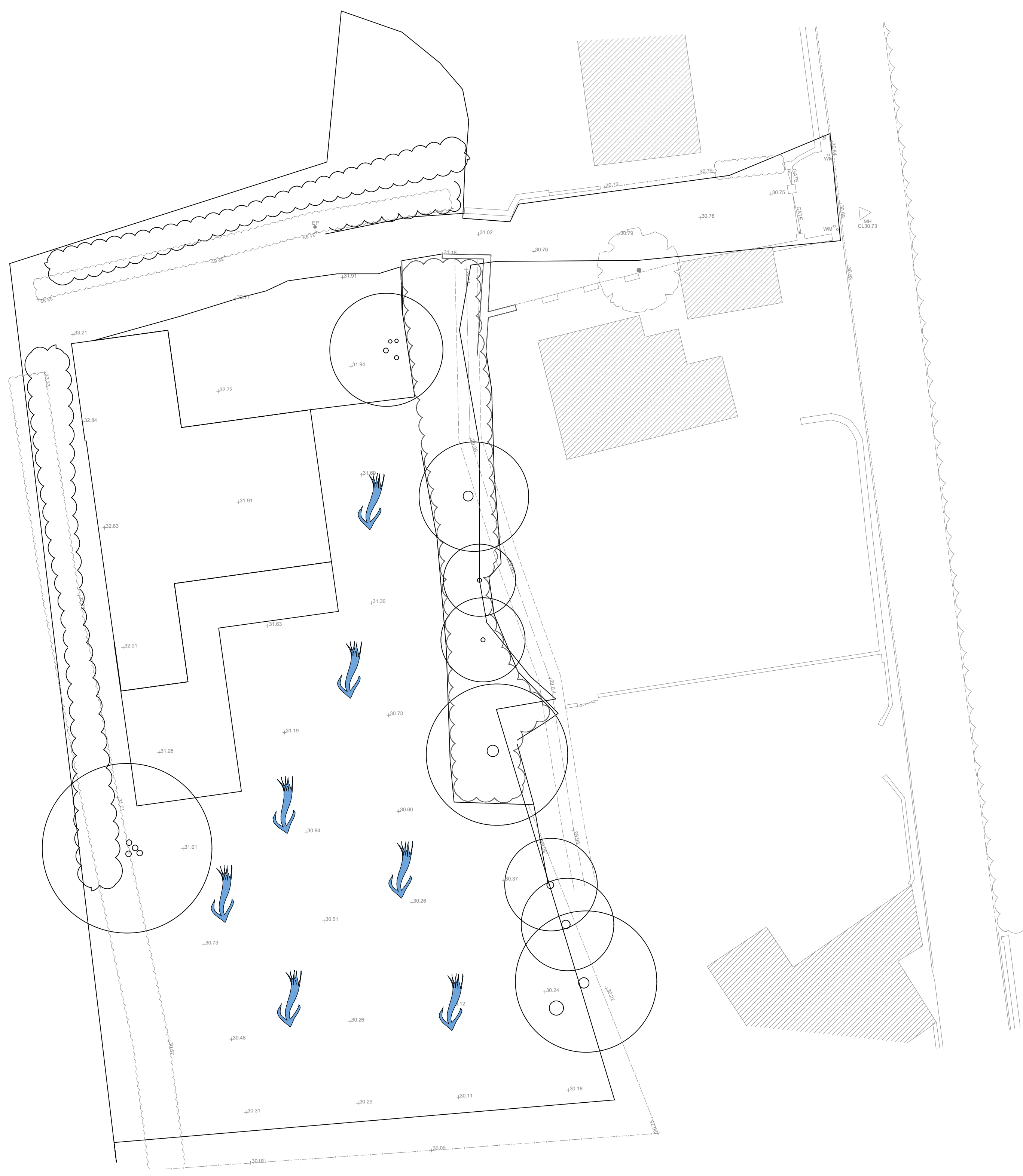
Orifice Outflow Control

Diameter (m) 0.032 Discharge Coefficient 0.600 Invert Level (m) 29.150

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APPENDIX H:
Flow Exceedance Plan



1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
3. DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
4. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
5. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
6. EXISTING SERVICES HAVE NOT BEEN SHOWN BUT ARE PRESENT - THE CONTRACTOR IS TO LIAISE WITH ALL STATUTORY AUTHORITIES PRIOR TO THE COMMENCEMENT OF ANY WORKS.

FLOW EXCEEDANCE ARROW

PRELIMINARY

	rev.	drawn	checked	approved	date	SAB Pre-App submission	
					06.04.26		
Client							
SKERRYVORE DESIGN LTD.							
Project							
LAND AT BRAMLEY, CATSASH ROAD NP18 2AN							
Title							
FLOW EXCEEDANCE PLAN							
 Vale Consultancy CONSULTANCY LTD. 01656 863794							
29 Bocam Park, Old Field Road, Pencoe, Bridgend CF35 5LJ. Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk							
date		drawn		checked		approved	
APRIL 26		AH		PG		PG	
				06.04.26		06.04.26	
scale @ A1				project no.			
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APPENDIX I:
Maintenance and Management Plan

MANAGEMENT & MAINTENANCE PLAN

Land at Bramley,
Catsash Road,
Langstone,
NP18 2AN

Prepared for: Skerryvore Design Ltd.
Project Ref: 23616_MP



DOCUMENT CONTROL

Project:	Land at Bramley, Catsash Road, Langstone, NP18 2AN
Client:	Skerryvore Design Ltd.
Vale Consultancy Ref:	23616

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1 INTRODUCTION

- 1.1 This SuDS Management and Maintenance Plan has been prepared by Vale Consultancy in support of a SuDS scheme for the proposed development at Land at Bramley, Catsash Road, Langstone, NP18 2AN.
- 1.2 The proposed project consists of a single house residential dwelling with associated driveway, whilst also incorporating various raingardens & permeable surfaces into the scheme to provide interception, amenity & biodiversity across the site.
- 1.3 The scheme incorporates a sustainable drainage system for surface water runoff, which consists of a raingarden, attenuation crate and permeable paving.
- 1.4 The purpose of this document is to set out the overall management and maintenance objectives for the proposed SuDS components and to describe the long-term maintenance required to allow the system to continue operating as is intended.
- 1.5 All references to SuDS components are based on the SAB submission drawings:
 - **23616_500_r01 – Proposed Drainage Layout**
 - **23616_509_r01 – Proposed Catchment Plan**
 - **23616_510_r01 – Drainage Details**
 - **23616_522_r01 – Exceedance Flow Plan**

2 MANAGEMENT RESPONSIBILITIES

- 2.1 The current site owner(s) shall be responsible for the implementation of the Management and Maintenance Plan. If deemed necessary, all maintenance operations shall be undertaken by suitable and qualified contractor appointed by the site owner.
- 2.2 All inspections and maintenance work must be recorded. This allows for future assessment of the maintenance activities and their response to the system. It can also provide protection against legal claims should the system be exceeded in a storm event leading to flooding elsewhere.

3 MANAGEMENT OBJECTIVES

- 3.1 The site shall be managed and maintained as an attractive, tidy, and safe finish to all landscape elements.
- 3.2 The proposed planting shall enhance the biodiversity and nature conservation interests.
- 3.3 The Site Owner(s) shall ensure establishment and long-term health of all landscape elements for the benefit of the tenants and visual amenity of the area.
- 3.4 Best Health & Safety practices shall always be used.
- 3.5 To monitor standards and make amendments where required, it is expected that the Site Owner will review the management work (with reference to this document) at least quarterly for the first year and annually thereafter.

4 INSPECTION AND MAINTENANCE ACCESS

- 4.1 Access to the site(s) for inspection and maintenance can be gained via Catsash Road.
- 4.2 Maintenance vehicles can park in the car park areas for maintenance of the various SuDS features as required.



5 MAINTENANCE VISITS OR INSPECTIONS

- 5.1 The Site Owner or appointed maintenance contractor shall carry out a minimum of 12 maintenance visits or inspections per year to check drainage SuDS components. Visits shall be monthly. Additional visits may be needed to deal with extreme weather conditions or specific horticultural requirements.

6 GENERAL

- 6.1 All materials and workmanship are to be to the highest possible standards and shall be in accordance with relevant British Standards, good horticultural and arboricultural practices, and the landscape specification.
- 6.2 The Site Owner shall employ suitably qualified staff for all work and when using sprays and mechanical equipment. All equipment shall be kept in a sound condition, fit for use and purpose.
- 6.3 The Site Owner and their appointed contractors shall comply with all relevant Health and Safety regulations and good working practices.
- 6.4 The Site Owner shall take care when work is beside any structure or paved area and will, at their own cost, be responsible for making good any damage caused.
- 6.5 Weeds, pruning's, leaves, rubbish and other arisings shall be removed from site for composting, where possible. No material shall be left on site, and the area shall be left in a neat and tidy condition after each visit.

7 LITTER COLLECTION

- 7.1 All hard surfacing shall be swept as necessary, and all rubbish removed from site.
- 7.2 Litter picking/clearance shall take place during each maintenance visit and all waste shall be removed from site.
- 7.3 During autumn maintenance visits all fallen leaves shall be collected and removed from site.



8 ORNAMENTAL PLANTING

Specific objectives:

- To ensure early establishment and healthy growth
- To maintain a dense canopy cover
- To maintain year-round appearance and visual interest

Maintenance Operations:

- 8.1 All shrub beds in the raingardens shall be maintained substantially free of weeds. Work shall be done either manually or with appropriate selective weed killer in accordance with manufacturer's recommendations. If weed killer is used the dead weeds shall be removed at the next maintenance visit. Care must be taken to avoid damage to adjacent planting and grass and replaced immediately if affected by weed killer.
- 8.2 Once established, shrubs shall be selectively thinned or reduced in height as appropriate by removal or pruning to allow room for growth and avoid overcrowding/overshadowing and create a natural form rather than cube or cloud shapes. Care shall be taken to avoid over pruning and so creating obvious gaps in the shrub beds.
- 8.3 Ground cover plants shall be clipped or pruned if necessary, to give a neat and tidy finish and contained within the planting bed. Work to remove dead vegetation shall be carried out during the winter months.
- 8.4 Pruning of herbaceous planting:
- 8.5 In spring cut stems close to the 'crown' or 'dormant' top of the plant, avoiding the removal of new shoots.
 - Tidy up the base of the plant, removing dead foliage and debris.
 - Remove all material from site.
 - If necessary, apply a 50mm layer of fine horticultural mulch. This will help moisture retention in the soil, contribute to weed suppression and allow delicate stems to grow.
 - Leave dried flower head over winter for relevant species e.g. ornamental grasses.
- 8.6 Fertilising:
 - One application, just before or at the time of spring growth.
 - A balanced fertiliser is required, one high in Phosphorus (which encourages blooming as well as strong roots and disease resistance). Fertilisers high in nitrogen should not be used as nitrogen promotes excess foliage at the expense of flowers and roots which can result in weak stems



9 TRADITIONAL DRAINAGE

- 9.1 A bi-monthly site inspection should be carried out, checking for any areas that are not operating correctly and collecting/removing litter and debris.
- 9.2 All rainwater pipes, channel drains, gullies and inspection chambers should be inspected biannually, typically spring and autumn.
- 9.3 Any excessive sediment build-up in rainwater pipes, channel drains, gullies or inspection chambers causing blockage or poor performance shall be cleared and cleaned as required.
- 9.4 Geo-cellular attenuation tanks require little to no maintenance. They should however be inspected after every major storm event. For traditional drainage systems it is recommended that a slit trap is incorporated into the pipework at the inlet to the tank. However, in SuDS applications silt and debris is usually removed by upstream SuDS components so there is less need for a silt trap.
- 9.5 Flow control devices provide customised water quantity management for surface water across a wide range of flows and for a variety of applications. The flow control has no moving parts and no power requirements and provides reliable, low-maintenance, engineered flood management. The two most common flow control devices are vortex and orifice plate flow controls. This scheme will incorporate orifice flow controls only and maintenance requirements are as detailed in section 9.

10 SUMMARY OF INSPECTION AND MAINTENANCE FOR SUDS

- 10.1 The following briefly summarises the frequency and type of inspections and maintenance required for the SuDS components and drainage system used in this scheme:

10.2 General

Operation and maintenance requirements for traditional drainage components		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of traditional drainage including rainwater pipes, channel drains, gullies and inspection chambers (as applicable).	Bi-annually
	Remove litter or build-up of foliage	Bi-annually (or as required)
Occasional maintenance	Clear channel drains and gullies of silt build up	Every 5 years (or as required)
Remedial Actions	Jet/vac inspection chambers and below ground pipework when blocked or performance is affected due to partial blockages	Every 20 years (or as required)



10.3 Flow control devices

Operation and maintenance requirements for orifice flow control		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of flow control device including litter and debris removal	Routine maintenance should be undertaken on completion of drainage works and then annually thereafter
	Check emergency drain down (if fitted) is in good working order	
	Check and clean orifice screening device and replace if damaged	
	Check component fixings are secure	
Occasional maintenance	De-silting / sediment removal	As required upon inspection
Remedial Actions	Damage repair	As required upon inspection



10.4 Bioretention areas (Raingardens)

Operation and maintenance requirements for Bioretention Raingardens		
Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years



10.5 Pervious Paving

Operation and maintenance requirements for Pervious Pavements		
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 glyphosate 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 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, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually



Operation and maintenance requirements for Geocellular Attenuation Crate		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	Remove sediment from pre-treatment structures	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect all inlets, outlets, overflows and vents to ensure that they are in good condition and operating as designed	Annually
	Check soakaway to ensure emptying is occurring	Annually
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years



11 LIFETIME MANAGEMENT AND MAINTENANCE COSTS FOR SUDS

11.1 Lifetime management and maintenance costs have been broken down for each SuDS drainage system. Costs are based on a 60-year design life.

11.2 The costs associated with the management and maintenance of the SuDS system over the 60-year design life of the scheme has been estimated based on the inspection and maintenance activities in section 10, as follows:

11.3 General

- General monthly inspection by the site owner (incl. litter removal) – no cost as is incorporated in general site maintenance undertaken by site owner
- Biannual check of traditional drainage - no cost as is incorporated in general site maintenance undertaken by site owner
- Annual check of flow control chamber - no cost as is incorporated in general site maintenance undertaken by site owner

11.4 Bioretention areas (Raingardens)

- Annual inspection - no cost as is incorporated in general site maintenance undertaken by site owner.
- Annual pruning/fertilising - no cost as is incorporated in general site maintenance undertaken by site owner.
- Plant replacement over 60 years, assuming 10% of plants need to be replaced each year with Meadowmat SuDS & Slopes seed mix (10% of 52 m² = 5.2 m²) @ £2 / m² / year - £624.00

11.5 Permeable Block Paving

- Weed kill every 5 years @ £0.30 / m² x 148 m² - £488.40
- Take up and clean/replace surface course once in year 30 @ £15 /m² x 148 m² - £2,220.00
- Brush and/or power wash surface every 10 years @ £500 / application - £500x5 = £2,500

11.6 Attenuation crates

- Annual inspections over £100 x 60 yr = £6,000
- Annual root trimming over £50 x 60 yr = £3,000

11.7 The total sum of management and maintenance costs for the proposed SuDS over a 60-year design life - £14,832.40 or circa £247.20 a year.