Surface Water Drainage Design Summary and Calculations		
Project Name:	Regal House, Shripney Road	
Project Number:	D2339	
Client:	Jeremey Brooks	
Prepared by and Date:	MJA	08/01/25 (v1.1)

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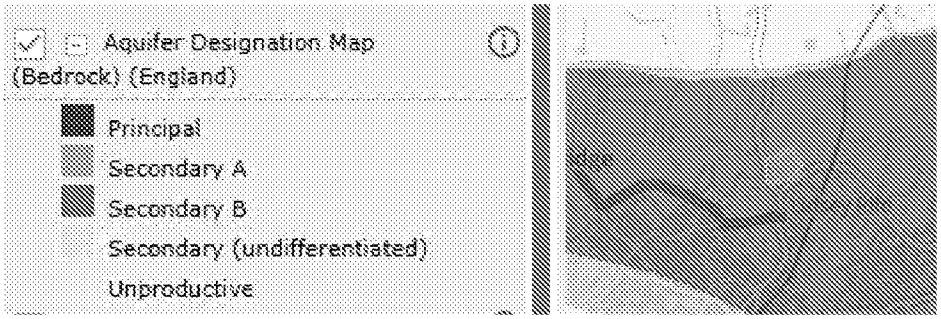
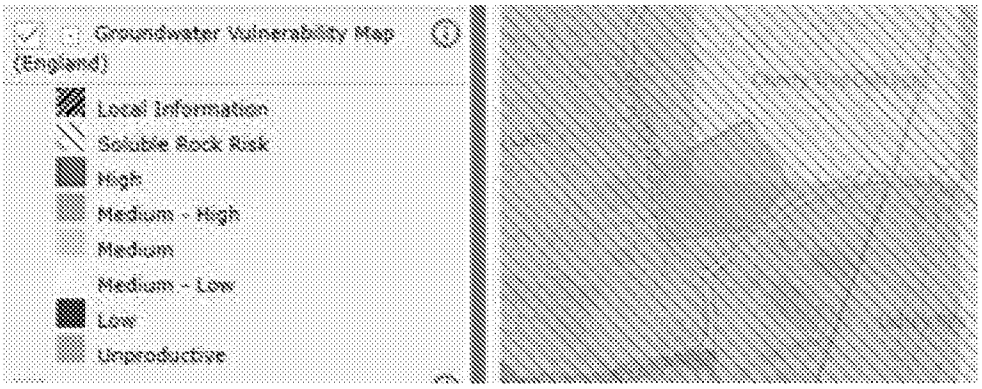
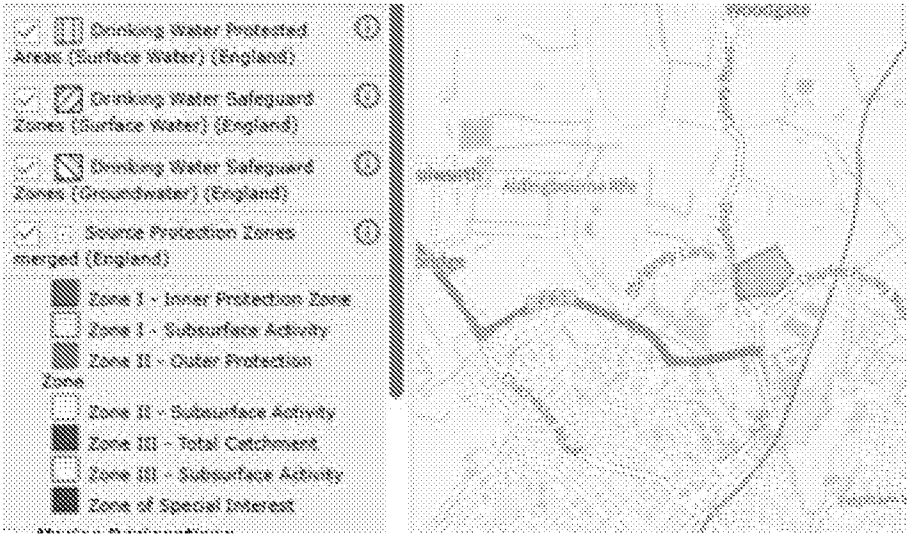
Site address:	Regal House, Shripney Road, PO22 9NP
Grid Reference:	SU 939019
Eastings / Northings:	493934,101962
Local Authority:	Arun District Council
Lead Local Flood Authority:	West Sussex County Council
Proposed Development:	The architectural development proposal is contained within **Appendix A**.
Site area:	4,004 (0.4 Ha.)
Topography:	The topography survey is contained within **Appendix B**.
Greenfield run-off rate:	**1.19l/s (QBar)** 1.01l/s (1 in 1 Year) 2.73l/s (1 in 30 Year) 3.79l/s (1 in 100 Year) 4.44l/s (1 in 200 Year) Refer to Wallingford calculations contained within **Appendix C.**
Brownfield run-off rate:	1.2 l/s (based on 50mm/hr (88sqm) peak runoff rate for run-off to Public Highway– no existing formal drainage network to model)
Geology:	**Bedrock:** Lewes Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk, Portsdown Chalk **Superficial Deposits:** River Terrace Deposits – Sand Silt Clay
Site Specific Investigation:	Infiltration testing and groundwater monitoring was completed by RSPD in their former Drainage & SUDS Strategy report ref:5871/0 dated September 2024. Infiltration testing conclude a rate of 1.91x10(-5), however groundwater was observed to be shallow being less than 1.0mbgl with a peak of 0.69mbgl. Testing did not cover a full winter period hence it is anticipated that the seasonal peaks would be worse. In light of the above, and adhering to the LLFA/LPA policy, a 1.0m freeboard is unachievable thus infiltration is not a viable solution for surface water drainage. Extracts from this report are contained within **Appendix D**.

Aquifer Designation:	**Bedrock:** Principal **Superficial Drift:** Principal 
Groundwater Vulnerability Zone:	Medium – High 
Groundwater Source Protection Zone:	None 
Drinking Water Safeguarding Zone (Surface Water and/or Groundwater):	None
Groundwater depth:	Up to 0.69mbgl
Soil infiltration rate:	1.91x10(-5), however these were not undertaken in strict accordance with BRE365.
Nearby watercourse:	Ordinary watercourse at east boundary of site
Nearby surface water sewer:	There is a surface water drain running northerly within the central reserve of Shripney Road. Whilst this asset is understood to be a WSCC highway drain, it is noted to also serve numerous private catchments. PL001 demonstrates a small portion of the site catchment of 88sqm falls westerly towards the Public Highway which is intercepted by road gullies.

	There is an existing 100mm diameter pipe surface water drain serving the northern residential plot which outfalls to the ordinary watercourse at east boundary of site.
Proposed method of disposal and reason:	Catchment A - Controlled discharge to WSCC highway drain. Catchment B - Controlled discharge to watercourse. Infiltration not viable due to high groundwater levels.
Design storms considered:	100 year
Climate change:	45%
Urban creep:	10%
Proposed catchment areas:	2,196m^2 (0.22 Ha.)
Proposed discharge rate:	Catchment A - 1.0 l/s to WSCC highway drain. Catchment B – 1.0l/s to watercourse via private 100mm diameter SW drain.
Flow control method:	Flow Control Manhole
Volume of storage provided and method:	Catchment A – Geocellular tank. Catchment B – Combination of geocellular tank and permeable pavement.
Calculations:	Hydraulic modelling calculations are contained within **Appendix E**. 10 year half drain times for the storage features are included within the calculations, to demonstrate 24 hour compliance.

Surface Water Treatment

Treatment:

1.1.1 The use of permeable paving will ensure that run-off from the site receives a level of treatment required by the SuDS manual, with hydrocarbons being filtered by the aggregate and geotextile layers.

1.1.2 In accordance with the CIRIA SuDS Manual C753 regarding methods for managing pollution risks, the risk posed by surface water run-off to the receiving environment depends on the pollution hazard at the site (the source), SuDS treatment techniques (the pathway), and the sensitivity of the environment (the receptor).

1.1.3 The simple index approach considers whether SuDS techniques are appropriate for the site. The states that for SuDS components to deliver adequate treatment, the total pollution mitigation index for each contaminant type should equal or exceed the pollution hazard index.

1.1.4 The SuDS Manual outlines three categories of pollution hazard identification, which vary depending on proposed land use, which are as follows:

- Total Suspended Solids (TSS).
- Metals (M).
- Hydrocarbons (H).

1.1.5 In accordance with C753 Table 26.2, the proposed land uses at the site are categorised as follows:

	• Residential Roofs and non-trafficked areas – very low/TSS=0.2/M=0.2/H=0.05 • Individual property driveways and low traffic roads – low/TSS=0.5/ M=0.4/H=0.4 1.1.6 In accordance with C753 Table 26.3, the values of SuDS Mitigation indices are: • Permeable Pavement – TSS=0.7/M=0.6/H=0.7 • Stormshark (or equivalent) - TSS=0.5/M=0.4/H=0.45 1.1.7 As the pollution hazard index does not exceed any pollution mitigation index for any contaminant type, the proposed SuDS methods will provide sufficient treatment for the proposed development.

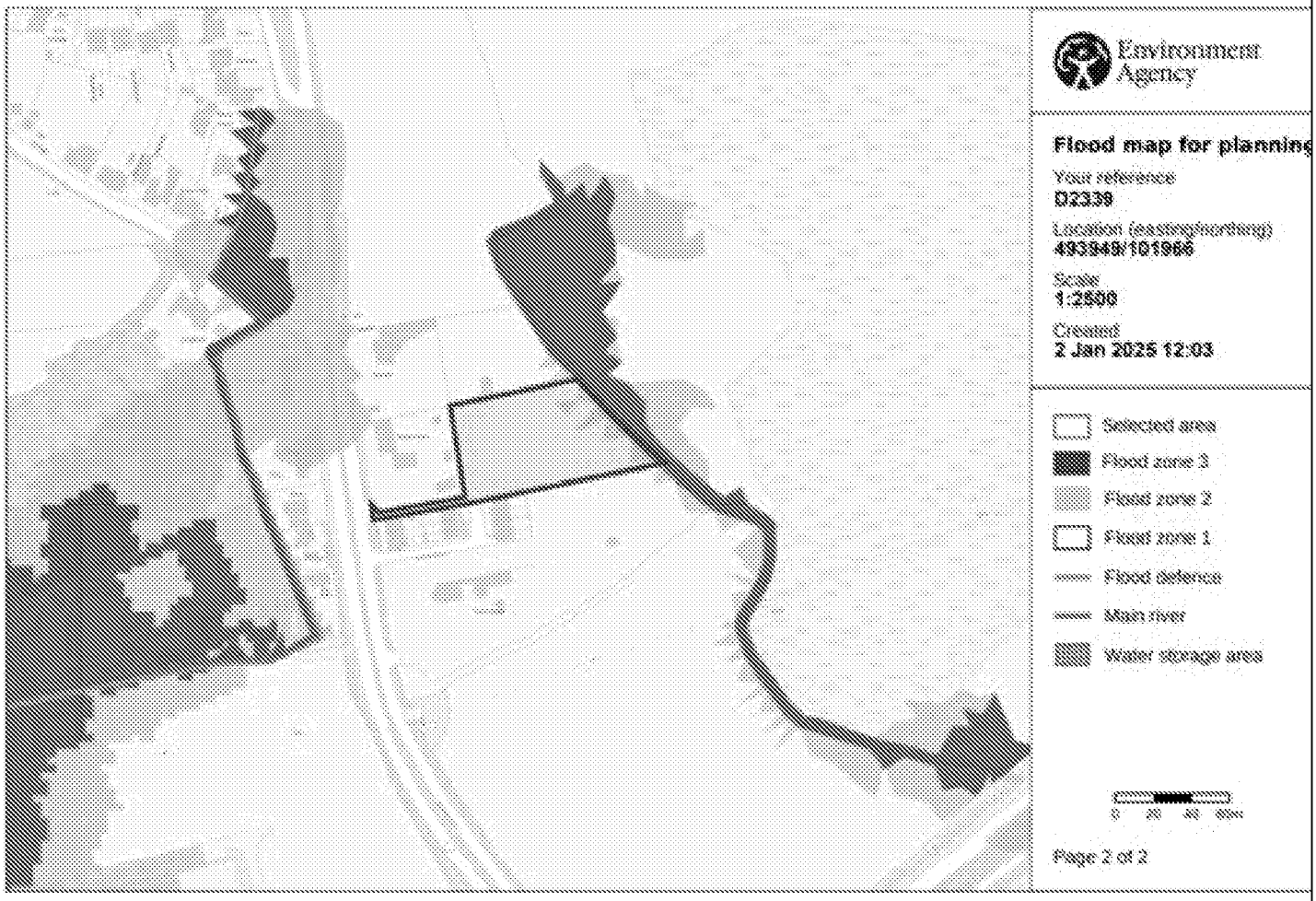
Foul Water Drainage Strategy

Number of properties:	7 No. 4 No. bedroom dwelling
Method of discharge:	Southern Water's public sewer records identify an existing public foul water sewers within the vicinity of the site. Public sewer records are contained within **Appendix F** There is a 150mm diameter Public foul sewer running northerly within Shripney Road alongside the western boundary. A new gravity connection will be made to said foul sewer.
Off-site works:	Connection to public sewer subject to S106 approval from Southern Water.

Flood Risk Summary

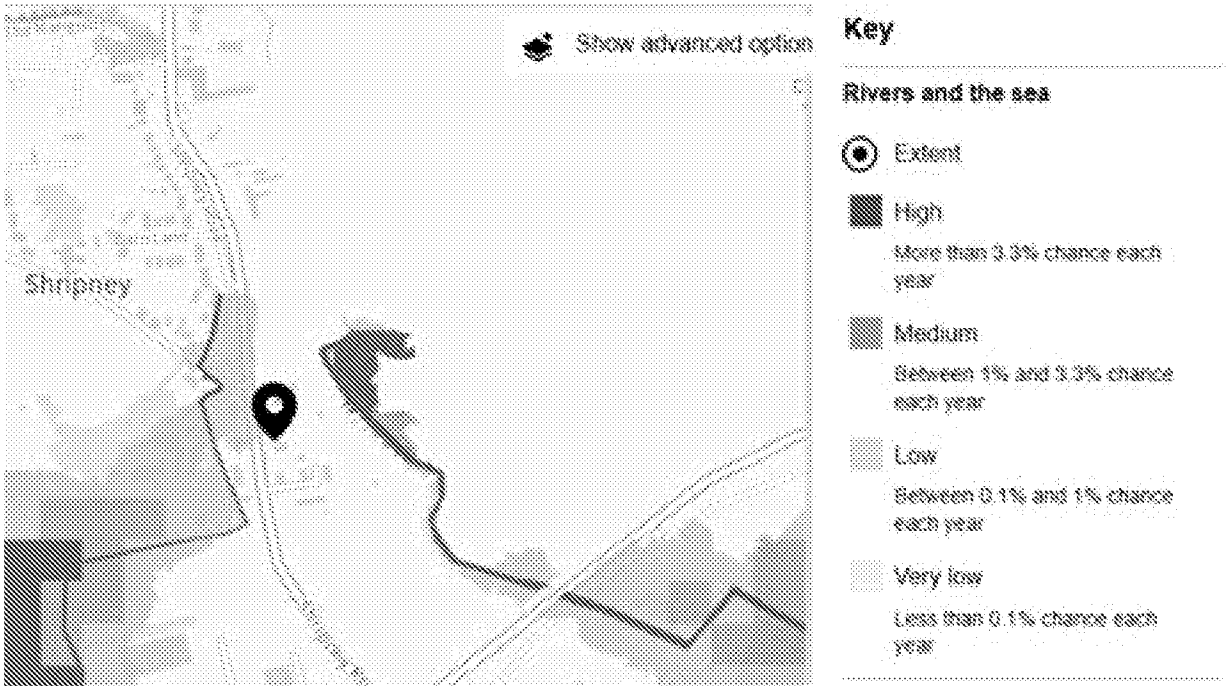
Flood Zone Classification:	Flood Zone 1 with small portion of east boundary clipping Flood Zone 2 & 3

MAP



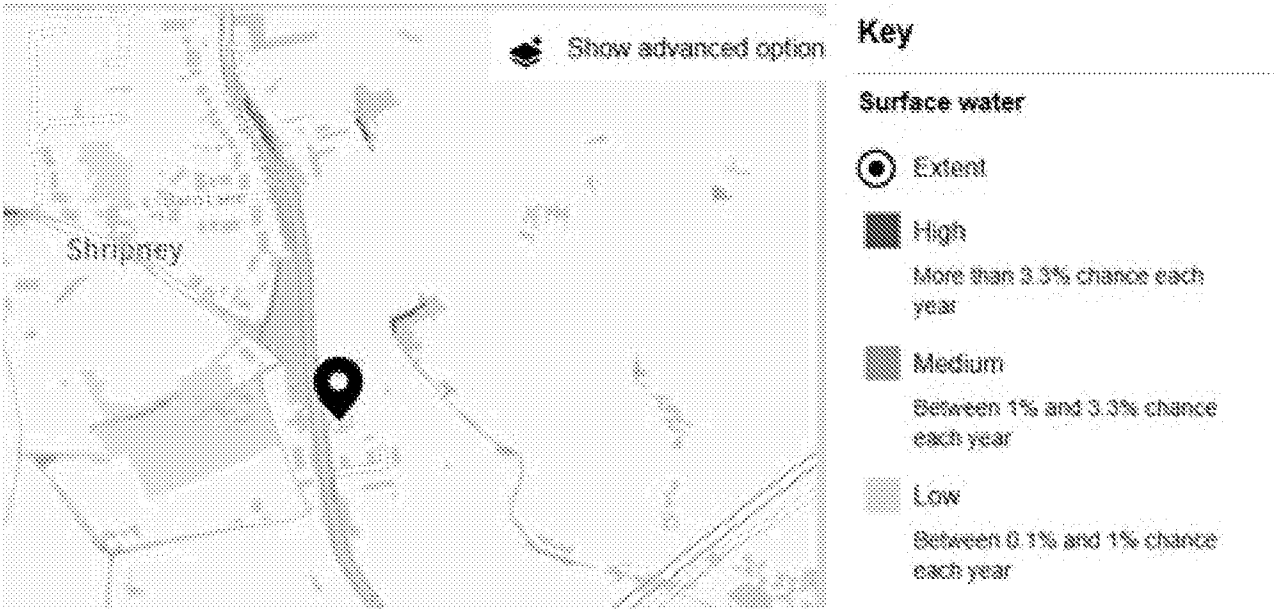
Rivers or the Sea:	Very Low

MAP



Surface Water:	Very Low

MAP



MANAGEMENT AND MAINTENANCE

Responsibility for Maintenance

The proposed drainage system will not be offered for adoption therefore the responsibility for the ongoing maintenance of drainage network will fall to the end user(s).

Infrastructure which is 'shared' (i.e. serving more than a single plot and/or falling outside of any individual plot's curtilage) will be the responsibility of the Management Company.

General Maintenance

Maintenance plays an important part in the long-term performance of a surface water drainage system and will be required to ensure that it remains fully operational.

The drainage system has been designed to minimise maintenance requirements; however, a number of key tasks will need to be undertaken so that the system remains effective. These operations are summarised in the table below, along with the required frequency of works. The frequencies given below are a minimum, and in order to establish an effective regime, the level of siltation in each of the components should be monitored in the early stages to inform the long term management and maintenance strategy.

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Inlet, Outfall	Inspection, vegetation clearance and additional clearing/cleansing of potential outfall blockages	At least once a year
	Desilting	Year 1, Year 3, then every 5 years
Catch pits, gully sumps and drains	Inspection and additional cleansing as required.	Every 6 months
	Desilting	Year 1, Year 3, then every 5 years
Pipework	Jetting to clear blockages	As required

The responsibility of any drainage infrastructure supporting a single dwelling/plot will be the sole responsibility of the owner/occupier of the associated dwelling.

Additional maintenance activities beyond this will be the responsibility of Jeremy Brooks or their appointed management company. It is understood funding and maintenance will be provided by Jeremy Brooks, who are the developer of the site, unless otherwise explicitly detailed.

Flow Control Chambers

A flow control chamber (such as a HydroBrake or Crown Vortex Flow Control) or device is self-activating, relying on upstream hydraulic head to generate an air-filled vortex within the centre of the casing. Once the vortex is initiated water drains down through a small opening in the back of the device at the designed restricted flow rate.

The flow control device includes a bypass valve for use should it become blocked. A valve is situated in the front of the unit which is operated from the surface by a release cable situated just under the chamber cover. The valve also proved access of rodding of the downstream pipework.

The flow control chamber will require the following maintenance:

- The sump within the flow control chamber should be monitored for build-up of silts and should be emptied as a minimum on the same regime as specified for catchpits previously within this document.
- The drain down door located on the centre of the unit will require inspection, greasing and opening annually, to ensure it is operating as intended.

The catchpit chambers will require the following maintenance:

- The catchpit chamber should be monitored for build-up of silts and should be emptied as a minimum on the same regime as specified for catchpits previously within this document.

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Flow Control Chambers	Clean out chamber/sump	Monthly for first 3 months then twice annually
	Inspect flow control unit and remove debris	

Permeable Pavements & Diffuser Units

The areas of permeable paving are designed to allow surface water run-off to percolate through the joints in the block paving surface course and into the sub-base below. This provides a volume of attenuated storage (as it is proposed that the permeable paving will be tanked in view of site constraints) before collected run-off is discharged, at a control rate, to the receiving outfall(s).

As part of the permeable paving system, diffuser units are used to discharge surface water run-off from roof areas into the sub-base, as well as forming links between areas of permeable paving. These diffuser units are small heavy-duty cellular units which allow more efficient discharge of surface water into the sub-base base of the permeable paved areas.

The areas of permeable paving will require additional maintenance measures to ensure they operate as designed. Failure in carrying out this maintenance, could increase the risk of flooding. The additional measures are as follows:

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Permeable Pavement	Surface sweeping to reduce silt and debris accumulation.	Every 8 to 12 weeks
	Replace broken slabs/blocks	As required
	Removal / management of weed growth	At least once a year
	Silt removal from permeable surfaces, possibly involving raking out of joints, redressing, removal and remedial works.	As required / to be specified by manufacturer
Diffuser units	Inspection and additional cleansing as required.	Annual
	Desilting.	Year 1, Year 3, then every 5 years

On-site & Boundary Ditches/Watercourses

The purpose of these features primarily is to convey water and provide an element of storage. It is the responsibility of the legal riparian for ensuring all ditches/watercourses are free flowing.

The existing watercourse provides conveyance for overland flow from Third Party Land to the north and east of the site, and thus the overland flow route will be maintained as existing including the provision of a ford across the access road.

The inspection frequency and maintenance requirements are illustrated in the table below and may be affected by other seasonal ecology constraints i.e. bird nesting.

Maintenance	Required Action	Required frequency of works
Regular Maintenance	Remove litter/debris	Monthly, or as required
	Cut grass – may be to suit design parameters	Monthly, or as required
	Manage and/or cut back vegetation	Monthly, or as required
	Inspect inlets/outlets (i.e. culvert at upstream and downstream headwalls)	Monthly
	Inspect base for silt and remove as required	Twice annually
Occasional Maintenance	Reseed areas of poor grass coverage and/or vegetation growth	As required
Remedial Actions	Repair erosion or other damage	As required
	Remove silt from base	As required
	Re-level uneven surfaces to existing/design surface profile	As required
	Remove and dispose of oils, petrols and/or other pollutants and dispose to licenced tip as required	As required

Remedial/Repair Actions

Significant storm events may cause considerable damage to SuDS and their associated components. As such, it may be necessary to inspect and carry out essential recovery works to return the feature to full working order.

Accidental Spillages

It is not envisaged that any materials are to be stored onsite once the development has been completed, which could cause major spills and potential pollution issues within the drainage system. If this situation alters in the future consultation with a specialist will be required in order to confirm if any upgrades to the existing system are necessary.

In the event of a serious spillage, either by volume or of unknown or toxic compounds, the spillage should be isolated with the use of soil, turf or fabric with outlet pipes from chambers downstream of the spillage blocked with a bung/bungs.

Minor spillages of fuels and oils from motor vehicles will be dealt with by the ponds and permeable pavement, by biodegrading / collecting the hydrocarbons respectively.

In the event of localised private spillage, the responsibility lies with the private resident to clear up any spillage before it enters the drainage network. The primary method of dealing with any spillage of hydrocarbons should be using sand (or equivalent) to soak up the leak and mitigate pollution migration. Any contaminated waste shall be disposed of by a licensed contractor.

The Environment Agency should then be contacted immediately on their incident hotline; **0800 807060**.

Construction Phasing

The main contractor is responsible for dealing with all occurrences of groundwater during the construction period.

The main contractor is responsible for dealing with all occurrences of surface water run-off and siltation during the construction period.

It is recommended that the construction of the permeable pavements and geocellular tanks, the flow control and outfall connection are completed prior to the commencement of construction of the buildings and hardstanding areas. This will ensure that flows are controlled and treated during construction. The proposed drainage systems will need a complete maintenance check upon completion of the development and any required remedial tasks undertaken.

By constructing these drainage components first, runoff from the construction site and the hardstanding areas will travel overland into the storage. This will ensure that run-off from the site receives the level of treatment required by the SuDS manual.

Future Alterations to the Development

Any future alterations to the drainage installations should be confirmed by a specialist.

Site Drawings

-SITE LOCATION PLAN KEY-

Site Boundary - 4,004m² (0.4Ha)

NOTES

A3

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Rev.	Date	Amendments
P01	06.03.25	Additional Survey Added
-	-	Original Issue

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Drawing Status
PLANNING
NOT FOR CONSTRUCTION

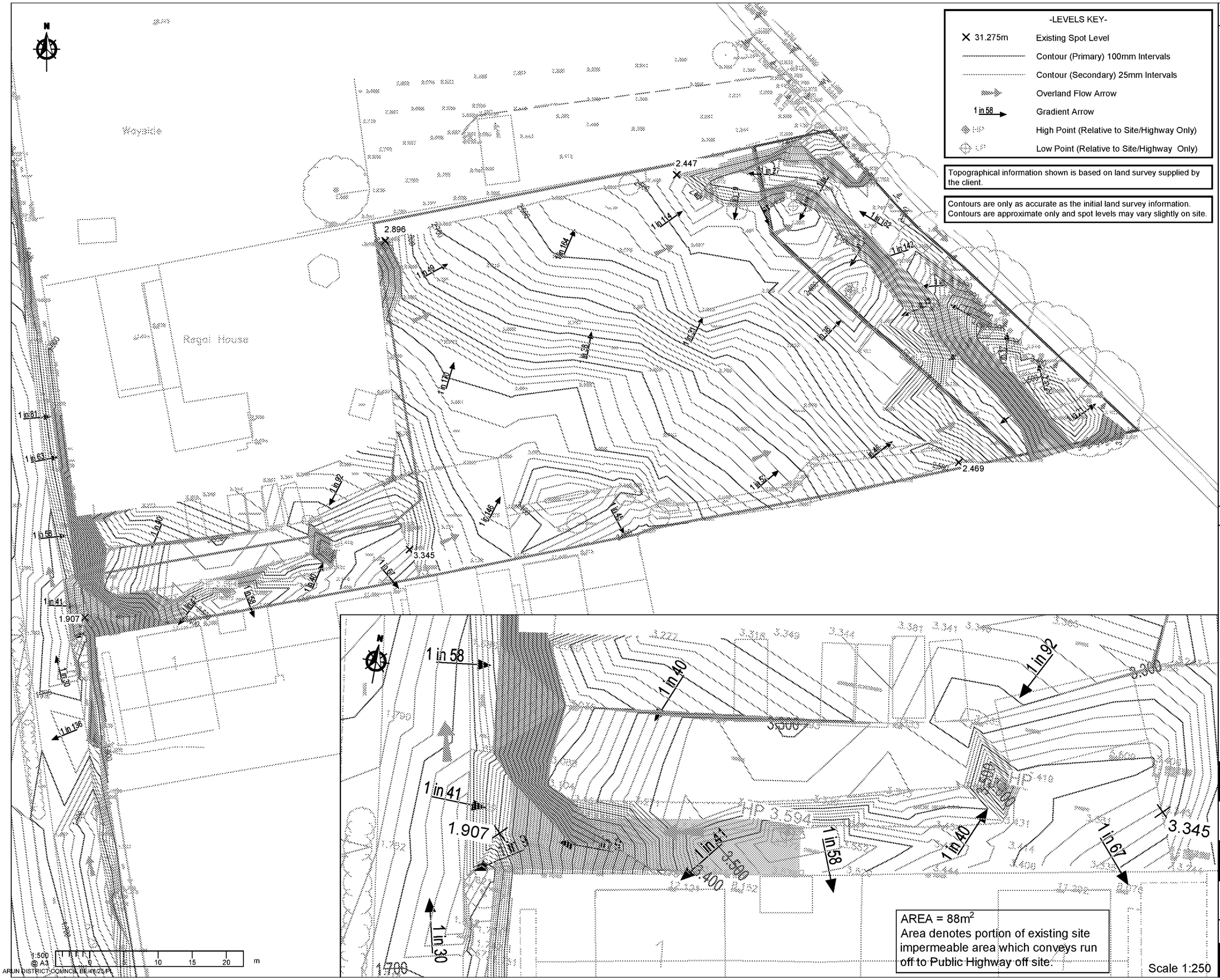
Client
Jeremy Brooks

Project
Land to the Rear of Regal House
Shripney Road, PO22 9NP

Drawing Title
Site Location Plan

Scale at A3	Date	Drawn By	Checked By	Project No.
	Jan 25	JHL	MJA	D2339

Drawing Code	Drawing No.	Rev.
000-BPC-WD-ZZ-D-C	PL001	P01



-LEVELS KEY-

X 31.275m	Existing Spot Level
----------	Contour (Primary) 100mm Intervals
----------	Contour (Secondary) 25mm Intervals
	Overland Flow Arrow
1 in 58	Gradient Arrow
HP	High Point (Relative to Site/Highway Only)
LP	Low Point (Relative to Site/Highway Only)

Topographical information shown is based on land survey supplied by the client.

Contours are only as accurate as the initial land survey information. Contours are approximate only and spot levels may vary slightly on site.

AREA = 88m²
Area denotes portion of existing site impermeable area which conveys run off to Public Highway off site.

Scale 1:250

NOTES

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Client: Jeremy Brooks

Project: Land to the Rear of Regal House
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Drawing Title: Topographic Survey with Contours

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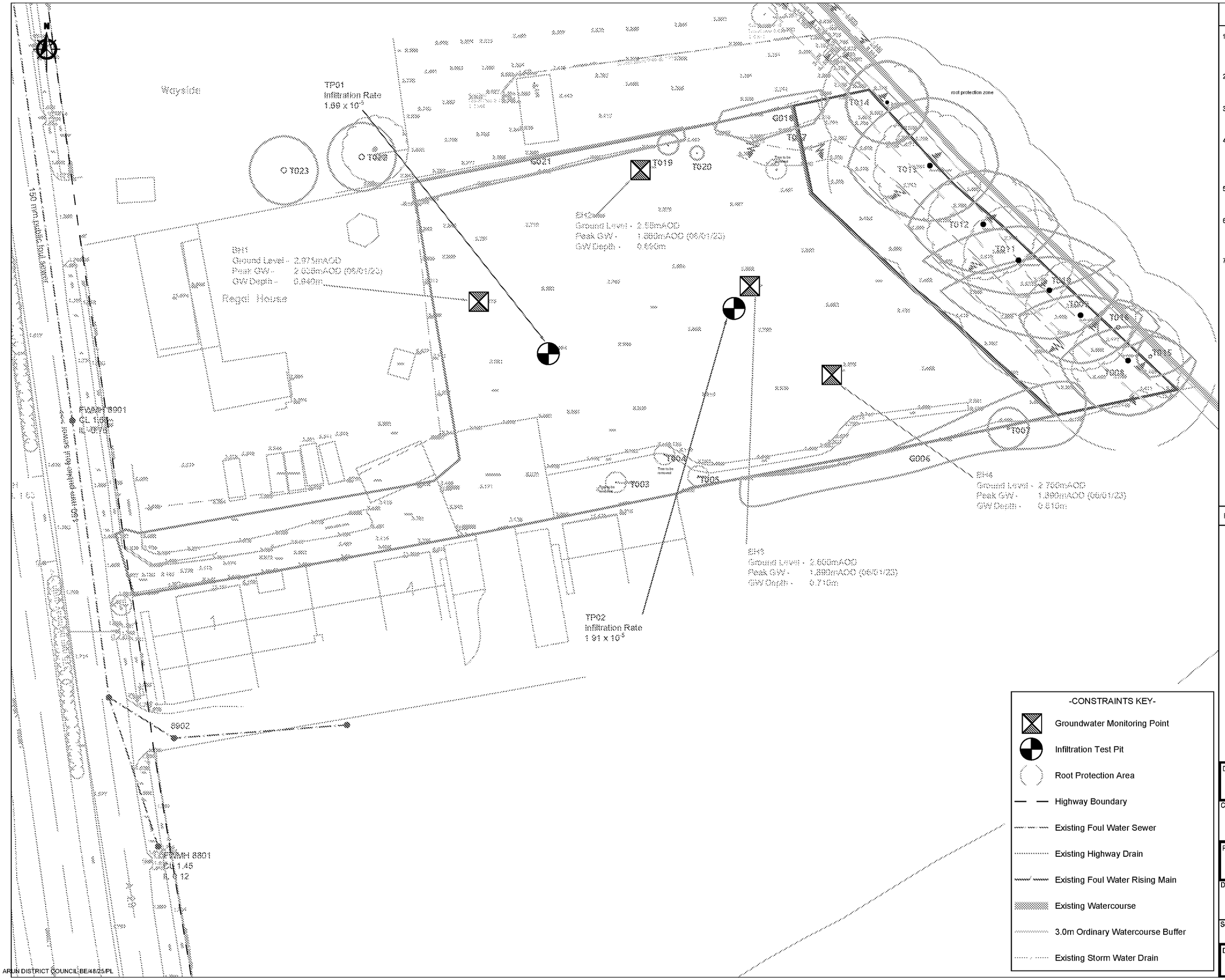
1:500	Jan 25	JHL	MJA	D2339

Drawing Code	Drawing No.	Rev.
000-BPC-WD-ZZ-D-C	PL002	P01



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-CONSTRAINTS KEY-

- Groundwater Monitoring Point
- Infiltration Test Pit
- Root Protection Area
- Highway Boundary
- Existing Foul Water Sewer
- Existing Highway Drain
- Existing Foul Water Rising Main
- Existing Watercourse
- 3.0m Ordinary Watercourse Buffer
- Existing Storm Water Drain

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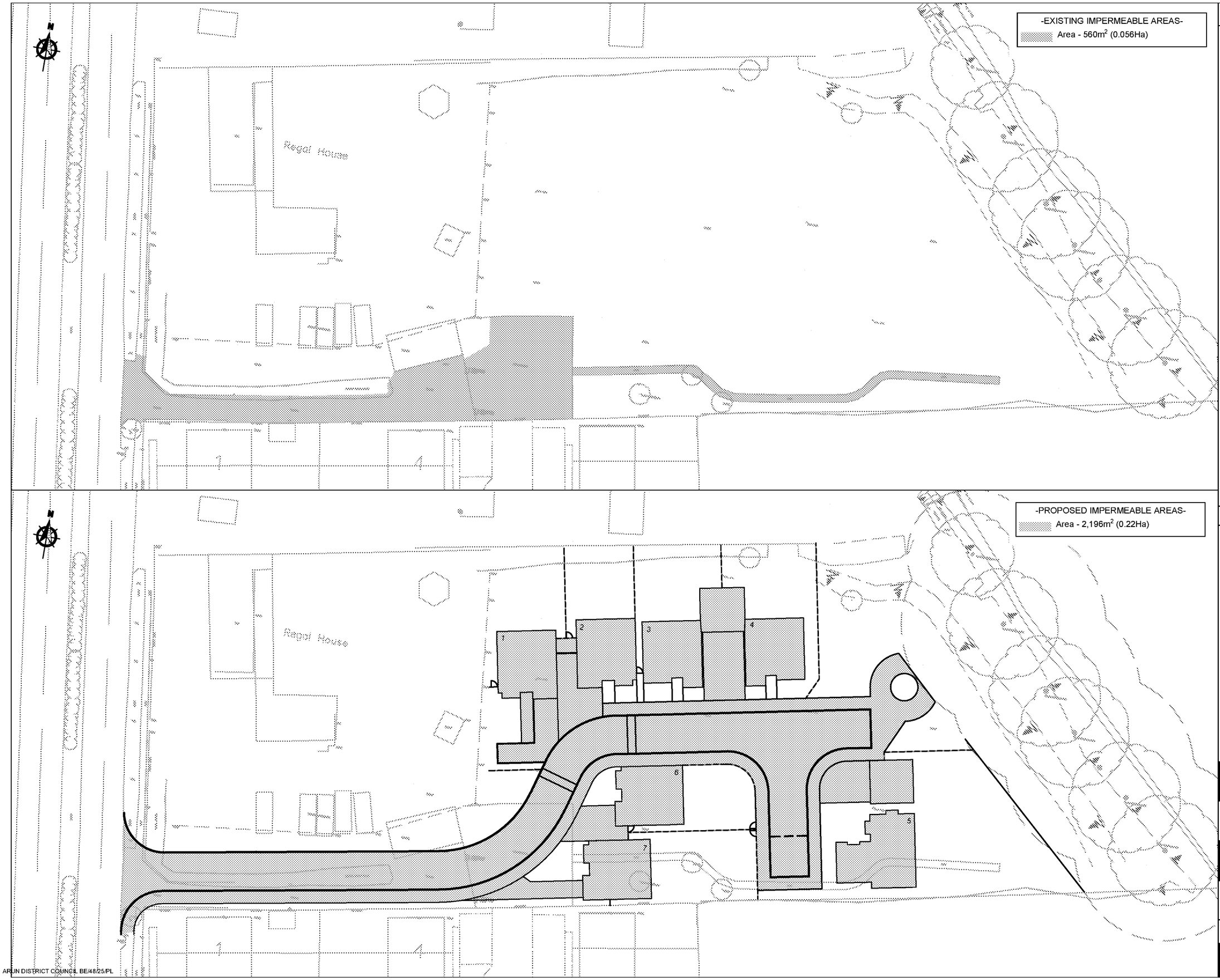
Drawing Title: Constraints Plan

Scale at A3	Date	Drawn By	Checked By	Project No.
1:500	Jan 25	JHL	MJA	D2339

Drawing Code	Drawing No.	Rev.
000-BPC-WD-ZZ-D-C	PL003	P01



A3

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Project
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Drawing Title
Impermeable Areas

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1:500	Jan 25	JHL	MJA	D2339

Drawing Code	Drawing No.	Rev.
000-BPC-WD-ZZ-D-C	004	P01

Manhole No.	Pipe No.	Adoptable IMP	Adoptable UC	Private IMP	Private UC	Total IMP + UC
S3	1.000	0.000	0.000	0.000	0.000	0.000
S2	1.001	0.000	0.000	274.819	0.000	274.819
PS11	0.000	0.000	0.000	180.726	12.067	192.793
PS12	0.000	0.000	0.000	79.012	7.901	86.913
PS9	1.000	0.000	0.000	201.803	8.355	210.158
PS8	1.001	0.000	0.000	0.000	0.000	0.000
PS7	1.002	0.000	0.000	652.806	8.355	661.162
PS6	1.003	0.000	0.000	306.686	0.000	306.686
PS3	1.004	0.000	0.000	0.000	0.000	0.000
PS4	1.005	0.000	0.000	0.000	0.000	0.000
PS2	1.006	0.000	0.000	0.000	0.000	0.000
PS10	2.000	0.000	0.000	286.452	16.711	303.163
PS13	3.000	0.000	0.000	183.292	14.204	197.496
Totals:		0.000	0.000	2165.596	67.593	2233.189

A3

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Drawing Status
PLANNING
NOT FOR CONSTRUCTION

Client
Jeremy Brooks

Project
Land to the Rear of Regal House
Shripney Road, PO22 9NP

Drawing Title
Catchment Areas

Scale at A3	Date	Drawn By	Checked By	Project No.
1:500	Jan 25	JHL	MJA	D2339

Drawing Code	Drawing No.	Rev.
000-BPC-WD-ZZ-D-C	005	P01

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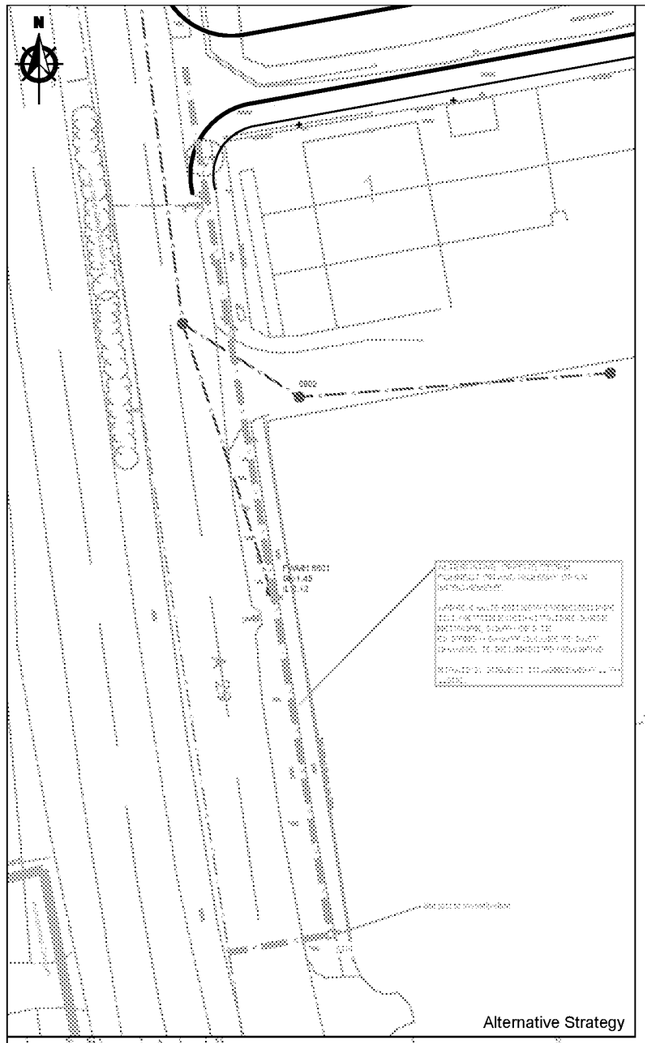

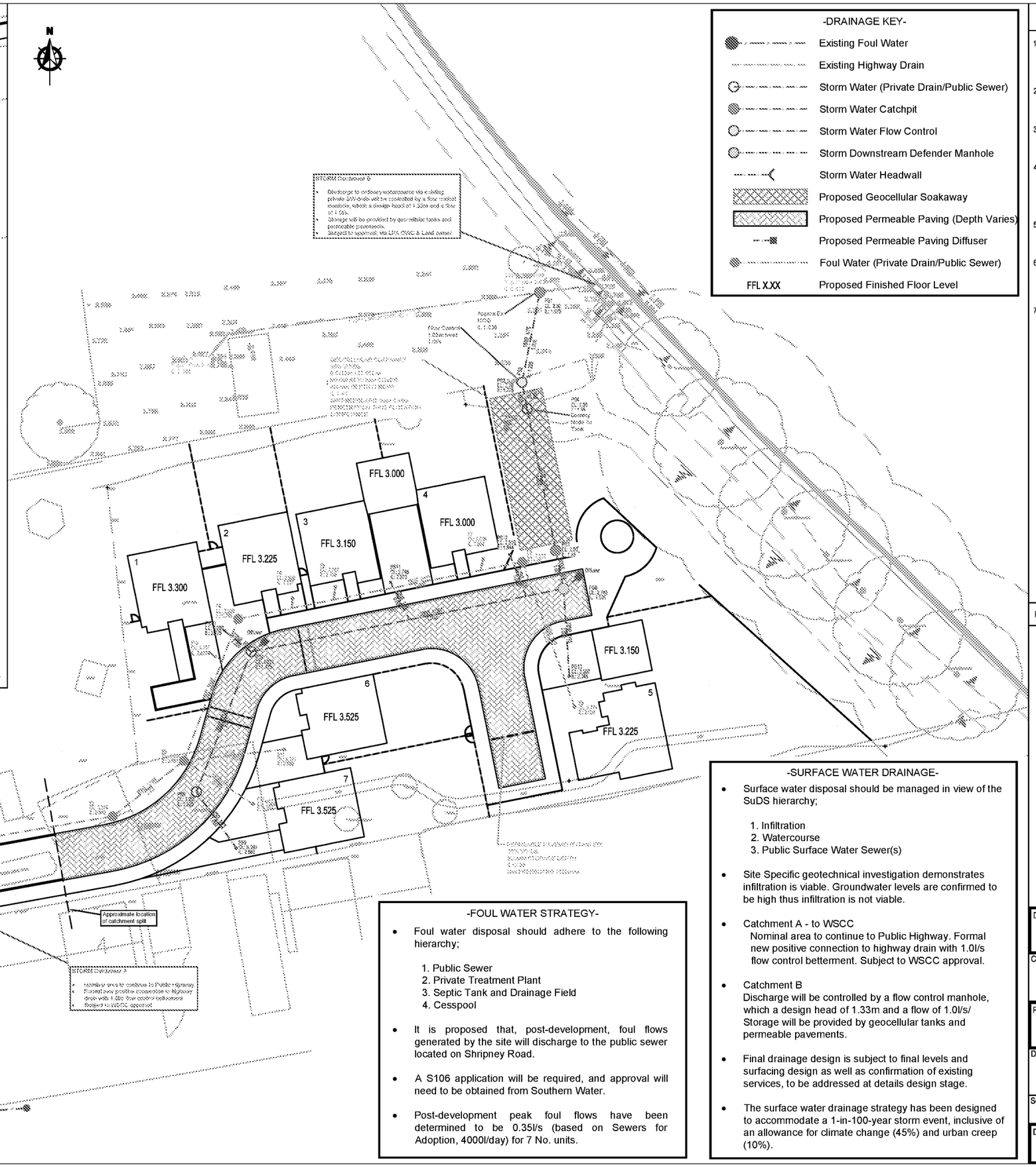

-DRAINAGE KEY-

- Existing Foul Water
- Existing Highway Drain
- Storm Water (Private Drain/Public Sewer)
- Storm Water Catchpit
- Storm Water Flow Control
- Storm Downstream Defender Manhole
- Storm Water Headwall
- Proposed Geocellular Soakaway
- Proposed Permeable Paving (Depth Varies)
- Proposed Permeable Paving Diffuser
- Foul Water (Private Drain/Public Sewer)
- FFL X.XX — Proposed Finished Floor Level

-FOUL WATER STRATEGY-

- Foul water disposal should adhere to the following hierarchy;
  1. Public Sewer
  2. Private Treatment Plant
  3. Septic Tank and Drainage Field
  4. Cesspool
- It is proposed that, post-development, foul flows generated by the site will discharge to the public sewer located on Shripney Road.
- A S106 application will be required, and approval will need to be obtained from Southern Water.
- Post-development peak foul flows have been determined to be 0.35l/s (based on Sewers for Adoption, 4000l/day) for 7 No. units.

-SURFACE WATER DRAINAGE-

- Surface water disposal should be managed in view of the SuDS hierarchy;
  1. Infiltration
  2. Watercourse
  3. Public Surface Water Sewer(s)
- Site Specific geotechnical investigation demonstrates infiltration is viable. Groundwater levels are confirmed to be high thus infiltration is not viable.
- Catchment A - to WSCC
  Nominal area to continue to Public Highway. Formal new positive connection to highway drain with 1.0l/s flow control betterment. Subject to WSCC approval.
- Catchment B
  Discharge will be controlled by a flow control manhole, which a design head of 1.33m and a flow of 1.0l/s/ Storage will be provided by geocellular tanks and permeable pavements.
- Final drainage design is subject to final levels and surfacing design as well as confirmation of existing services, to be addressed at details design stage.
- The surface water drainage strategy has been designed to accommodate a 1-in-100-year storm event, inclusive of an allowance for climate change (45%) and urban creep (10%).

NOTES

A3

1. This drawing is to be read in conjunction with all other BP Civils drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
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3. Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.
4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain. The main contractor is responsible for checking all information on site prior to work commencing and taking due care whilst undertaking the works.
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Rev.	Date	Amendments
P01	13.03.25	Additional Survey Added
-	-	Original Issue

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Drawing Status: PLANNING
NOT FOR CONSTRUCTION

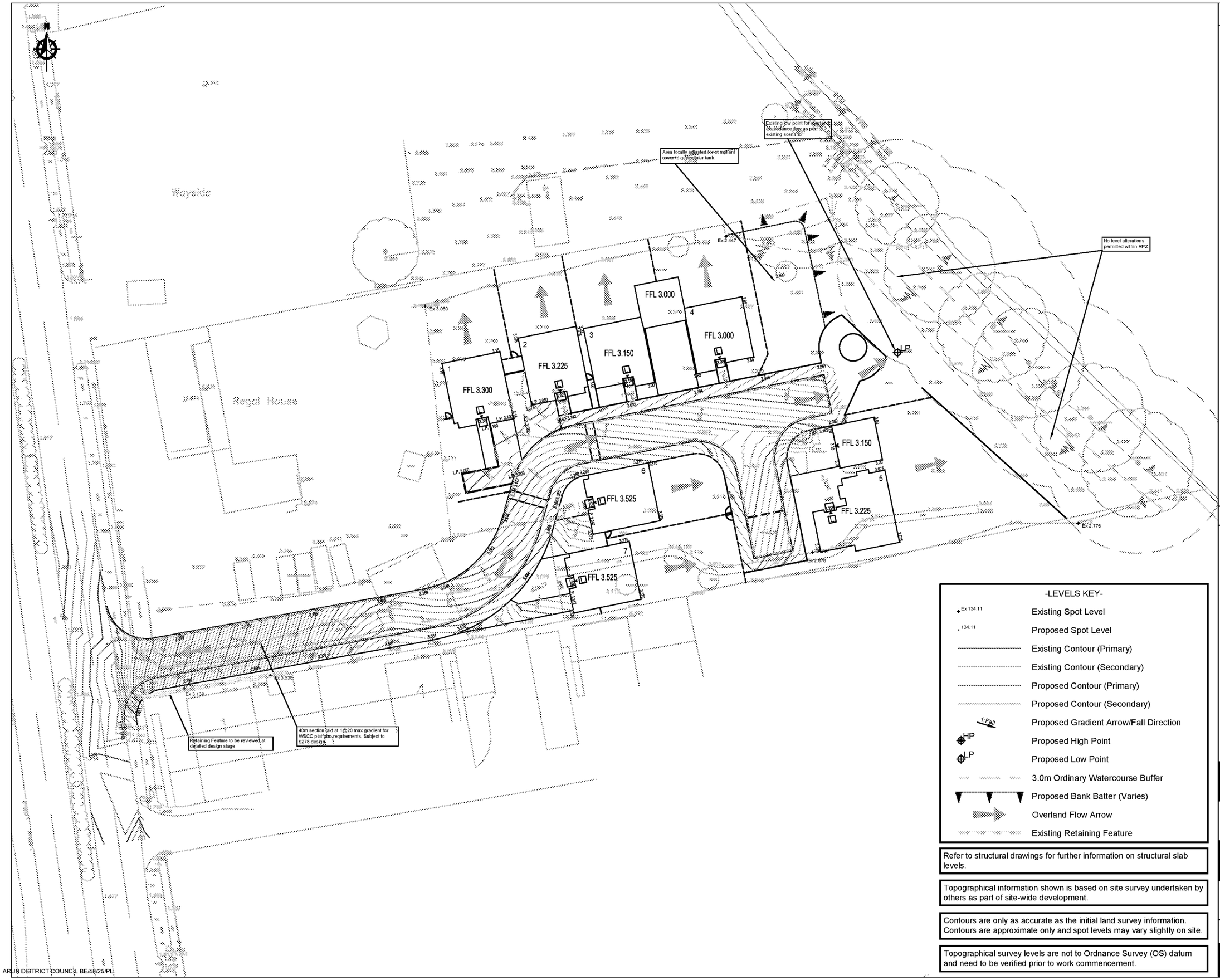
Client: Jeremy Brooks

Project: Land to the Rear of Regal House, Shripney Road, PO22 9NP

Drawing Title: Proposed Drainage

Scale at A3	Date	Drawn By	Checked By	Project No.
1:500	Jan 25	JHL	MJA	D2339

Drawing Code	Drawing No.	Rev.
000-BPC-WD-ZZ-D-C	006	P01



NOTES

A3

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Rev.	Date	Amendments
P01	13.03.25	Additional Survey Added
-	-	Original Issue

-LEVELS KEY-

- Ex 134.11 — Existing Spot Level
- 134.11 — Proposed Spot Level
- Existing Contour (Primary)
- Existing Contour (Secondary)
- Proposed Contour (Primary)
- Proposed Contour (Secondary)
- 1:Fall — Proposed Gradient Arrow/Fall Direction
- HP — Proposed High Point
- LP — Proposed Low Point
- 3.0m Ordinary Watercourse Buffer
- Proposed Bank Batter (Varies)
- Overland Flow Arrow
- Existing Retaining Feature

Refer to structural drawings for further information on structural slab levels.

Topographical information shown is based on site survey undertaken by others as part of site-wide development.

Contours are only as accurate as the initial land survey information. Contours are approximate only and spot levels may vary slightly on site.

Topographical survey levels are not to Ordnance Survey (OS) datum and need to be verified prior to work commencement.

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Drawing Status: PLANNING
NOT FOR CONSTRUCTION

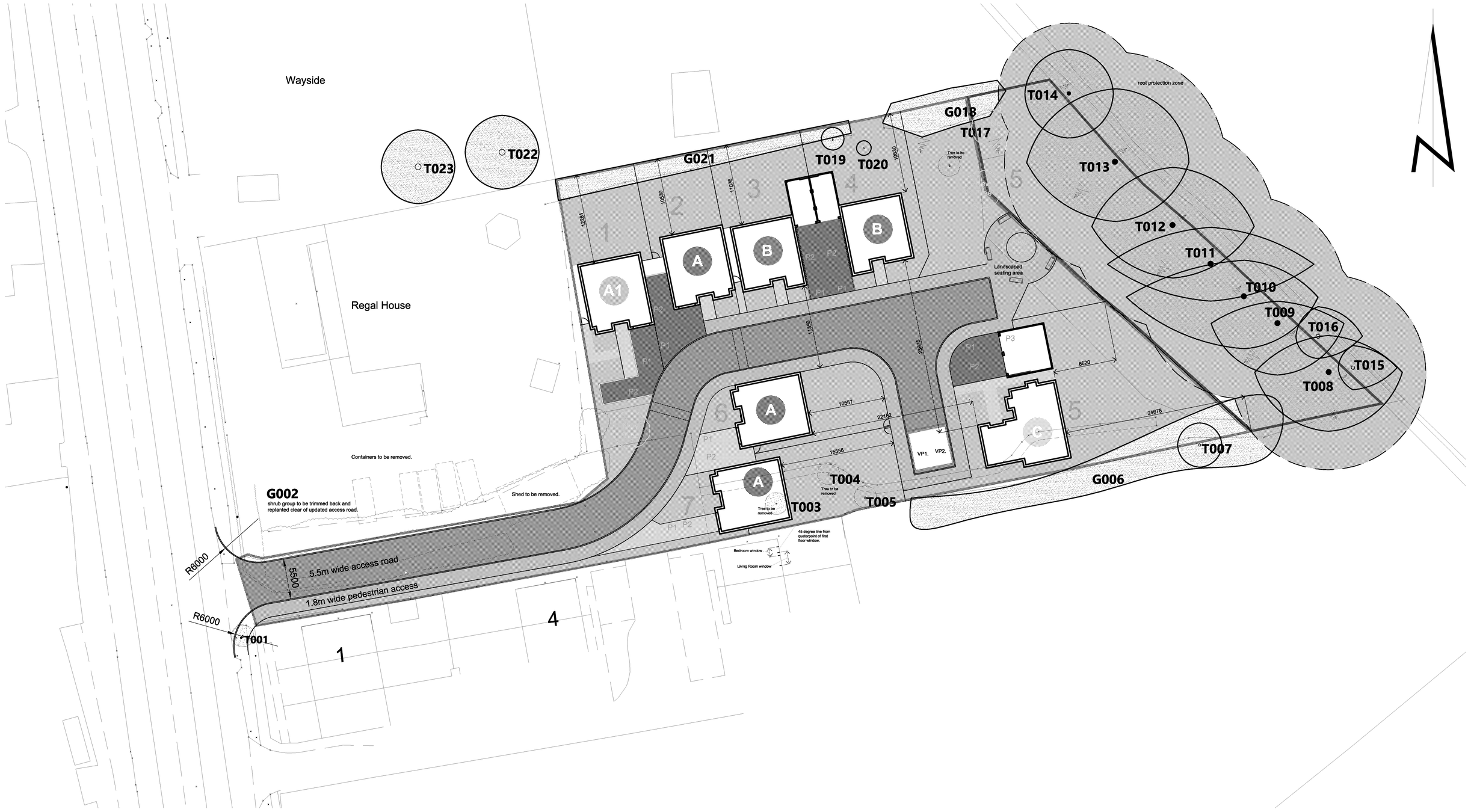
Client: Jeremy Brooks

Project: Land to the Rear of Regal House, Shripney Road, PO22 9NP

Drawing Title: Proposed Levels

Scale at A3	Date	Drawn By	Checked By	Project No.
1:500	Jan 25	JHL	MJA	D2339

Drawing Code	Drawing No.	Rev.
000-BPC-WD-ZZ-D-C	007	P01



Scale Bar 1:250 (Metres)
0 1 2 3 4 5 10 15 20 25 30

Proposed Site Layout Plan

July 2024 1:250 at A1

CAD file name: Shripney Road 2024 - Rev04.dwg

SITE AREA = 0.406 hect

HOUSING MIX

				G.I.A
A	TYPE A	3 bed	2 car spaces	118.7m²
A1	TYPE A1	2 bed	2 car spaces	80.7m²
B	TYPE B	4 bed	3 car spaces	140.0m²
C	TYPE C	5 bed	3 car spaces	170.0m²

NB. gross internall areas exclude attached / integral garages.

Total Dwellings 7

SITE ACHIEVES 21.5 DWELLINGS / HECTARE

Dwellings / hectare calculated on site area x 80% as site is over 0.4 hect

PLOT AREAS	Type Beds / People	Parking
Plot 1 - 349.7m²	2 bed 4p	2 spaces
Plot 2 - 265.6m²	3 bed 4p	2 spaces
Plot 3 - 290.9m²	4 bed 5p	2 spaces
Plot 4 - 289.7m²	4 bed 5p	2 spaces
Plot 5 - 663.0m²	5 bed 7p	3 spaces
Plot 6 - 248.7m²	3 bed 4p	2 spaces
Plot 7 - 349.8m²	3 bed 4p	2 spaces
	Visitor Parking	2 Spaces
	Total	23 Spaces

MANHIRE LLP Surveyors

60A North Street, Chichester, West Sussex, PO19 1NB, tel 01243 815720, email: chris@manhirellp.com

Land to the East of Shripney Rd, Shripney, Bognor Regis PO22 9NPT - Proposed Site Layout Plan

RH24/SL-30 C

Appendix B

NOTES
Survey accurate at time of site attendance. Do not scale from printed drawings except for planning purposes.

Grid is based on ordnance survey national grid fixed by GPS satellite active network.
Levels are related to the ordnance survey GPS active Network and transformed using the OSGM15 & OSTN15 model.

Drainage pipe sizes (where shown) have been gauged from the surface for safety reasons and should be regarded as approximate only.

Tree species (where shown) should be treated with caution and expert identification is advised.

Although this is a digital survey the accuracy and amount of detail shown is only commensurate with the graphical scale of mapping as specified. Care should be exercised when working to larger scales.

Visible features in the vicinity of the boundaries as shown above, may not represent the extent of legally conveyed ownership.

Whilst every effort has been made to achieve accuracy on this plan, CRUCIAL clearance dimensions, levels and invert levels should be checked prior to design and construction.

Areas of dense undergrowth cannot be surveyed in detail, these areas will be shown in outline only and marked as 'dense undergrowth' on the plan.

Kerb levels have been taken on the top of the channel.

Ordnance Survey Overlay
National Grid 1:2500 (Accuracy data) Surveying tolerances:
Distances up to 200 metres ±1 in100m
Distances 200 to1,000 metres ±2m
Distances over 1,000 metres ±1 in 500m

ABBREVIATIONS (where applicable)

AV Air Valve	MH Manhole Cover
BK Brick	MK Marker
BL Bollard	MS Milestone
BS Bus Stop	MT Meter
BT British Telecom	MY Mercury
CB Control Box	OH Overhead
C/B Close Boarded	PAV Paving
CL Cover Level	PB Post Box
CLK Chainlink	PE Pipe
CO Column	PM Parking Meter
Conc Concrete	P/R Post and Rail
CP Catch Pit	PT Post
CPS Concrete Paving Slabs	P/W Post and Wire
CATV Cable Television	RE Rodding Eye
DC Drainage Channel	RET Retaining
DP Drain Pipe	RS Road Sign
EC Electricity Cover	RSJ Rolled Steel Joist
ER Earthing Rod	SC Stop Cock
FB Flower Bed	SK Soakaway
FE Fence	SP Signpost
FH Fire Hydrant	ST Silt Trap
FL Floor Level	SV Stop Valve
FP Flag Pole	SVC Security Video Camera
GP Gate Post	TCB Telephone Call Box
GV Gas Valve	TK Tank
GY,G Gully	TL Traffic Light
HT Height	TP Telegraph Pole
IC Inspection Cover	UG Underground
IL Invert Level	UTF Unable To Trace Further
IN Interceptor	UTL Unable To Lift
I/R Iron Railings	VP Vent Pipe
KO Kerb Outlet	WL Water Level
LB Litter Bin	WM Water Meter
LP Lamp Post	WO Wash Out

0 2 4 6 8 10 12
SCALE 1:250

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07717 205 388

project: REGAL HOUSE, SHRIPNEY ROAD
client: J.BROOKS
job ref: S1635
title: TOPO SURVEY
scale 1:250 @A1
date MARCH 2022
dwg no: EX01 rev:

Appendix C

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Mark Akmenkalns
Site name:	Regal House
Site location:	Shripney

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.

Site Details

Latitude:	50.80940° N
Longitude:	0.66892° W
Reference:	1682645899
Date:	Jan 07 2025 14:44

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): .4

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	720	720

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.19	1.19
1 in 1 year (l/s):	1.01	1.01
1 in 30 years (l/s):	2.73	2.73
1 in 100 year (l/s):	3.79	3.79
1 in 200 years (l/s):	4.44	4.44

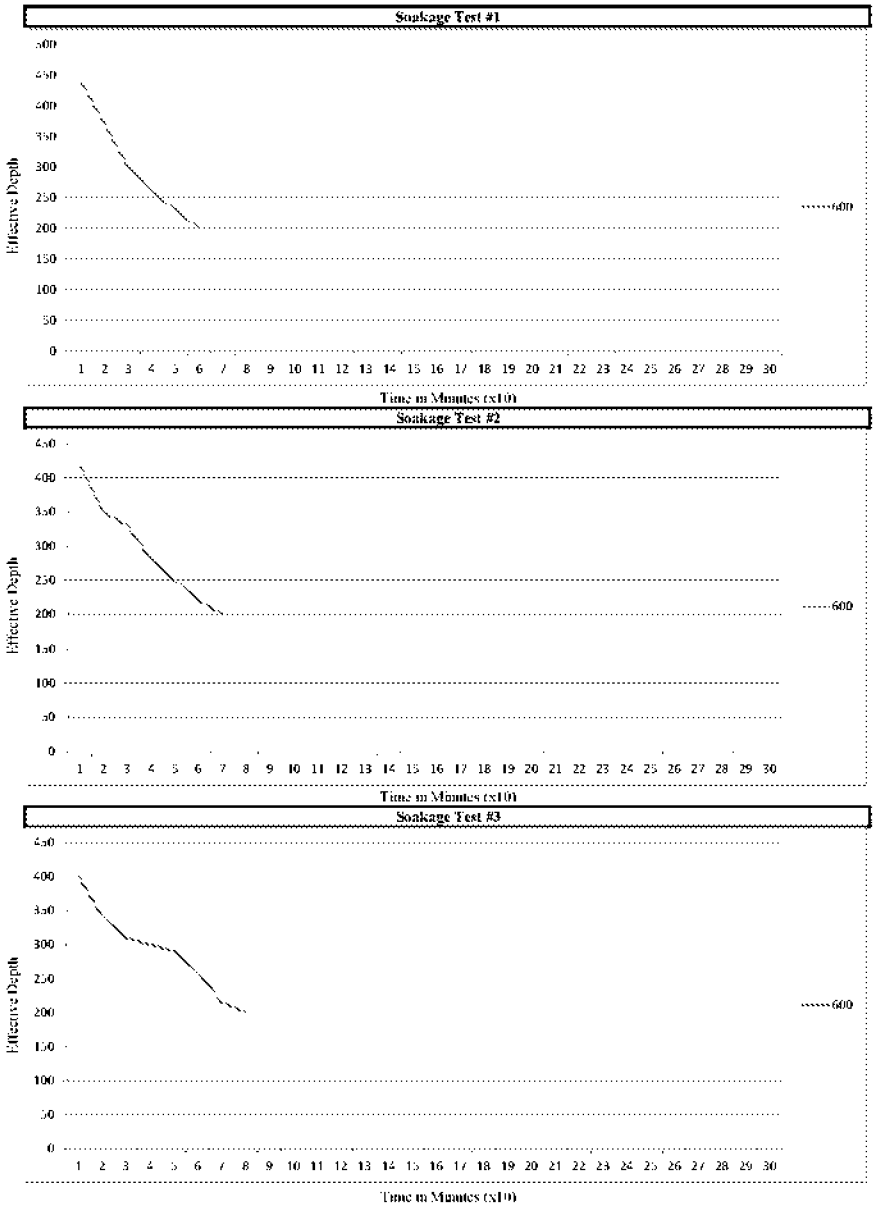
This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of 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, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix D

Soil Infiltration to BRE 365 (TP 1)

Soil Infiltration Rates to BRE 365		
Length of trial pit	1.5	m
Width of trial pit	0.3	m
Depth of trial pit	0.8	m
Effective storage depth	0.4	m
Effective storage volume	0.09	m³
Effective surface area + base	1.17	m²
Time to empty from 75% -> 25% effective depth	76	mins
Soil infiltration rate	1.69	x10⁻⁵ m/sec
Using the least favourable result taken from Test #	3	

Test No.1		Test No.2		Test No.3	
Time (t)	Head	Time (t)	Head	Time (t)	Head
0	600	0	600	0	600
10	440	10	420	10	400
20	370	20	350	20	340
30	300	30	330	30	310
40	260	40	280	40	300
50	230	50	250	50	290
60	200	60	220	60	260
70		70	200	70	215
80		80		80	200
90		90		90	
100		100		100	
110		110		110	
120		120		120	
130		130		130	
140		140		140	
150		150		150	
160		160		160	
170		170		170	
180		180		180	
190		190		190	
200		200		200	
210		210		210	
220		220		220	
230		230		230	
240		240		240	
250		250		250	
260		260		260	
270		270		270	
280		280		280	
290		290		290	
300		300		300	



Soil Infiltration to BRE 365 (TP 2)

Soil Infiltration Rates to BRE 365		
Length of trial pit	1.5	m
Width of trial pit	0.3	m
Depth of trial pit	0.8	m
Effective storage depth	0.4	m
Effective storage volume	0.09	m³
Effective surface area + base	1.17	m²
Time to empty from 75% -> 25% effective depth	67	mins
Soil infiltration rate	1.91	x10⁻⁵ m/sec
Using the least favourable result taken from Test #	3	

Test No.1		Test No.2		Test No.3	
Time (t)	Head	Time (t)	Head	Time (t)	Head
0	600	0	600	0	600
10	450	10	400	10	480
20	390	20	340	20	355
30	340	30	300	30	310
40	270	40	260	40	275
50	230	50	220	50	260
60	200	60	200	60	230
70		70		70	200
80		80		80	
90		90		90	
100		100		100	
110		110		110	
120		120		120	
130		130		130	
140		140		140	
150		150		150	
160		160		160	
170		170		170	
180		180		180	
190		190		190	
200		200		200	
210		210		210	
220		220		220	
230		230		230	
240		240		240	
250		250		250	
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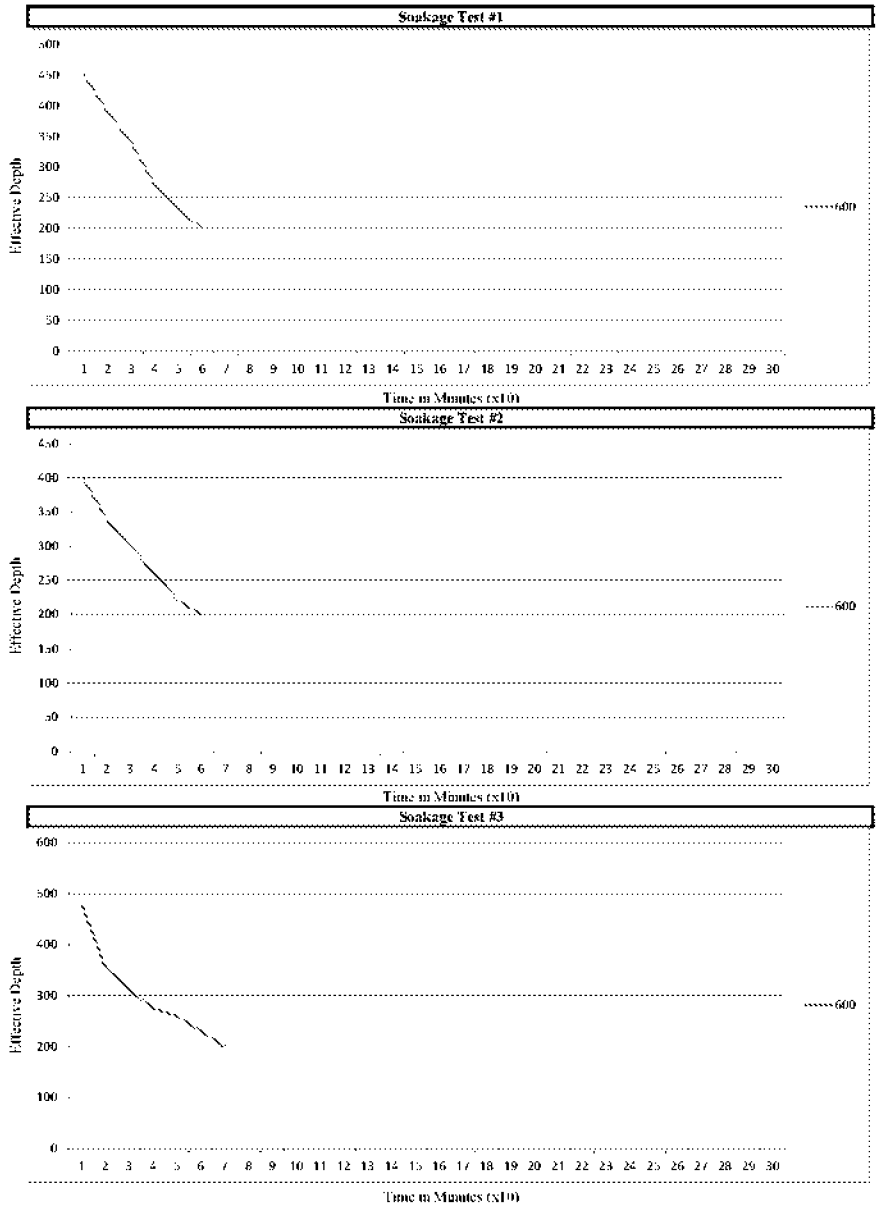
290		290		290	
300		300		300	



Winter Groundwater Monitoring Data

Site: Regal House, Shripney Road, Bognor Regis, West Sussex, PO22 9NP

Bore Hole 1

Grid Reference: 493923 (E) 101972 (N)

Ground Level: 2.975

Date	Groundwater (mAOD)	Depth Below Existing Ground (m)
10/12/2022	1.635	1.340
06/01/2023	2.035	0.940
03/02/2023	1.295	1.680
03/03/2023	0.995	1.980
21/04/2023	1.395	1.580

Bore Hole 2

Grid Reference: 493947 (E) 101991 (N)

Ground Level: 2.55

Date	Groundwater (mAOD)	Depth Below Ground
10/12/2022	1.610	0.940
06/01/2023	1.860	0.690
03/02/2023	1.250	1.300
03/03/2023	1.020	1.530
21/04/2023	1.280	1.270

Bore Hole 3

Grid Reference: 493963 (E) 101974 (N)

Ground Level: 2.600

Date	Groundwater (mAOD)	Depth Below Ground
10/12/2022	1.630	0.970
06/01/2023	1.890	0.710
03/02/2023	1.280	1.320
03/03/2023	1.020	1.580
21/04/2023	1.320	1.280

Bore Hole 4

Grid Reference: 493975 (E) 101961 (N)

Ground Level: 2.700

Date	Groundwater (mAOD)	Depth Below Ground
10/12/2022	1.590	1.110
06/01/2023	1.890	0.810
03/02/2023	1.280	1.420
03/03/2023	1.020	1.680
21/04/2023	1.300	1.400

Appendix E

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S3	0.000	1.200	Type E	2.717	1.050	1.442	493889.876	101938.144
S2	0.027	0.450	Unknown	1.914	0.950	0.814	493874.020	101935.269
S1	0.000	0.450	450	1.773	0.800	0.823	493861.567	101933.856

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S3	1.050	S2	1.000	Circ	0.225mØ	16.114	322.3	0.600	1.442	0.689
1.001	S2	0.950	S1	0.800	Circ	0.15mØ	12.533	83.6	0.600	0.814	0.823

Outfall Details

Outfall Manhole S1 : Surcharged (Constant Level)

Surcharged Constant

Water Elevation (m)	Water Depth (m)
1.500	0.700

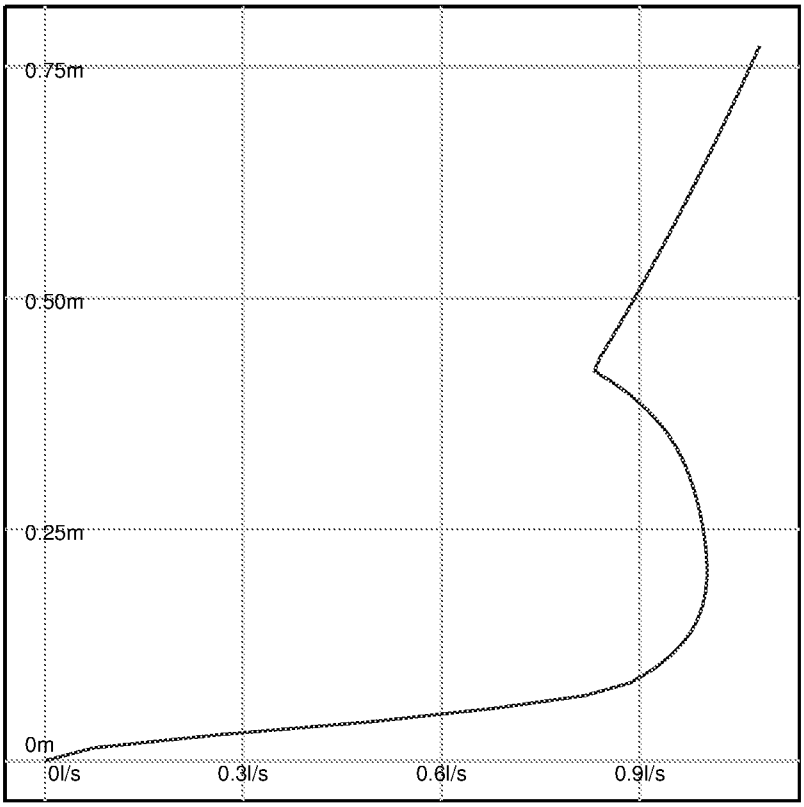
Flow Control Details

Controls within Manhole S2

Hydro-Brake® Optimum Control at Manhole S2

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0051-1000-0650-1000	0.650	1.000	0.000	0.205	1.002	0.422	0.828

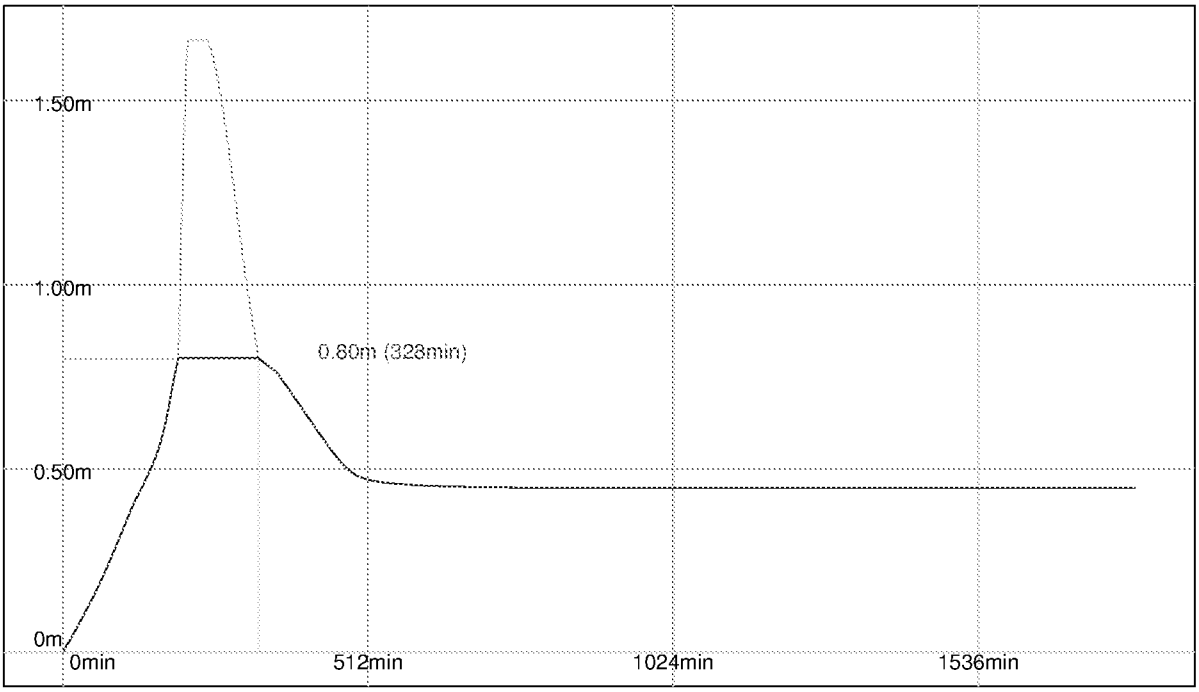
Hydro-Brake® Optimum Control at S2



Tank Structure at Manhole S2

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
0.950	0.800	95.00	24.000	22.800	18.240	0.00000000	0.00000000	2.00

Tank at S2 (100Yr+45% 360Min Summer)



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_494310_101620_v5_0_1.xml

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Periods (yrs) + Climate Change: (2, +0%), (10, +0%), (30, +0%), (100, +0%), (100, +45%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 15Min Winter	32.899	0.00	3.21	30Yr 360Min Summer	8.967	0.00	1.68
2Yr 15Min Summer	32.899	0.00	3.21	30Yr 360Min Winter	8.967	0.00	1.71
2Yr 30Min Winter	21.299	0.00	3.20	30Yr 480Min Summer	7.114	0.00	1.56
2Yr 30Min Summer	21.299	0.00	3.21	30Yr 480Min Winter	7.114	0.00	1.57
2Yr 60Min Summer	13.400	0.00	3.21	30Yr 600Min Summer	5.920	0.00	1.49
2Yr 60Min Winter	13.400	0.00	3.21	30Yr 600Min Winter	5.920	0.00	1.50
2Yr 120Min Winter	9.238	0.00	3.21	30Yr 720Min Summer	5.083	0.00	1.45
2Yr 120Min Summer	9.238	0.00	3.21	30Yr 720Min Winter	5.083	0.00	1.45
2Yr 180Min Summer	7.285	0.00	3.06	30Yr 960Min Summer	3.997	0.00	1.38
2Yr 180Min Winter	7.285	0.00	3.04	30Yr 960Min Winter	3.997	0.00	1.38
2Yr 240Min Winter	5.925	0.00	2.75	30Yr 1440Min Summer	2.854	0.00	1.30
2Yr 240Min Summer	5.925	0.00	2.76	30Yr 1440Min Winter	2.854	0.00	1.29
2Yr 360Min Summer	4.440	0.00	2.34	100Yr 15Min Summer	102.297	0.00	3.21
2Yr 360Min Winter	4.440	0.00	2.37	100Yr 15Min Winter	102.297	0.00	3.21
2Yr 480Min Summer	3.598	0.00	2.15	100Yr 30Min Summer	68.343	0.00	3.20
2Yr 480Min Winter	3.598	0.00	2.18	100Yr 30Min Winter	68.343	0.00	3.21
2Yr 600Min Summer	3.027	0.00	2.06	100Yr 60Min Summer	43.622	0.00	2.69
2Yr 600Min Winter	3.027	0.00	2.07	100Yr 60Min Winter	43.622	0.00	2.69
2Yr 720Min Winter	2.617	0.00	2.00	100Yr 120Min Summer	26.099	0.00	2.13
2Yr 720Min Summer	2.617	0.00	1.99	100Yr 120Min Winter	26.099	0.00	2.13
2Yr 960Min Summer	2.090	0.00	1.91	100Yr 180Min Summer	19.139	0.00	1.84
2Yr 960Min Winter	2.090	0.00	1.91	100Yr 180Min Winter	19.139	0.00	1.86
2Yr 1440Min Summer	1.529	0.00	1.81	100Yr 240Min Summer	15.374	0.00	1.67
2Yr 1440Min Winter	1.529	0.00	1.80	100Yr 240Min Winter	15.374	0.00	1.69
10Yr 15Min Summer	63.225	0.00	3.21	100Yr 360Min Summer	11.177	0.00	1.47
10Yr 15Min Winter	63.225	0.00	3.21	100Yr 360Min Winter	11.177	0.00	1.49
10Yr 30Min Summer	41.249	0.00	3.21	100Yr 480Min Summer	8.873	0.00	1.36
10Yr 30Min Winter	41.249	0.00	3.21	100Yr 480Min Winter	8.873	0.00	1.38
10Yr 60Min Summer	26.000	0.00	3.21	100Yr 600Min Summer	7.399	0.00	1.31
10Yr 60Min Winter	26.000	0.00	3.21	100Yr 600Min Winter	7.399	0.00	1.31
10Yr 120Min Summer	16.299	0.00	2.89	100Yr 720Min Summer	6.366	0.00	1.26
10Yr 120Min Winter	16.299	0.00	2.87	100Yr 720Min Winter	6.366	0.00	1.26
10Yr 180Min Summer	12.236	0.00	2.46	100Yr 960Min Summer	5.015	0.00	1.20
10Yr 180Min Winter	12.236	0.00	2.46	100Yr 960Min Winter	5.015	0.00	1.20
10Yr 240Min Summer	9.830	0.00	2.19	100Yr 1440Min Summer	3.579	0.00	1.13
10Yr 240Min Winter	9.830	0.00	2.21	100Yr 1440Min Winter	3.579	0.00	1.12
10Yr 360Min Summer	7.183	0.00	1.90	100Yr+45% 15Min Summer	148.331	0.00	3.20
10Yr 360Min Winter	7.183	0.00	1.93	100Yr+45% 15Min Winter	148.331	0.00	3.21
10Yr 480Min Winter	5.720	0.00	1.77	100Yr+45% 30Min Summer	99.097	0.00	2.58
10Yr 480Min Summer	5.720	0.00	1.75	100Yr+45% 30Min Winter	99.097	0.00	2.58
10Yr 600Min Summer	4.767	0.00	1.68	100Yr+45% 60Min Summer	63.252	0.00	1.98
10Yr 600Min Winter	4.767	0.00	1.68	100Yr+45% 60Min Winter	63.252	0.00	1.99
10Yr 720Min Summer	4.095	0.00	1.63	100Yr+45% 120Min Summer	37.843	0.00	1.59
10Yr 720Min Winter	4.095	0.00	1.63	100Yr+45% 120Min Winter	37.843	0.00	1.60
10Yr 960Min Summer	3.229	0.00	1.55	100Yr+45% 180Min Summer	27.752	0.00	1.17
10Yr 960Min Winter	3.229	0.00	1.55	100Yr+45% 180Min Winter	27.752	0.00	1.22
10Yr 1440Min Summer	2.319	0.00	1.47	100Yr+45% 240Min Summer	22.293	0.00	0.46
10Yr 1440Min Winter	2.319	0.00	1.46	100Yr+45% 240Min Winter	22.293	0.00	0.91
30Yr 15Min Summer	81.572	0.00	3.21	100Yr+45% 360Min Summer	16.207	0.00	0.35
30Yr 15Min Winter	81.572	0.00	3.21	100Yr+45% 360Min Winter	16.207	0.00	0.89
30Yr 30Min Summer	53.995	0.00	3.21	100Yr+45% 480Min Summer	12.866	0.00	0.60
30Yr 30Min Winter	53.995	0.00	3.21	100Yr+45% 480Min Winter	12.866	0.00	1.08
30Yr 60Min Summer	34.192	0.00	3.15	100Yr+45% 600Min Summer	10.729	0.00	0.88
30Yr 60Min Winter	34.192	0.00	3.16	100Yr+45% 600Min Winter	10.729	0.00	1.03
30Yr 120Min Summer	20.842	0.00	2.49	100Yr+45% 720Min Summer	9.231	0.00	0.99

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 120Min Winter	20.842	0.00	2.49	100Yr+45% 720Min Winter	9.231	0.00	0.98
30Yr 180Min Summer	15.403	0.00	2.14	100Yr+45% 960Min Summer	7.272	0.00	0.93
30Yr 180Min Winter	15.403	0.00	2.15	100Yr+45% 960Min Winter	7.272	0.00	0.93
30Yr 240Min Summer	12.347	0.00	1.92	100Yr+45% 1440Min Winter	5.189	0.00	0.87
30Yr 240Min Winter	12.347	0.00	1.94	100Yr+45% 1440Min Summer	5.189	0.00	0.87

Simulation Results

Return Period Yrs: 2.0
Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S3	480 min Summer	264	1.562	0.512	0.000		Surcharged
S2	480 min Summer	264	1.562	0.510	0.729		Surcharged
S1	15 min Winter	0	1.500	0.700	0.843		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	65	S3	S2	0.225	0.005	0.109	0.004	OK
1.001	480 min Summer	264	S2	S1	0.150	0.041	0.733	0.038	Surcharged

Return Period Yrs: 10.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S3	360 min Summer	214	1.619	0.569	0.000		Surcharged
S2	360 min Summer	214	1.619	0.566	0.953		Surcharged
S1	15 min Summer	0	1.500	0.700	0.842		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	30	S3	S2	0.225	0.003	0.105	0.004	OK
1.001	360 min Summer	214	S2	S1	0.150	0.054	0.953	0.049	Surcharged

Return Period Yrs: 30.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S3	360 min Summer	220	1.675	0.625	0.000		Surcharged
S2	360 min Summer	220	1.675	0.623	0.992		Surcharged
S1	15 min Summer	0	1.500	0.700	0.842		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	20	S3	S2	0.225	0.003	0.107	0.004	OK
1.001	360 min Summer	220	S2	S1	0.150	0.056	0.997	0.051	Surcharged

Return Period Yrs: 100.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S3	360 min Summer	227	1.757	0.707	0.001		Surcharged
S2	360 min Summer	227	1.757	0.705	1.006		Surcharged
S1	15 min Summer	0	1.500	0.700	0.841		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	20	S3	S2	0.225	0.003	0.138	0.005	OK
1.001	600 min Summer	336	S2	S1	0.150	0.057	1.002	0.052	Surcharged

Return Period Yrs: 100.0

Climate Change %: 45

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S3	360 min Summer	209	2.717	1.667	1.463	1.071	Flood
S2	360 min Summer	211	2.717	1.664	2.342		Surcharged
S1	15 min Summer	0	1.500	0.700	0.841		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	180 min Summer	192	S3	S2	0.225	0.018	0.705	0.025	OK
1.001	180 min Summer	122	S2	S1	0.150	0.061	1.081	0.056	Surcharged

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
PS9	0.021	0.225	Type E	3.390	2.565	0.600	493929.819	101941.722
PS8	0.000	1.200	Type D	3.202	1.925	0.977	493924.943	101948.656
PS10	0.030	0.225	Type E	3.098	2.275	0.598	493928.425	101968.436
PS7	0.066	1.200	Type D	3.021	1.775	0.946	493931.679	101965.875
PS13	0.020	0.225	Type E	3.097	2.345	0.527	493970.770	101962.849
PS6	0.031	1.200	Type D	2.745	1.525	0.920	493970.050	101973.631
PS3	0.000	1.200	Type E	2.800	1.450	1.050	493969.107	101978.299
PS4	0.000	1.200	Type E	2.800	1.350	1.300	493965.586	101995.706
PS2	0.000	1.200	Type E	2.700	1.225	1.325	493964.946	101998.985
PS1	0.000	0.180	Type E	2.300	1.075	1.075	493967.136	102010.040

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	PS9	2.565	PS8	2.000	Circ	0.225mØ	8.477	15.0	0.600	0.600	0.977
1.001	PS8	1.925	PS7	1.775	Circ	0.3mØ	18.490	123.3	0.600	0.977	0.946
2.000	PS10	2.275	PS7	1.850	Circ	0.225mØ	4.140	9.7	0.600	0.598	0.946
1.002	PS7	1.775	PS6	1.525	Circ	0.3mØ	39.147	156.6	0.600	0.946	0.920
3.000	PS13	2.345	PS6	1.600	Circ	0.225mØ	10.806	14.5	0.600	0.527	0.920
1.003	PS6	1.525	PS3	1.450	Circ	0.3mØ	4.763	63.5	0.600	0.920	1.050
1.004	PS3	1.450	PS4	1.350	Circ	0.3mØ	17.759	177.6	0.600	1.050	1.150
1.005	PS4	1.350	PS2	1.225	Circ	0.15mØ	3.341	26.7	0.600	1.300	1.325
1.006	PS2	1.225	PS1	1.075	Circ	0.15mØ	11.270	75.1	0.600	1.325	1.075

Permeable Paving Schedule

Permeable Paving	Assigned Manhole	Effective Storage Volume (m3)	CL (m)	IL (m)	Storage Infil Rate (m/hr)	Safety Factor	Easting (m)	Northing (m)
Permeable Paving1	PS7	45.340	3.021	2.641	0.00000000	2.00	493923.954	101947.056
Permeable Paving2	PS6	57.504	2.745	2.365	0.00000000	2.00	493961.205	101968.594

Outfall Details

Outfall Manhole PS1 : Surcharged (Constant Level)

Surcharged Constant

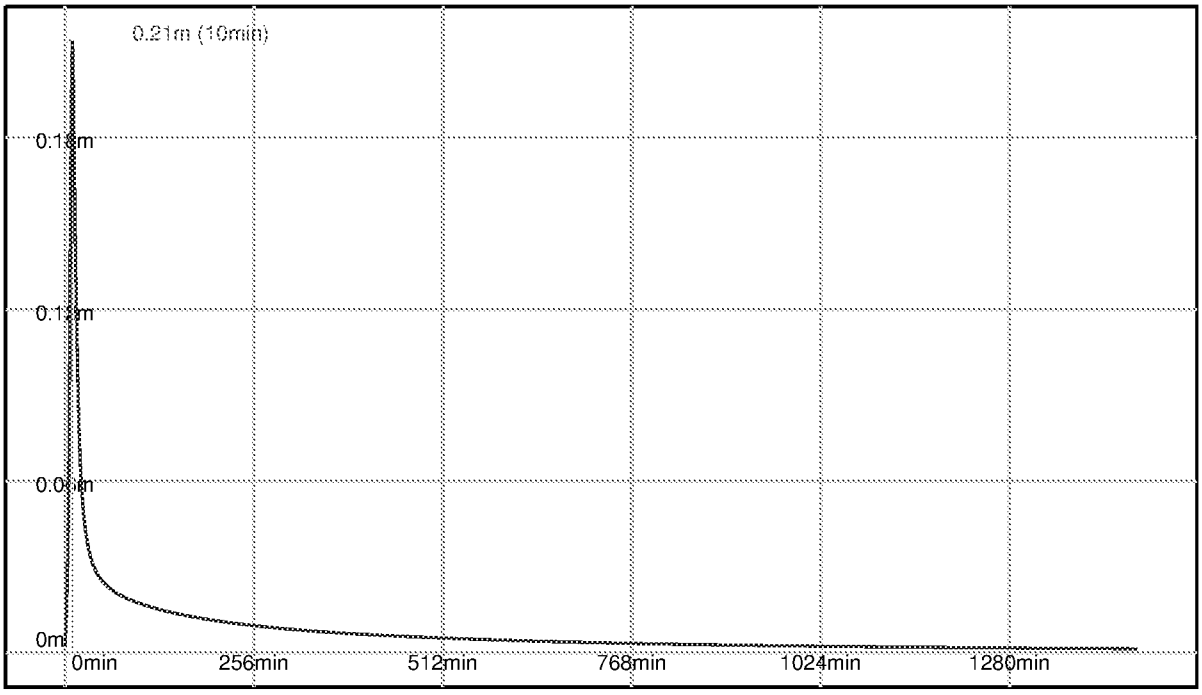
Water Elevation (m)	Water Depth (m)
1.500	0.425

Flow Control Details

Tank Structure at Manhole PS7

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
1.775	0.600	30.00	241.813	72.544	43.526	0.00000000	0.00000000	2.00

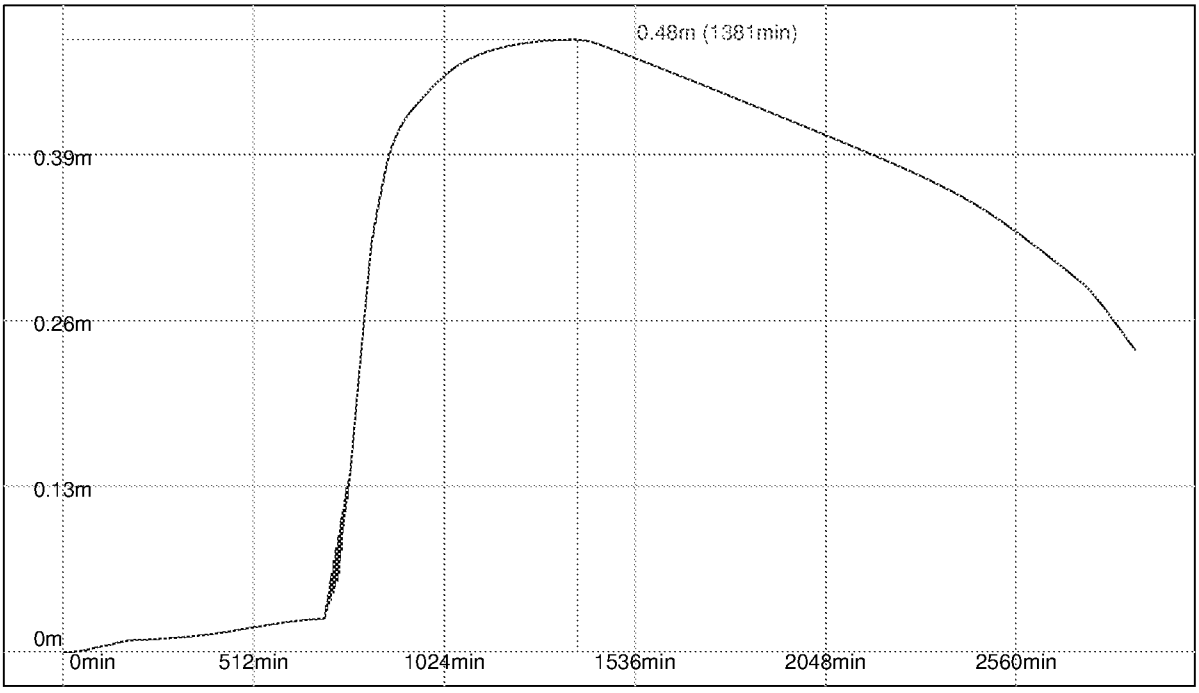
Tank at PS7 (100Yr+45% 15Min Summer)



Tank Structure at Manhole PS6

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
1.525	0.600	30.00	306.686	92.006	55.203	0.00000000	0.00000000	2.00

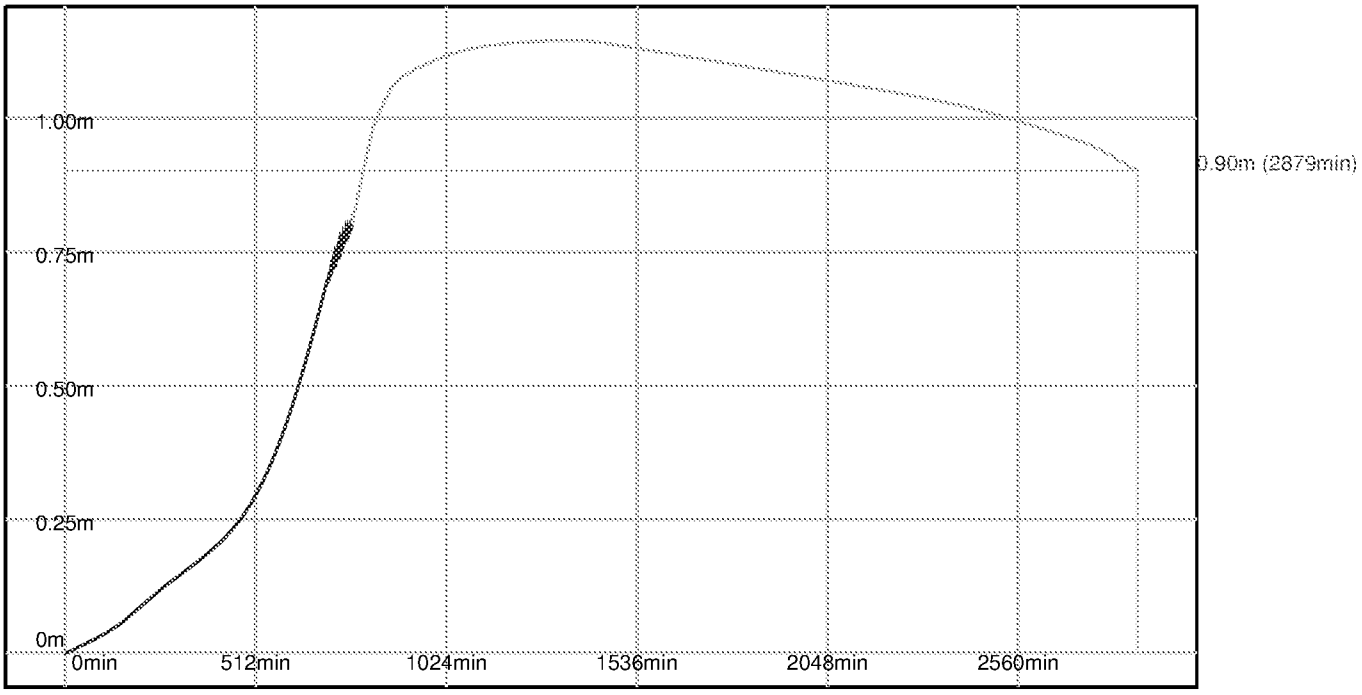
Tank at PS6 (100Yr+45% 1440Min Winter)



Tank Structure at Manhole PS4

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
1.350	0.800	95.00	123.500	117.325	93.860	0.00000000	0.00000000	2.00

Tank at PS4 (100Yr+45% 1440Min Winter)

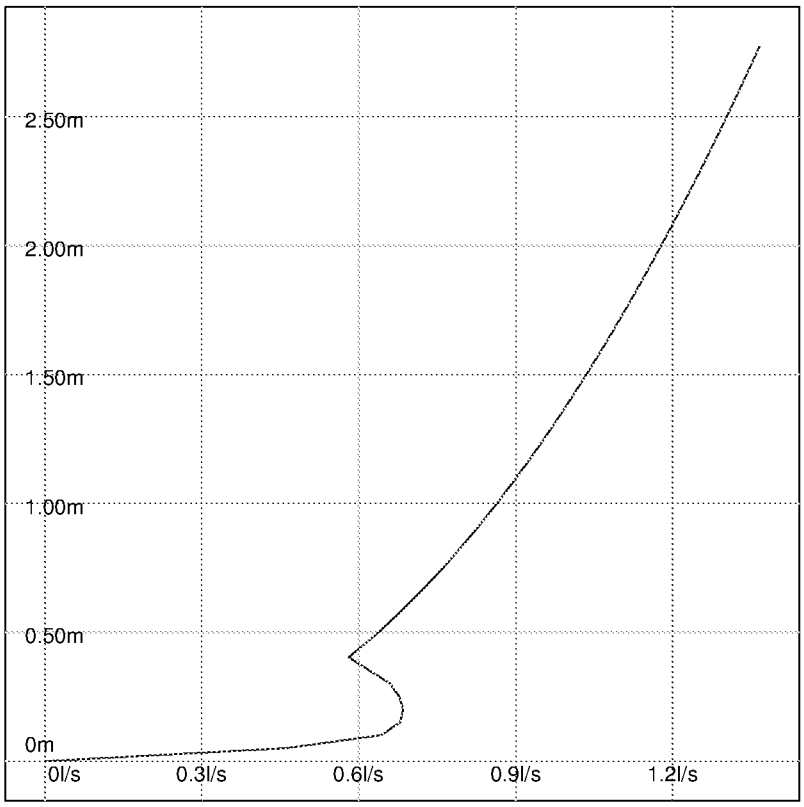


Controls within Manhole PS2

Hydro-Brake® Optimum Control at Manhole PS2

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0043-1000-1400-1000	1.400	1.000	0.000	0.191	0.685	0.386	0.570

Hydro-Brake® Optimum Control at PS2



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_494310_101620_v5_0_1.xml

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Periods (yrs) + Climate Change: (2, +0%), (10, +0%), (30, +0%), (100, +0%), (100, +45%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 15Min Winter	32.899	0.00	1.08	30Yr 360Min Summer	8.967	0.00	0.28
2Yr 15Min Summer	32.899	0.00	1.07	30Yr 360Min Winter	8.967	0.00	0.28
2Yr 30Min Winter	21.299	0.00	1.00	30Yr 480Min Summer	7.114	0.00	0.29
2Yr 30Min Summer	21.299	0.00	1.00	30Yr 480Min Winter	7.114	0.00	0.29
2Yr 60Min Summer	13.400	0.00	0.84	30Yr 600Min Summer	5.920	0.00	0.30
2Yr 60Min Winter	13.400	0.00	0.84	30Yr 600Min Winter	5.920	0.00	0.29
2Yr 120Min Winter	9.238	0.00	0.60	30Yr 720Min Summer	5.083	0.00	0.29
2Yr 120Min Summer	9.238	0.00	0.60	30Yr 720Min Winter	5.083	0.00	0.29
2Yr 180Min Summer	7.285	0.00	0.50	30Yr 960Min Summer	3.997	0.00	0.28
2Yr 180Min Winter	7.285	0.00	0.50	30Yr 960Min Winter	3.997	0.00	0.27
2Yr 240Min Winter	5.925	0.00	0.46	30Yr 1440Min Summer	2.854	0.00	0.24
2Yr 240Min Summer	5.925	0.00	0.45	30Yr 1440Min Winter	2.854	0.00	0.23
2Yr 360Min Summer	4.440	0.00	0.40	100Yr 15Min Summer	102.297	0.00	0.45
2Yr 360Min Winter	4.440	0.00	0.40	100Yr 15Min Winter	102.297	0.00	0.46
2Yr 480Min Summer	3.598	0.00	0.36	100Yr 30Min Summer	68.343	0.00	0.34
2Yr 480Min Winter	3.598	0.00	0.36	100Yr 30Min Winter	68.343	0.00	0.34
2Yr 600Min Summer	3.027	0.00	0.34	100Yr 60Min Summer	43.622	0.00	0.28
2Yr 600Min Winter	3.027	0.00	0.34	100Yr 60Min Winter	43.622	0.00	0.28
2Yr 720Min Winter	2.617	0.00	0.33	100Yr 120Min Summer	26.099	0.00	0.29
2Yr 720Min Summer	2.617	0.00	0.32	100Yr 120Min Winter	26.099	0.00	0.29
2Yr 960Min Summer	2.090	0.00	0.30	100Yr 180Min Summer	19.139	0.00	0.34
2Yr 960Min Winter	2.090	0.00	0.30	100Yr 180Min Winter	19.139	0.00	0.33
2Yr 1440Min Summer	1.529	0.00	0.27	100Yr 240Min Summer	15.374	0.00	0.41
2Yr 1440Min Winter	1.529	0.00	0.27	100Yr 240Min Winter	15.374	0.00	0.41
10Yr 15Min Summer	63.225	0.00	0.74	100Yr 360Min Summer	11.177	0.00	0.48
10Yr 15Min Winter	63.225	0.00	0.74	100Yr 360Min Winter	11.177	0.00	0.47
10Yr 30Min Summer	41.249	0.00	0.57	100Yr 480Min Summer	8.873	0.00	1.58
10Yr 30Min Winter	41.249	0.00	0.56	100Yr 480Min Winter	8.873	0.00	1.17
10Yr 60Min Summer	26.000	0.00	0.44	100Yr 600Min Summer	7.399	0.00	0.95
10Yr 60Min Winter	26.000	0.00	0.44	100Yr 600Min Winter	7.399	0.00	1.54
10Yr 120Min Summer	16.299	0.00	0.35	100Yr 720Min Summer	6.366	0.00	0.82
10Yr 120Min Winter	16.299	0.00	0.35	100Yr 720Min Winter	6.366	0.00	1.40
10Yr 180Min Summer	12.236	0.00	0.31	100Yr 960Min Summer	5.015	0.00	1.36
10Yr 180Min Winter	12.236	0.00	0.31	100Yr 960Min Winter	5.015	0.00	0.89
10Yr 240Min Summer	9.830	0.00	0.28	100Yr 1440Min Summer	3.579	0.00	0.62
10Yr 240Min Winter	9.830	0.00	0.29	100Yr 1440Min Winter	3.579	0.00	1.02
10Yr 360Min Summer	7.183	0.00	0.26	100Yr+45% 15Min Summer	148.331	0.00	0.32
10Yr 360Min Winter	7.183	0.00	0.26	100Yr+45% 15Min Winter	148.331	0.00	0.32
10Yr 480Min Winter	5.720	0.00	0.25	100Yr+45% 30Min Summer	99.097	0.00	0.26
10Yr 480Min Summer	5.720	0.00	0.25	100Yr+45% 30Min Winter	99.097	0.00	0.26
10Yr 600Min Summer	4.767	0.00	0.24	100Yr+45% 60Min Summer	63.252	0.00	0.46
10Yr 600Min Winter	4.767	0.00	0.24	100Yr+45% 60Min Winter	63.252	0.00	0.46
10Yr 720Min Summer	4.095	0.00	0.23	100Yr+45% 120Min Summer	37.843	0.00	0.69
10Yr 720Min Winter	4.095	0.00	0.23	100Yr+45% 120Min Winter	37.843	0.00	0.73
10Yr 960Min Summer	3.229	0.00	0.22	100Yr+45% 180Min Summer	27.752	0.00	1.49
10Yr 960Min Winter	3.229	0.00	0.22	100Yr+45% 180Min Winter	27.752	0.00	0.92
10Yr 1440Min Summer	2.319	0.00	0.20	100Yr+45% 240Min Summer	22.293	0.00	0.74
10Yr 1440Min Winter	2.319	0.00	0.20	100Yr+45% 240Min Winter	22.293	0.00	1.41
30Yr 15Min Summer	81.572	0.00	0.57	100Yr+45% 360Min Summer	16.207	0.00	0.81
30Yr 15Min Winter	81.572	0.00	0.58	100Yr+45% 360Min Winter	16.207	0.00	0.56
30Yr 30Min Summer	53.995	0.00	0.43	100Yr+45% 480Min Summer	12.866	0.00	0.58
30Yr 30Min Winter	53.995	0.00	0.43	100Yr+45% 480Min Winter	12.866	0.00	0.58
30Yr 60Min Summer	34.192	0.00	0.34	100Yr+45% 600Min Summer	10.729	0.00	0.59
30Yr 60Min Winter	34.192	0.00	0.34	100Yr+45% 600Min Winter	10.729	0.00	0.90
30Yr 120Min Summer	20.842	0.00	0.28	100Yr+45% 720Min Summer	9.231	0.00	0.66

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 120Min Winter	20.842	0.00	0.28	100Yr+45% 720Min Winter	9.231	0.00	0.71
30Yr 180Min Summer	15.403	0.00	0.26	100Yr+45% 960Min Summer	7.272	0.00	0.61
30Yr 180Min Winter	15.403	0.00	0.26	100Yr+45% 960Min Winter	7.272	0.00	0.74
30Yr 240Min Summer	12.347	0.00	0.26	100Yr+45% 1440Min Winter	5.189	0.00	0.54
30Yr 240Min Winter	12.347	0.00	0.26	100Yr+45% 1440Min Summer	5.189	0.00	0.62

Simulation Results

Return Period Yrs: 2.0
Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
PS9	15 min Summer	8	2.592	0.027	4.086		OK
PS8	30 min Summer	19	2.367	0.442	1.960		Surcharged
PS10	30 min Summer	18	2.367	0.092	3.751		OK
PS7	30 min Summer	19	2.364	0.073	10.585		Surcharged
PS13	15 min Summer	8	2.381	0.036	3.840		OK
PS6	60 min Summer	37	2.049	0.034	10.905		Surcharged
PS3	1440 min Summer	1049	1.742	0.292	0.680		OK
PS4	1440 min Summer	1049	1.742	0.392	0.680		Surcharged
PS2	1440 min Summer	1049	1.742	0.517	0.679		Surcharged
PS1	15 min Winter	0	1.500	0.425	0.671		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	PS9	PS8	0.126	1.041	4.076	0.030	OK
1.001	30 min Summer	19	PS8	PS7	0.187	0.099	4.491	0.045	OK
2.000	30 min Summer	19	PS10	PS7	0.082	0.633	5.054	0.030	OK
1.002	60 min Summer	35	PS7	PS6	0.053	1.257	10.341	0.117	OK
3.000	120 min Summer	64	PS13	PS6	0.027	0.858	1.883	0.014	OK
1.003	1440 min Summer	1036	PS6	PS3	0.150	0.417	2.684	0.019	OK
1.004	1440 min Summer	1049	PS3	PS4	0.296	0.050	2.615	0.031	OK
1.005	720 min Summer	429	PS4	PS2	0.150	0.040	0.700	0.020	Surcharged
1.006	1440 min Winter	1372	PS2	PS1	0.150	0.039	0.685	0.033	Surcharged

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving1	480 min Summer	296	2.658	0.018	0.343		OK
Permeable Paving2	480 min Summer	303	2.384	0.019	0.377		OK

Return Period Yrs: 10.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
PS9	15 min Summer	8	2.602	0.037	7.855		OK
PS8	30 min Summer	18	2.410	0.485	5.081		Surcharged
PS10	30 min Summer	18	2.412	0.137	7.238		OK
PS7	30 min Summer	18	2.409	0.118	28.048		Surcharged
PS13	15 min Summer	7	2.393	0.048	7.033		OK
PS6	30 min Summer	20	2.070	0.055	27.769		Surcharged
PS3	960 min Summer	966	1.984	0.534	0.625		Surcharged
PS4	960 min Summer	966	1.984	0.634	0.625		Surcharged
PS2	960 min Summer	966	1.984	0.759	0.628		Surcharged
PS1	15 min Summer	0	1.500	0.425	0.671		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	PS9	PS8	0.131	1.161	7.842	0.058	OK
1.001	30 min Summer	18	PS8	PS7	0.209	0.135	6.397	0.064	OK
2.000	30 min Summer	18	PS10	PS7	0.127	0.600	9.733	0.058	OK
1.002	30 min Summer	19	PS7	PS6	0.085	1.684	27.705	0.313	OK
3.000	30 min Summer	18	PS13	PS6	0.043	1.681	6.462	0.047	OK
1.003	480 min Summer	287	PS6	PS3	0.163	0.926	9.036	0.065	OK
1.004	240 min Summer	182	PS3	PS4	0.300	0.459	13.934	0.168	Surcharged
1.005	240 min Summer	144	PS4	PS2	0.150	0.043	0.768	0.022	Surcharged
1.006	180 min Summer	702	PS2	PS1	0.150	0.039	0.685	0.033	Surcharged

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving1	240 min Summer	155	2.670	0.029	0.713		OK
Permeable Paving2	240 min Summer	159	2.395	0.030	0.777		OK

Return Period Yrs: 30.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
PS9	15 min Summer	8	2.607	0.041	10.135		OK
PS8	30 min Summer	18	2.433	0.508	6.635		Surcharged
PS10	15 min Summer	10	2.436	0.160	11.675		OK
PS7	30 min Summer	18	2.432	0.141	37.001		Surcharged
PS13	15 min Summer	7	2.398	0.053	9.076		OK
PS6	960 min Summer	960	2.095	0.080	0.735		Surcharged
PS3	960 min Summer	961	2.094	0.644	5.106		Surcharged
PS4	960 min Summer	962	2.095	0.745	2.735		Surcharged
PS2	960 min Summer	962	2.095	0.870	0.709		Surcharged
PS1	15 min Summer	0	1.500	0.425	0.671		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	PS9	PS8	0.133	1.129	10.120	0.075	OK
1.001	30 min Summer	18	PS8	PS7	0.220	0.155	8.354	0.084	OK
2.000	30 min Summer	18	PS10	PS7	0.150	0.578	12.740	0.076	OK
1.002	30 min Summer	18	PS7	PS6	0.103	1.834	39.179	0.443	OK
3.000	30 min Summer	18	PS13	PS6	0.052	1.680	8.420	0.061	OK
1.003	960 min Summer	960	PS6	PS3	0.190	0.591	18.383	0.132	OK
1.004	180 min Summer	120	PS3	PS4	0.300	0.603	20.890	0.251	Surcharged
1.005	720 min Winter	616	PS4	PS2	0.150	0.052	0.916	0.027	Surcharged
1.006	960 min Summer	953	PS2	PS1	0.150	0.039	0.688	0.034	Surcharged

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving1	180 min Summer	119	2.677	0.036	1.006		OK
Permeable Paving2	240 min Summer	156	2.403	0.038	1.086		OK

Return Period Yrs: 100.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
PS9	15 min Summer	8	2.611	0.046	12.712		OK
PS8	15 min Summer	10	2.459	0.534	10.217		Surcharged
PS10	15 min Summer	10	2.460	0.185	14.631		OK
PS7	15 min Summer	10	2.455	0.164	56.483		Surcharged
PS13	15 min Summer	7	2.403	0.058	11.385		OK
PS6	960 min Winter	943	2.278	0.263	0.775		Surcharged
PS3	960 min Winter	943	2.278	0.828	0.773		Surcharged
PS4	960 min Winter	943	2.278	0.928	0.773		Surcharged
PS2	960 min Winter	943	2.278	1.053	0.773		Surcharged
PS1	15 min Summer	0	1.500	0.425	0.671		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	PS9	PS8	0.136	1.214	12.695	0.094	OK
1.001	15 min Summer	10	PS8	PS7	0.232	0.309	13.936	0.139	OK
2.000	15 min Summer	10	PS10	PS7	0.175	0.963	17.927	0.107	OK
1.002	960 min Winter	928	PS7	PS6	0.140	0.926	4.700	0.053	OK
3.000	720 min Summer	678	PS13	PS6	0.116	0.751	1.369	0.010	OK
1.003	960 min Winter	943	PS6	PS3	0.281	0.790	36.098	0.259	OK
1.004	600 min Winter	406	PS3	PS4	0.300	0.561	39.635	0.477	Surcharged
1.005	600 min Winter	509	PS4	PS2	0.150	0.468	8.264	0.239	Surcharged
1.006	960 min Winter	943	PS2	PS1	0.150	0.044	0.773	0.038	Surcharged

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving1	180 min Summer	117	2.685	0.044	1.369		OK
Permeable Paving2	240 min Summer	154	2.412	0.047	1.497		OK

Return Period Yrs: 100.0

Climate Change %: 45

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
PS9	15 min Summer	8	2.621	0.056	18.438		OK
PS8	15 min Summer	10	2.509	0.584	14.787		Surcharged
PS10	15 min Summer	10	2.511	0.235	21.200		Surcharged
PS7	15 min Summer	10	2.505	0.214	82.294		Surcharged
PS13	1440 min Winter	1369	2.495	0.150	0.084		OK
PS6	1440 min Winter	1370	2.495	0.480	0.863		Surcharged
PS3	1440 min Winter	1370	2.495	1.045	0.862		Surcharged
PS4	1440 min Winter	1370	2.495	1.145	0.862		Surcharged
PS2	1440 min Winter	1370	2.495	1.270	0.862		Flood Risk
PS1	15 min Summer	0	1.500	0.425	0.674		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	PS9	PS8	0.140	1.210	18.417	0.136	OK
1.001	15 min Summer	10	PS8	PS7	0.257	0.337	16.670	0.167	OK
2.000	15 min Summer	10	PS10	PS7	0.219	0.973	26.141	0.156	OK
1.002	1440 min Winter	1369	PS7	PS6	0.252	0.933	5.331	0.060	OK
3.000	1440 min Winter	1369	PS13	PS6	0.188	0.525	0.721	0.005	OK
1.003	240 min Summer	197	PS6	PS3	0.300	1.287	46.586	0.334	Surcharged
1.004	30 min Summer	26	PS3	PS4	0.300	2.125	89.781	1.081	Surcharged
1.005	360 min Summer	221	PS4	PS2	0.150	0.688	12.152	0.352	Surcharged
1.006	1440 min Winter	1370	PS2	PS1	0.150	0.049	0.862	0.042	Surcharged

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving1	120 min Summer	80	2.705	0.064	2.500		OK
Permeable Paving2	1440 min Winter	1371	2.495	0.130	0.131		OK

BRIGHT PLAN CIVILS

Appendix F