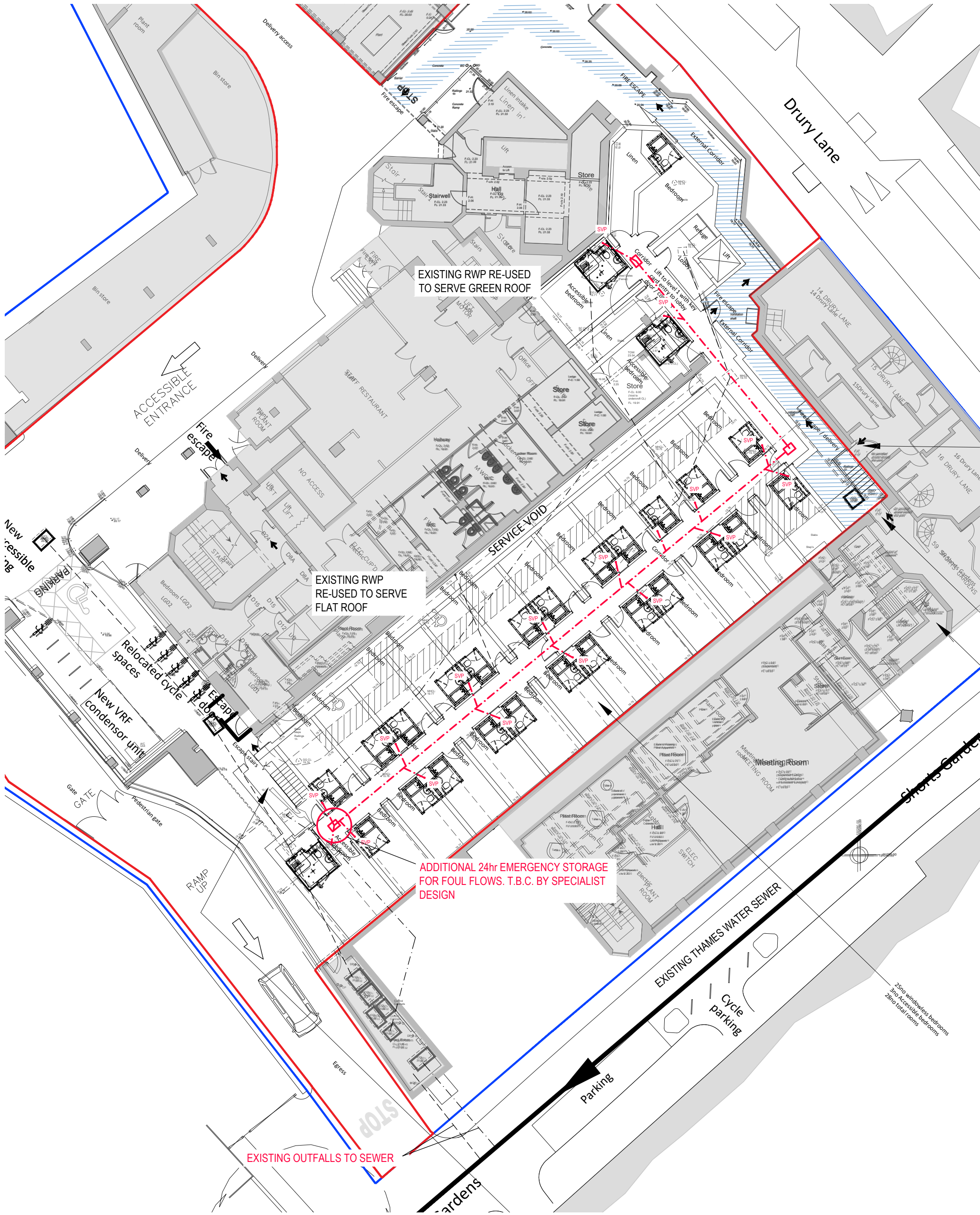


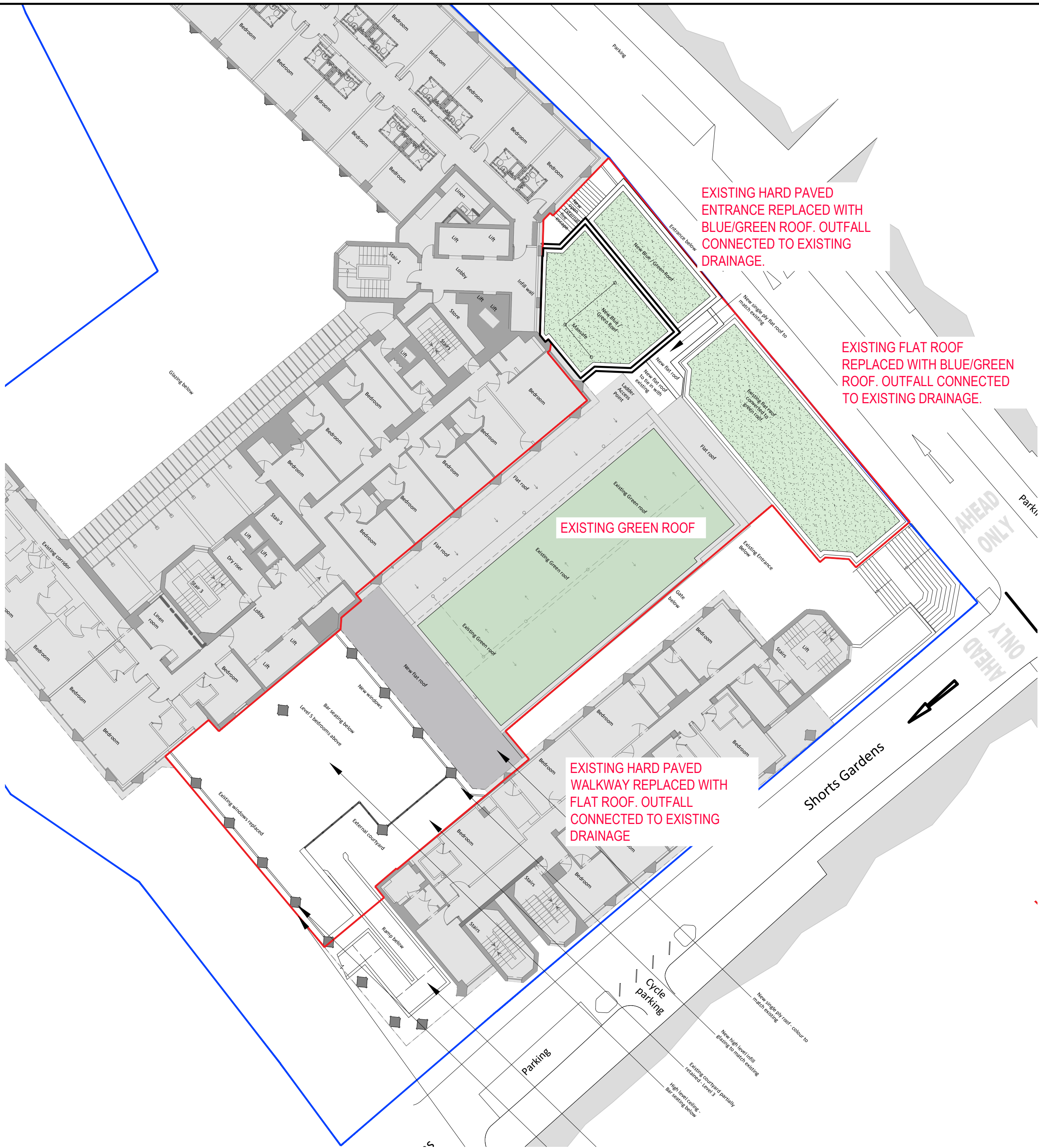


## Appendix H – Drainage Design Package Including Runoff Rates





LEVEL 1 PROPOSED DRAINAGE LAYOUT  
SCALE 1:200

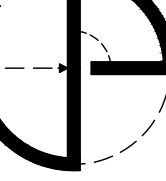


LEVEL 4 PROPOSED DRAINAGE LAYOUT  
SCALE 1:200

Notes

- GENERAL
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERS AND ARCHITECTS DRAWINGS AND THE SPECIFICATION. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORKS.
  2. ALL WORKMANSHIP AND MATERIALS ARE TO BE CARRIED OUT IN ACCORDANCE WITH CURRENT EUROCODES, CODES OF PRACTICE AND GOOD BUILDING PRACTICE.
  3. ALL WORK SHALL BE TO THE SATISFACTION OF THE ENGINEER AND THE LOCAL AUTHORITY.
  4. SETTING OUT DETAILS ARE SHOWN ON THE ARCHITECTS DRAWINGS UNLESS NOTED OTHERWISE. ENGINEERS DRAWINGS INDICATE STRUCTURAL ELEMENTS ONLY.
  5. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS ARE IN MILLIMETRES. THE CONTRACTOR IS TO CHECK ALL DIMENSIONS ON SITE BEFORE CARRYING OUT ANY WORKS.
  6. ALL EXISTING DETAILS AND DIMENSIONS INDICATED ON THIS DRAWING ARE FOR GUIDANCE ONLY AND ARE TO BE CHECKED ON SITE BY THE CONTRACTOR.
  7. THE CONTRACTOR IS RESPONSIBLE FOR AND MUST TAKE ALL NECESSARY PRECAUTIONS TO ENSURE THE STABILITY OF EXISTING STRUCTURES AND THE WORKS AT ALL TIMES DURING CONSTRUCTION.
  8. ALL SERVICES ARE TO BE LOCATED AND PROTECTED AS NECESSARY BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF THE WORKS.
  9. THIS DRAWING IS FOR THE PRIVATE AND CONFIDENTIAL USE OF THE CLIENT FOR WHOM IT WAS UNDERTAKEN AND IT SHOULD NOT BE REPRODUCED IN WHOLE OR IN PART OR RELIED UPON BY THIRD PARTIES FOR ANY USE WITHOUT THE EXPRESS WRITTEN AUTHORITY OF J P CHICK AND PARTNERS LIMITED.
- DRAINAGE NOTES
1. ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT H AND BRITISH STANDARD EN 752.
  2. PRIOR TO COMMENCEMENT OF THE WORKS THE CONTRACTOR SHALL LAISE WITH ALL RELEVANT AUTHORITIES TO OBTAIN THEIR REQUIREMENTS AND TO OBTAIN APPROVAL FOR HIS METHOD OF WORKING AND WHERE APPROPRIATE HIS INTENDED CHOICE OF MATERIALS.
  3. ALL MATERIALS, UNLESS OTHERWISE SPECIFIED, SHALL COMPLY WITH THE RELEVANT BRITISH STANDARD. SOURCES OF MATERIALS ARE TO BE AGREED WITH THE EMPLOYERS REPRESENTATIVE/ENGINEER IN ADVANCE OF THE WORKS.
  4. PRIOR TO COMMENCEMENT OF THE WORKS ALL DRAINAGE OUTFALL POINTS, WHETHER EXISTING SEWER, DRAIN OR WATERCOURSE, SHALL BE VERIFIED ON SITE BY THE CONTRACTOR IF THE OUTFALL POINT IS FOUND TO BE HIGHER OR SIGNIFICANTLY LOWER THAN SHOWN ON THE DRAWINGS. THEN THE ENGINEER IS TO BE NOTIFIED (SIGNIFICANT REDESIGN OF DRAINAGE AND LEVELS MAY BE NECESSARY).
  5. ALL WORKS TO NEW OR EXISTING PUBLIC SEWERS SHALL BE TO THE APPROVAL OF THE WATER AUTHORITY AND IN ACCORDANCE WITH 'SEWERS FOR ADOPTION' THE LATEST EDITION.
  6. ALL COVER LEVELS SHOWN ON THIS DRAWING ARE APPROXIMATE. EXACT LEVELS OF NEW COVERS AND FRAMES TO BE DETERMINED ON SITE TO MATCH LEVEL AND PROFILE OF FINISHED SURFACE.
  7. ALL COVERS, GRATINGS AND FRAMES TO CHAMBERS, GULLIES, CHANNELS AND SHALL BE OF THE CORRECT LOAD CLASS TO SUIT THEIR LOCATION.
- LOAD CLASS A15 PEDESTRIAN AREAS (NOT ACCESSIBLE BY VEHICLES)  
LOAD CLASS B125 PRIVATE DRIVES.  
LOAD CLASS C250 LIGHTLY TRAFFICKED ROADS.  
LOAD CLASS D400 MAIN ROADS
8. THE CONTRACTORS ATTENTION IS DRAWN TO DIAGRAMS 7 AND 8 OF 'THE BUILDING REGULATIONS APPROVED DOCUMENT H' SHOWING DETAILS OF DRAINS LAID BELOW AND NEAR TO BUILDINGS. WHERE GROUND BEAMS ARE USED THEIR LEVEL SHALL BE SET TO AVOID CLASHING WITH DRAIN CONNECTIONS.
  9. FOR THE EXACT LOCATION OF SOIL PIPES, SUBSTACKS W.C.'s AND OTHER DRAINAGE CONNECTIONS REFER TO M&E/ARCHITECTS DRAWINGS.
  10. ALL PIPES TO BE 100mmØ @ 1:80 UNLESS NOTED OTHERWISE.
  11. ALL BEDDING AND SURROUND TO BE GRANULAR U.N.O. IN LANDSCAPED AREAS WHERE PIPES HAVE LESS THAN 600mm COVER PROVIDE CONCRETE BEDDING AND SURROUND. IN ROADS AND CAR PARKS PROVIDE CONCRETE BEDDING AND SURROUND WHERE COVER IS LESS THAN 900mm.

P4	29.01.24	GJB	ARCHITECTS PLAN UPDATED		
P3	03.07.23	GJB	THAMES WATER SEWER ADDED		
P2	23.03.23	GJB	DRAWING AMENDED		
P1	16.03.23	GJB	PRELIMINARY ISSUE		

Rev.	Date	By	Amendment	Chk	App
Status					
PRELIMINARY					
JP Chick & Partners Ltd					
Consulting Civil & Structural Engineers					
					
7 Museum Street, Ipswich, Suffolk. IP1 1HQ. T: (01473) 280699 F: (01473) 280701					
W: <a href="http://www.chick.co.uk">www.chick.co.uk</a> E: <a href="mailto:ipswich@chick.co.uk">ipswich@chick.co.uk</a>					
Also at:					
8 Atlantic Square, Station Rd, Witham, Essex, CM8 2TL. T: (01376) 503020					
23 St Stephens Road, Norwich, Norfolk, NR1 3SP T: (01603) 619093 F: (01603) 610840					

Client

**Barnes**  
CONSTRUCTION

Project  
**TRAVELODGE  
DRURY LANE  
COVENT GARDEN**

Drawing Title  
**DRAINAGE LAYOUT**

Scale 1:200 @ A1	Checked	Date
Date MARCH 2023	Drawn By GJB	
Drawing Number <b>IG22/185/201</b>	Rev <b>P4</b>	

THIS DRAWING IS COPYRIGHT



## Run-off from Hard Standing Areas - Pre Development

Peak Discharge  $Q = 3.61 C_v i A$   $C_v = 0.9$   
 $i =$  Rainfall Intensity From Micro Drainage  
 $A =$  Area  $=$  0.03 ha

### 1 Year Event

15 minute storm	=	3.61	x	0.9	x	38.37	x	0.03	=	3.740 l/s
30 minute storm	=	3.61	x	0.9	x	24.06	x	0.03	=	2.345 l/s
120 minute storm	=	3.61	x	0.9	x	8.68	x	0.03	=	0.846 l/s
6 hour storm	=	3.61	x	0.9	x	3.78	x	0.03	=	0.368 l/s

### 30 Year Event

15 minute storm	=	3.61	x	0.9	x	80.60	x	0.03	=	7.856 l/s
30 minute storm	=	3.61	x	0.9	x	51.64	x	0.03	=	5.033 l/s
120 minute storm	=	3.61	x	0.9	x	18.76	x	0.03	=	1.829 l/s
6 hour storm	=	3.61	x	0.9	x	7.90	x	0.03	=	0.770 l/s

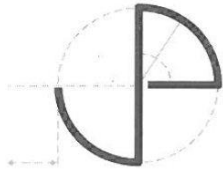
### 100 Year Event

15 minute storm	=	3.61	x	0.9	x	104.81	x	0.03	=	10.216 l/s
30 minute storm	=	3.61	x	0.9	x	67.67	x	0.03	=	6.595 l/s
120 minute storm	=	3.61	x	0.9	x	24.65	x	0.03	=	2.403 l/s
6 hour storm	=	3.61	x	0.9	x	10.25	x	0.03	=	0.999 l/s

### Volume of Run-off from Hard Standing 6 Hour Storm

1 Year Storm	=	0.368	x	60	x	60	x	6	=	7958 litres or 7.958 m <sup>3</sup>
30 Year Storm	=	0.770	x	60	x	60	x	6	=	16626 litres or 16.626 m <sup>3</sup>
100 Year Storm	=	0.999	x	60	x	60	x	6	=	21582 litres or 21.582 m <sup>3</sup>

### Project: DRURY LANE TRAVELODGE

 <p>7 Museum Street Ipswich Suffolk IP1 1HQ</p> <p>Tel: (01473) 280699 Fax: (01473) 280701</p> <p><b>JP Chick &amp; Partners Ltd</b> Consulting Civil &amp; Structural Engineers</p> <p>www.chick.co.uk ipswich@chick.co.uk</p>	Designed GJB	Checked	Date Mar-23	Job No. IG22/185
	Calculation Sheet			
	Sheet No. <span style="margin-left: 50px;">1</span> of <span style="margin-left: 50px;">1</span>			

# BLUE ROOF ATTENUATION AND OUTFLOW SUMMARY

## PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	Travelodge Hotel off Drury Lane, London - Existing Flat Roof		
Prepared for:	JP Chick, Ipswich.		
Date:	29/01/2024		
ABG Project ID:	24735	Calculator version:	1.30
Prepared by:	Matt Gledhill, matthew.gledhill@abgltd.com		
Notes/description:	Green roof. Maintenance access only. Warm roof/inverted roof, construction, with zero falls - TBC. Existing flat roof, being converted to blue/green.		

### Input Parameters - Rainfall Information (Flood Studies Report 1975)

Return period:	100 years	As supplied by Client
Allowance for Climate Change:	40 %	As supplied by Client
Location selected for FSR data:	London (Central)	

### Input Parameters - Roof Information

Total catchment area:	101 m <sup>2</sup>	As supplied by Client
Attenuation area:	96 m <sup>2</sup>	As supplied by Client
Maximum allowable runoff:	0.5 l/s	As supplied by Client

### Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	5 hours and 20 minutes	0.3
30 mins	6 hours and 10 minutes	0.3
1 hour	6 hours and 50 minutes	0.3
2 hours	7 hours and 0 minutes	0.3
4 hours	6 hours and 40 minutes	0.3
6 hours	5 hours and 50 minutes	0.3
10 hours	4 hours and 30 minutes	0.2
24 hours	0 hours and 30 minutes	0.1
48 hours	0 hours and 0 minutes	0.0

**Total attenuation required: 5.9 m<sup>3</sup>**  
**Half empty time: 0 hours and 30 minutes.**

### Output - Recommended Blue Roof System

System Name:	ABG bluerroof VF HD 129mm
Description:	The blue roof depth of 129mm, already includes for a 25mm deep, reservoir board. No. of control positions TBC by design team, and also with the structural engineer's deflection analysis. Additional 'tell-tale'/emergency parapet overflow outlets, may also be added by the architect.

Total attenuation capacity:	10.9 m <sup>3</sup>
Number of Blue Roof outlets:	2

- Notes:
1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
  2. Further details on the theories used in this estimate are available upon request from ABG. The values given for the performance of the system relate to testing, modelling and analysis of our systems obtained from laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes to our systems without notice at any time.
  3. The estimate given in this report is based on the stated parameters as per the brief. If these parameters are not correct or have changed, ABG should be contacted to provide a revised estimate.
  4. This estimate is specific to the characteristics of ABG products/systems and is not applicable to other competitor products. The substitution of the whole or any component of this design for a material supplied from another source renders this estimate invalid.
  5. Final determination of the suitability of any information is the sole responsibility of the user. ABG will be pleased to discuss the use of this or any other product but responsibility for selection of a material and its application in any specific project remains with the user.

Blue Roof Estimate

## 1. DEFINITIONS

‘Consultant’ means ABG Geosynthetics Ltd and its legal successors. ‘Client’ means the person, firm, company or organisation for whom the Consultant is performing the Services. ‘Agreement’ means the contract referred to in Clause 2. ‘Services’ means the services to be performed by the Consultant in accordance with the proposal from the Consultant. ‘Project’ means the project or works for which the Client has commissioned the Services.

## 2. GENERAL

Unless and until a formal agreement is entered into, the Client’s acceptance of the proposal for Services from the Consultant or a request for some or all the Services to be performed by the Consultant, shall constitute a binding contract between the Client and the Consultant which contract will be subject to any terms and conditions contained or referred to in the aforementioned proposal and these terms and conditions. In the event of any conflict, the terms and conditions in the proposal shall prevail over these terms and conditions. The Agreement so formed shall supersede all previous understandings, commitments or agreements whether written or oral between the Client and the Consultant relating to the subject matter hereof. No person or entity shall have any rights in relation to this Agreement, whether as third parties or otherwise, save the parties to this Agreement. Should any term or condition of this Agreement be held to be unenforceable or invalid by the courts of any jurisdiction to which it is subject then such term or condition shall be disregarded and the remaining terms and conditions shall remain in full force and effect.

## 3. PERFORMANCE OF SERVICES AND SCOPE

The Consultant shall perform the Services using the degree of skill care and diligence to be expected from a consultant experienced in the provision of services of similar scope size and complexity. The Consultant shall use reasonable endeavours to complete the Services within the time or programme agreed but shall not be responsible for any delay beyond the reasonable control of the Consultant. The fee contained in the proposal is for the scope of services as defined therein. If not already contained in the proposal the Consultant and the Client shall agree as an initial activity an integrated project services programme to include the activities of all the parties to the Project relevant to the Services to be supplied by the Consultant. The aforesaid programme shall show the key dates for final information and the delivery of such to the Consultant so as to enable the Consultant to carry out the services in an efficient once through manner to achieve the programme delivery dates for the Services.

The Consultant provides various services including Design and Product use advice which is distinct from a Design Service. The Design Service may or may not attract a fee.

Where the Consultant’s services are of an advisory nature and dependent upon the degree of information and release thereof by the Client then the Client agrees that any reliance placed on the services by the Client shall take due account of such constraints.

## 4. CONFIDENTIALITY AND INTELLECTUAL PROPERTY RIGHTS

i. The Consultant and the Client shall keep confidential all information pertaining to the Services.  
ii. Copyright for all reports, documents and the like produced by the Consultant in the performance of the Services shall remain vested with the Consultant but the Consultant shall grant an irrevocable royalty free license to the Client to use such reports, documents and the like for any purpose in connection with the Project.

## 5. LIABILITY

i. The Consultant shall be liable to pay compensation to the Client arising out of or in connection with this Agreement only if a breach of the duty of care in Clause 3 is established against the Consultant.  
ii. Notwithstanding any other term to the contrary in this Agreement or any related document and whether the cause of action for any claim arises under or in connection with the Agreement in contract or in tort, in negligence or for breach of statutory duty or otherwise the Consultant shall have no liability to the Client in respect of any claim for loss or damage arising from acts of war or terrorism or arising from flooding, burst water mains or failed drainage or arising from any incidence of toxic mould or asbestos but otherwise in relation to any cause of action as aforesaid the total liability of the Consultant in the aggregate for all claims shall be limited to a sum equivalent to ten (10) times the fee payable under this Agreement or £50,000, whichever is the lesser, or such other sum as may be expressly stated in the Consultant’s proposal, and further but without prejudice to the aforesaid limit of liability any such liability of the Consultant shall be limited to such sum or sums as it would be just and equitable for the Consultant to pay having regard to the Consultant’s responsibility for the same and on the basis that all other parties appointed or to be appointed by the Client to perform related services in connection with the Project shall be deemed to have provided undertakings on terms no less onerous than this Agreement and shall be deemed to have paid to the Client such contribution as it would be just and equitable for them to pay having regard to their responsibility for any loss or damage and providing that it shall be deemed that such other parties have not limited or excluded their liability to the Client for such loss or damage in any way which may be prejudicial to the Consultant’s liability under this clause. Nothing in this clause shall operate to exclude or limit the Consultant’s liability for death or personal injury.  
iii. The Client shall indemnify and keep indemnified the Consultant from and against all claims, demands, proceedings, damages, costs and expenses arising out of or in connection with this Agreement or the Project arising from acts of terrorism or arising otherwise in excess of the liability of the Consultant under this Agreement or which may be made in respect of events occurring after the expiry of the period of liability stated in this Agreement.  
iv. No action or proceedings under or in connection with this Agreement shall be commenced against the Consultant after the expiry of one year from completion of the Services.  
v. ABG Geosynthetics Ltd is not responsible for consequential, indirect or incidental losses.

## 6. INSURANCE

The Consultant shall arrange Professional Indemnity Insurance cover for the amount stated in Clause 5(ii). The Consultant will use all reasonable endeavours to maintain Professional Indemnity Insurance cover for the period stated in 5(iv) above, providing such insurance remains available to the Consultant at commercially reasonable rates.

## 7. CLIENT’S OBLIGATIONS

The Client shall supply, without charge and in such time so as not to delay or disrupt the performance of the Consultant in carrying out the Services, all necessary and relevant information, in his possession or available to him from his other agents or consultants and all necessary approvals or consents. Any deviation on any information from the proposal shall be confirmed in writing and any attendant consequential fees will be forwarded for approval by the Client before any changes are made. The Consultant shall not be liable for any consequential delays on site. Every reasonable effort will be made to mitigate against delays, however no liability for losses and costs will be accepted. The approval or consent by the Client to the Services shall not relieve the Consultant from any liability under this Agreement. All work undertaken by the Consultant must be ratified and signed off by the Client.

## 8. PAYMENT

i. The Client shall pay the Consultant for the Services in accordance with the proposal and this Agreement. If the Consultant performs any additional services or if the Services are delayed or disrupted for reasons beyond the reasonable control of the Consultant then the Consultant shall be entitled to such additional fees as are fair and reasonable in the circumstances. The Consultant may render an invoice at monthly intervals for services properly performed. The agreed invoice, or in the event of a dispute the undisputed element, shall be paid within 28 days of receipt of the invoice by the Client. Any invoice paid after this period will attract interest at 3% above the base rate of the central bank of the country of the currency of payment along with any collection costs which may occur.  
ii. The Client shall not withhold any payment of any sum or part of a sum due to the Consultant under this Agreement by reason of claims or alleged claims against the Consultant unless the amount to be withheld has been agreed between the Client and the Consultant as due to the Client or such sum arises from an award in adjudication, arbitration or litigation in favour of the Client and arises under or in connection with the Agreement. Save as aforesaid all rights of set off at common law, in equity or otherwise which the Client may otherwise be entitled to exercise are hereby expressly excluded.

## 9. TERMINATION

If a party is in breach of a material term of this Agreement and despite written notice from the other party fails to remedy such breach within 30 days or such other period as may be agreed between the parties, then the other party shall be entitled to terminate this Agreement forthwith. The Consultant may seek to recoup costs incurred for works completed prior to termination.

## 10. DISPUTE RESOLUTION

Any dispute between the parties that cannot be settled by mutual agreement shall be referred for final settlement to the arbitration of a person agreed between the parties or failing such agreement appointed upon the application of either party by the President of the Chartered Institute of Arbitrators and the said arbitration shall be carried out in accordance with the Construction Industry Model Arbitration Rules 1998 or such other version current at the time of the referral under this clause. Where the Agreement is subject to a governing law other than that of England and Wales then any dispute between the parties that cannot be settled by mutual agreement shall be finally settled by arbitration in accordance with the UNCITRAL Arbitration Rules by one arbitrator appointed in compliance with the said Rules. In either case such rules as appropriate are deemed to be incorporated into this Agreement by reference.

## 11. COMPLIANCE WITH LAWS

This Agreement shall be governed by and construed in accordance with the law of England and Wales unless stated otherwise in the proposal for services from the Consultant.

Changes to the above terms and conditions will only be considered if agreed in writing as part of the appointment process prior to ABG Geosynthetics commencing work.

# BLUE ROOF ATTENUATION AND OUTFLOW SUMMARY

## PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	Travelodge Hotel off Drury Lane, London - Level 3, Green Roof		
Prepared for:	JP Chick, Ipswich.		
Date:	29/01/2024		
ABG Project ID:	24735	Calculator version:	1.30
Prepared by:	Matt Gledhill, matthew.gledhill@abgltd.com		
Notes/description:	Green roof. Maintenance access only. Warm roof/inverted roof, construction, with zero falls - TBC.		

### Input Parameters - Rainfall Information (Flood Studies Report 1975)

Return period:	100 years	As supplied by Client
Allowance for Climate Change:	40 %	As supplied by Client
Location selected for FSR data:	London (Central)	

### Input Parameters - Roof Information

Total catchment area:	40 m <sup>2</sup>	As supplied by Client
Attenuation area:	27 m <sup>2</sup>	As supplied by Client
Maximum allowable runoff:	0.5 l/s	As supplied by Client

### Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	3 hours and 40 minutes	0.2
30 mins	4 hours and 20 minutes	0.2
1 hour	4 hours and 30 minutes	0.2
2 hours	4 hours and 30 minutes	0.2
4 hours	4 hours and 0 minutes	0.2
6 hours	3 hours and 10 minutes	0.1
10 hours	1 hour and 50 minutes	0.1
24 hours	0 hours and 0 minutes	0.0
48 hours	0 hours and 0 minutes	0.0

**Total attenuation required: 2.1 m<sup>3</sup>**  
**Half empty time: 1 hours and 0 minutes.**

### Output - Recommended Blue Roof System

System Name:	ABG blueroo VF HD 129mm
Description:	The blue roof depth of 129mm, already includes for a 25mm deep, reservoir board. No. of control positions TBC by design team, and also with the structural engineer's deflection analysis. Additional 'tell-tale'/emergency parapet overflow outlets, may also be added by the architect.

Total attenuation capacity:	3.0 m <sup>3</sup>
Number of Blue Roof outlets:	1

- Notes:
1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
  2. Further details on the theories used in this estimate are available upon request from ABG. The values given for the performance of the system relate to testing, modelling and analysis of our systems obtained from laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes to our systems without notice at any time.
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Blue Roof Estimate

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iii. The Client shall indemnify and keep indemnified the Consultant from and against all claims, demands, proceedings, damages, costs and expenses arising out of or in connection with this Agreement or the Project arising from acts of terrorism or arising otherwise in excess of the liability of the Consultant under this Agreement or which may be made in respect of events occurring after the expiry of the period of liability stated in this Agreement.  
iv. No action or proceedings under or in connection with this Agreement shall be commenced against the Consultant after the expiry of one year from completion of the Services.  
v. ABG Geosynthetics Ltd is not responsible for consequential, indirect or incidental losses.

## 6. INSURANCE

The Consultant shall arrange Professional Indemnity Insurance cover for the amount stated in Clause 5(ii). The Consultant will use all reasonable endeavours to maintain Professional Indemnity Insurance cover for the period stated in 5(iv) above, providing such insurance remains available to the Consultant at commercially reasonable rates.

## 7. CLIENT’S OBLIGATIONS

The Client shall supply, without charge and in such time so as not to delay or disrupt the performance of the Consultant in carrying out the Services, all necessary and relevant information, in his possession or available to him from his other agents or consultants and all necessary approvals or consents. Any deviation on any information from the proposal shall be confirmed in writing and any attendant consequential fees will be forwarded for approval by the Client before any changes are made. The Consultant shall not be liable for any consequential delays on site. Every reasonable effort will be made to mitigate against delays, however no liability for losses and costs will be accepted. The approval or consent by the Client to the Services shall not relieve the Consultant from any liability under this Agreement. All work undertaken by the Consultant must be ratified and signed off by the Client.

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ii. The Client shall not withhold any payment of any sum or part of a sum due to the Consultant under this Agreement by reason of claims or alleged claims against the Consultant unless the amount to be withheld has been agreed between the Client and the Consultant as due to the Client or such sum arises from an award in adjudication, arbitration or litigation in favour of the Client and arises under or in connection with the Agreement. Save as aforesaid all rights of set off at common law, in equity or otherwise which the Client may otherwise be entitled to exercise are hereby expressly excluded.

## 9. TERMINATION

If a party is in breach of a material term of this Agreement and despite written notice from the other party fails to remedy such breach within 30 days or such other period as may be agreed between the parties, then the other party shall be entitled to terminate this Agreement forthwith. The Consultant may seek to recoup costs incurred for works completed prior to termination.

## 10. DISPUTE RESOLUTION

Any dispute between the parties that cannot be settled by mutual agreement shall be referred for final settlement to the arbitration of a person agreed between the parties or failing such agreement appointed upon the application of either party by the President of the Chartered Institute of Arbitrators and the said arbitration shall be carried out in accordance with the Construction Industry Model Arbitration Rules 1998 or such other version current at the time of the referral under this clause. Where the Agreement is subject to a governing law other than that of England and Wales then any dispute between the parties that cannot be settled by mutual agreement shall be finally settled by arbitration in accordance with the UNCITRAL Arbitration Rules by one arbitrator appointed in compliance with the said Rules. In either case such rules as appropriate are deemed to be incorporated into this Agreement by reference.

## 11. COMPLIANCE WITH LAWS

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# BLUE ROOF ATTENUATION AND OUTFLOW SUMMARY

## PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	Travelodge Hotel off Drury Lane, London - Level 4, Green Roof		
Prepared for:	JP Chick, Ipswich.		
Date:	29/01/2024		
ABG Project ID:	24735	Calculator version:	1.30
Prepared by:	Matt Gledhill, matthew.gledhill@abgltd.com		
Notes/description:	Green roof. Maintenance access only. Warm roof/inverted roof, construction, with zero falls - TBC.		

### Input Parameters - Rainfall Information (Flood Studies Report 1975)

Return period:	100 years	As supplied by Client
Allowance for Climate Change:	40 %	As supplied by Client
Location selected for FSR data:	London (Central)	

### Input Parameters - Roof Information

Total catchment area:	66 m <sup>2</sup>	As supplied by Client
Attenuation area:	55 m <sup>2</sup>	As supplied by Client
Maximum allowable runoff:	0.5 l/s	As supplied by Client

### Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	3 hours and 20 minutes	0.3
30 mins	3 hours and 50 minutes	0.3
1 hour	4 hours and 0 minutes	0.3
2 hours	4 hours and 0 minutes	0.3
4 hours	3 hours and 20 minutes	0.3
6 hours	2 hours and 30 minutes	0.2
10 hours	1 hour and 10 minutes	0.1
24 hours	0 hours and 0 minutes	0.0
48 hours	0 hours and 0 minutes	0.0

**Total attenuation required: 3.5 m<sup>3</sup>**  
**Half empty time: 0 hours and 20 minutes.**

### Output - Recommended Blue Roof System

System Name:	ABG bluerroof VF HD 129mm
Description:	The blue roof depth of 129mm, already includes for a 25mm deep, reservoir board. No. of control positions TBC by design team, and also with the structural engineer's deflection analysis. Additional 'tell-tale'/emergency parapet overflow outlets, may also be added by the architect.

Total attenuation capacity:	6.2 m <sup>3</sup>
Number of Blue Roof outlets:	2

- Notes:
1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
  2. Further details on the theories used in this estimate are available upon request from ABG. The values given for the performance of the system relate to testing, modelling and analysis of our systems obtained from laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes to our systems without notice at any time.
  3. The estimate given in this report is based on the stated parameters as per the brief. If these parameters are not correct or have changed, ABG should be contacted to provide a revised estimate.
  4. This estimate is specific to the characteristics of ABG products/systems and is not applicable to other competitor products. The substitution of the whole or any component of this design for a material supplied from another source renders this estimate invalid.
  5. Final determination of the suitability of any information is the sole responsibility of the user. ABG will be pleased to discuss the use of this or any other product but responsibility for selection of a material and its application in any specific project remains with the user.

Blue Roof Estimate



## 1. DEFINITIONS

‘Consultant’ means ABG Geosynthetics Ltd and its legal successors. ‘Client’ means the person, firm, company or organisation for whom the Consultant is performing the Services. ‘Agreement’ means the contract referred to in Clause 2. ‘Services’ means the services to be performed by the Consultant in accordance with the proposal from the Consultant. ‘Project’ means the project or works for which the Client has commissioned the Services.

## 2. GENERAL

Unless and until a formal agreement is entered into, the Client’s acceptance of the proposal for Services from the Consultant or a request for some or all the Services to be performed by the Consultant, shall constitute a binding contract between the Client and the Consultant which contract will be subject to any terms and conditions contained or referred to in the aforementioned proposal and these terms and conditions. In the event of any conflict, the terms and conditions in the proposal shall prevail over these terms and conditions. The Agreement so formed shall supersede all previous understandings, commitments or agreements whether written or oral between the Client and the Consultant relating to the subject matter hereof. No person or entity shall have any rights in relation to this Agreement, whether as third parties or otherwise, save the parties to this Agreement. Should any term or condition of this Agreement be held to be unenforceable or invalid by the courts of any jurisdiction to which it is subject then such term or condition shall be disregarded and the remaining terms and conditions shall remain in full force and effect.

## 3. PERFORMANCE OF SERVICES AND SCOPE

The Consultant shall perform the Services using the degree of skill care and diligence to be expected from a consultant experienced in the provision of services of similar scope size and complexity. The Consultant shall use reasonable endeavours to complete the Services within the time or programme agreed but shall not be responsible for any delay beyond the reasonable control of the Consultant. The fee contained in the proposal is for the scope of services as defined therein. If not already contained in the proposal the Consultant and the Client shall agree as an initial activity an integrated project services programme to include the activities of all the parties to the Project relevant to the Services to be supplied by the Consultant. The aforesaid programme shall show the key dates for final information and the delivery of such to the Consultant so as to enable the Consultant to carry out the services in an efficient once through manner to achieve the programme delivery dates for the Services.

The Consultant provides various services including Design and Product use advice which is distinct from a Design Service. The Design Service may or may not attract a fee.

Where the Consultant’s services are of an advisory nature and dependent upon the degree of information and release thereof by the Client then the Client agrees that any reliance placed on the services by the Client shall take due account of such constraints.

## 4. CONFIDENTIALITY AND INTELLECTUAL PROPERTY RIGHTS

i. The Consultant and the Client shall keep confidential all information pertaining to the Services.  
ii. Copyright for all reports, documents and the like produced by the Consultant in the performance of the Services shall remain vested with the Consultant but the Consultant shall grant an irrevocable royalty free license to the Client to use such reports, documents and the like for any purpose in connection with the Project.

## 5. LIABILITY

i. The Consultant shall be liable to pay compensation to the Client arising out of or in connection with this Agreement only if a breach of the duty of care in Clause 3 is established against the Consultant.  
ii. Notwithstanding any other term to the contrary in this Agreement or any related document and whether the cause of action for any claim arises under or in connection with the Agreement in contract or in tort, in negligence or for breach of statutory duty or otherwise the Consultant shall have no liability to the Client in respect of any claim for loss or damage arising from acts of war or terrorism or arising from flooding, burst water mains or failed drainage or arising from any incidence of toxic mould or asbestos but otherwise in relation to any cause of action as aforesaid the total liability of the Consultant in the aggregate for all claims shall be limited to a sum equivalent to ten (10) times the fee payable under this Agreement or £50,000, whichever is the lesser, or such other sum as may be expressly stated in the Consultant’s proposal, and further but without prejudice to the aforesaid limit of liability any such liability of the Consultant shall be limited to such sum or sums as it would be just and equitable for the Consultant to pay having regard to the Consultant’s responsibility for the same and on the basis that all other parties appointed or to be appointed by the Client to perform related services in connection with the Project shall be deemed to have provided undertakings on terms no less onerous than this Agreement and shall be deemed to have paid to the Client such contribution as it would be just and equitable for them to pay having regard to their responsibility for any loss or damage and providing that it shall be deemed that such other parties have not limited or excluded their liability to the Client for such loss or damage in any way which may be prejudicial to the Consultant’s liability under this clause. Nothing in this clause shall operate to exclude or limit the Consultant’s liability for death or personal injury.  
iii. The Client shall indemnify and keep indemnified the Consultant from and against all claims, demands, proceedings, damages, costs and expenses arising out of or in connection with this Agreement or the Project arising from acts of terrorism or arising otherwise in excess of the liability of the Consultant under this Agreement or which may be made in respect of events occurring after the expiry of the period of liability stated in this Agreement.  
iv. No action or proceedings under or in connection with this Agreement shall be commenced against the Consultant after the expiry of one year from completion of the Services.  
v. ABG Geosynthetics Ltd is not responsible for consequential, indirect or incidental losses.

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# Green Roofs

A guide to the design  
and specification of  
ABG Geosynthetics  
green roof systems

**abg** creative  
geosynthetic  
engineering





Virtually any type of roof structure can accommodate a Green Roof, including domestic and commercial and on both new-build and retro-fit projects. The significant benefits of a Green Roof are wide ranging, such as helping to mitigate the effects of climate change, to whole-life cost benefits or by simply adding a natural aesthetic to an urban environment.

As much as 95% of rainfall on undeveloped land is naturally absorbed into the vegetated surface whilst the remainder runs off. Urbanisation and development of land creates hard impervious surfaces, which absorb only 5% of the rainfall leaving the remaining rainfall to run-off into both natural and man-made water systems which struggle to cope with the volumes. This has been highlighted in recent flooding events occurring all over the country.

Green roofs can play an important role in mitigating these events especially when designed as an integral element of a sustainable urban drainage system, also known as SUDs. In the future Green Roofs will be used to attenuate water, providing an alternative solution to SUDs tanks and helping reduce flooding in urban environments,

The next time you are thinking of incorporating a Green Roof system into a new or existing development don't hesitate to contact ABG Creative Geosynthetic Engineering directly and let us assist you through every stage of the process from design through to installation.

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Intensive Green Roof on podium deck construction - Raithwaite Hall, North Yorkshire.



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### Added protection for the waterproofing layer

The build-up of a green roof helps reduce the impact of temperature fluctuations thereby reducing thermal stresses. A green roof protects the waterproofing by mitigating expansion and contraction whilst protecting the waterproofing from harmful UV rays and the effects of the freeze thaw cycle during winter months. This protection prolongs the life of the waterproofing to such an extent that many waterproofing companies will extended their warranties when an ABG green roof is installed.

---

### Scoring BREEAM points

Improving the energy performance of buildings and embracing Green Roofs helps to meet standards such as the code for sustainable homes and BREEAM. It also helps to meet planning requirements and revisions in Part L Building Regulations. A development incorporating a Green Roof can earn up to 6.2 points on an Eco Homes score. It can also score substantial points for sections LE04 and LE05 using the ecology of the roof to enhance plant species, local biodiversity and water storage.

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### Reduces whole life costs

Typical roof installations have a life expectancy in the region of between 15 and 20 years. The building of a green roof system have been shown to have a life expectancy in excess of 50 years. The greatly improved life expectancy of a green roof means the costs over the whole life of the development are actually significantly lower than a traditional roof construction.

---

### Green roofs as part of a SUDs solution

Urbanisation and land development creates hard impervious surfaces, which absorb only 5% of rainfall. The remaining 95% of the rainfall becomes run off. The result is that streams, rivers and ageing sewer systems cannot accommodate this huge influx, which in turn can cause severe flooding and erosion.

A Green Roof is an effective way to help attenuate rainfall as the vegetated surface allows infiltration into the roof build up. This solution benefits the environment by allowing developments to have a similar rainfall response to the natural land. In addition to this a Green Roof will function in areas where a SUDs tank will perform poorly e.g. clay, contaminated land, aquifers etc.

---

### Aid planning consent

Although there are no regulations in place with regards to Green Roofs, many local authorities favour proposals that incorporate sustainable drainage systems.

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### Creates Amenity

A green roof can be used to create an amenity that the building occupiers can use and enjoy. Typical amenities within green roofs can include playgrounds and play areas, ornamental gardens or areas in which fruit and vegetables can grow.

---

### Mitigating the Urban Heat Island effect

City centres are known to have higher temperatures than surrounding rural areas. This is due to a number of factors, many of which are linked to the specific heat and impervious nature of city surfaces such as concrete, tarmac and traditional membrane roofs. This is known as the Urban Heat Island Effect.

Including a Green Roof allows the heat generated by the building to be drawn into the cool roof construction and then dissipated more readily to the environment than with traditional roof constructions.

---

### Creates Habitat

Green Roofs help create a living habitat for small wildlife and a wide variety of plant species. This is particularly useful when a development has taken some previous existing habitat, as the creation of new space on the roof can be used to offset the environmental impact of this. Also, whilst the formation of specific engineered habitat areas is possible, simple practices, such as including rocks and logs within the design, are often equally as effective in reaching the end result.

---

### Insulation

It has been proven that Green Roofs have a cooling effect in summer, reducing air conditioning load and we are currently working with University of Sheffield on a research project to determine the level of insulation provided against heat loss in winter.

Green Roofs currently rely on an insulating layer to meet specification. This specification is on a project specific basis to ensure the building regulations regarding thermal insulation are met using the green roof. We work with leading UK insulation manufacturers to ensure the thermal requirements are met using the minimum thickness of material.

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### Noise reduction

A Green Roof is very good at reducing low frequency sounds, an extensive Green Roof can insulate up to 40dB and an intensive Green Roof can insulate up to 50dB. This can make a noticeable difference especially near airports.

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### Extracts pollutants

The vegetation, growing media and filtration fabrics within the green roof construction helps filter dust and pollution from the air and rainfall thus reducing the amount of chemicals and pollutants that reach the river networks.

Water discharged from a green roof is proven to be cleaner than the precipitation from which it fell. In many cases the water is clean enough to be collected and used for irrigation and even for grey water applications such as toilet flushing.

---

### Aesthetics

Green roofs can be used to allow the creation of a ‘green bridge’ through the built environment. This not only helps with the aesthetics of the area but also allows the natural flow of flora and fauna through urban developments.



# Features & Benefits

It is now widely acknowledged that a Green Roof system protects and prolongs the life of a roof by mitigating expansion and contraction whilst shielding the roof from harmful UV rays and the effects of the freeze thaw cycle during winter months.

This protection prolongs the life of the waterproofing to such an extent that many waterproofing companies will extend their warranties when an ABG Green Roof is installed.

On top of this Green Roofs offer many environmental benefits; it is proven that including a green roof improves the thermal performance of the roof and can assist in improving the carbon efficiency of the development.

Intensive green roof on a podium deck construction - Mei Foo Station, Hong Kong.



# Extensive Green Roofs

Extensive green roofs are the most common type and characteristically consist of a shallow layer of growing media; typically between 60mm and 120mm deep. This is planted with a variety of drought tolerant hardy plants.

This type of roof is relatively self-sufficient; they are not designed or constructed with the intention of being trafficked by pedestrians. Whilst not providing any kind of amenity area they do contribute to improving air quality, reducing the visual impact of the roof and assist in controlling rain water run-off/ harvesting as well as contributing to the acoustic and thermal properties of the roof.

Because access to the roof tends to be limited other than for annual maintenance, the choice of vegetation should be selected with this in mind with low maintenance planting such as sedums and indigenous species recommended.

## Geotextile Filter Fabric

Laid beneath substrate to prevent fines filtering through to voids below.

## Growing Media

ABG peat free media derived from sustainable, 100% recycled, UK sourced materials. Using a specifically developed growing media can help provide the right growing environment for the selected vegetation and also reduce the load on the roof.

## Vegetation

Specifically selected to suit the final finish requirements of the client/end user. On Extensive green roofs low maintenance varieties such as mosses, herbaceous plants, sedums wildflowers and grasses tend to be used.

## Roofdrain

Forms a lightweight high performance drainage layer with integrated filter geotextile. Using Roofdrain allows for the collection and storage of water to irrigate the plants during low rainfall periods whilst providing a continuous drainage layer across the roof structure. In this system it is shown as strip specifically developed to be positioned between the standing seams.

## Roof Deck

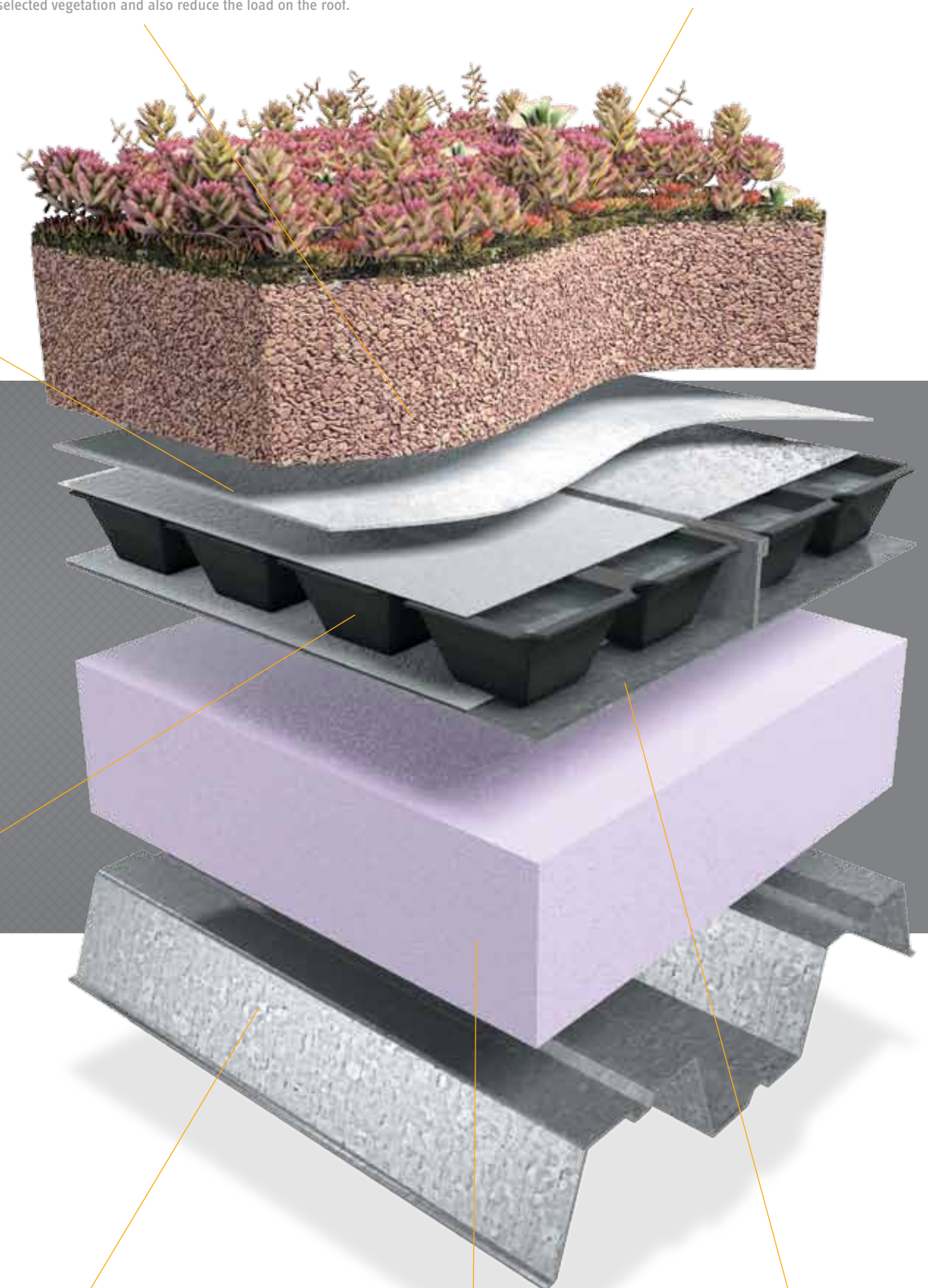
In this instance illustrated as a profile metal deck but other systems can be used.

## Insulation

Specified to meet thermal requirements of the roof structure.

## Waterproofing

Illustrated as a Standing Seam System.





# Intensive Green Roofs

Sometimes referred to as roof gardens, an intensive green roof can be as simplistic or as complex as the client requires. Generally speaking an intensive green roof requires the same level of care as any traditional garden.

Intensive green roofs consist of a deep layer of engineered growing media, typically 150mm to 1500mm. As a result of this soil depth there is a greater scope of planting available and the roof can be viewed very much like a garden area and may be landscaped to include trees, lawns, flower beds and paved areas. With an intensive roof the only real limit to its scope is the weight of the system and the structure necessary to support it.

Many modern developments incorporate landscaped roofs at ground level, for example above basement areas and underground car parks. These are commonly referred to as podium decks. The decked areas themselves create additional usable space in urban developments. For large areas it is imperative that consideration is given to the provision of adequate sub-surface drainage.

## Deckdrain

Forms a lightweight high performance drainage layer with integrated filter geotextile that eliminates clogging within the drainage structure that provides a continuous drainage layer across the structure.

## Engineered Growing Media

ABG peat free media derived from sustainable, recycled, UK sourced materials. Using a specifically developed growing media can help provide the right growing environment for the selected vegetation and also reduce the load on the roof.

## Vegetation/surfacing

Specifically selected to suit the final finish requirements of the client/end user. On Intensive green roofs a wide variety of vegetation can be used from grasses to shrubs and trees as well as hard surfacing such as pavers and block paving.

## Root Barrier

The GRO Best Practice Guide for Green Roof Construction recommends, for some roof types, the inclusion of Root Barrier above the waterproofing.

## Waterproofing

Waterproofing layer specified according to project requirements and roof type.

## Roof Deck

Roof deck specified by others to meet project requirements and roof type.





# Biodiverse Roofs

A roof which is commonly used where the vegetation is intended to replace or replicate the existing site habitat. With an increasing number of developments being undertaken on brownfield land the use of biodiverse roofs can partly mitigate the loss of habitat on development sites.

This type of roof may be seeded like both the intensive and extensive varieties or can be allowed to self-colonise; however, seeding increases the biodiversity potential of the roof in the short term. Biodiverse roofs often include areas of logs and rocks to try and create habitat to suit colonisation by as broad a band of species as possible, because of this they are referred to as 'brown' or 'rubble' roofs.

Maintenance is similar to that of an extensive green roof; minimal maintenance is required. Aggregate and vegetation choice determined by the biodiversity objective the client would like to achieve.

## Roofdrain

Forms a lightweight high performance drainage layer with integrated filter geotextile. Using Roofdrain allows for the collection and storage of water to irrigate the plants during low rainfall periods whilst providing a continuous drainage layer across the roof structure.

## Engineered Growing Media

ABG peat free media derived from sustainable, recycled, UK sourced materials. Using a specifically developed growing media can help provide the right growing environment for the selected vegetation and also reduce the load on the roof.

## Vegetation/surfacing

Specifically selected to suit the final finish requirements of the client/end user incorporating rocks and log outcrop areas to create additional habitat for biodiversity.

## ABG Slimline Membrane

High performance non-woven polyethylene barrier that resists the passage of water but is vapour permeable.

## Insulation

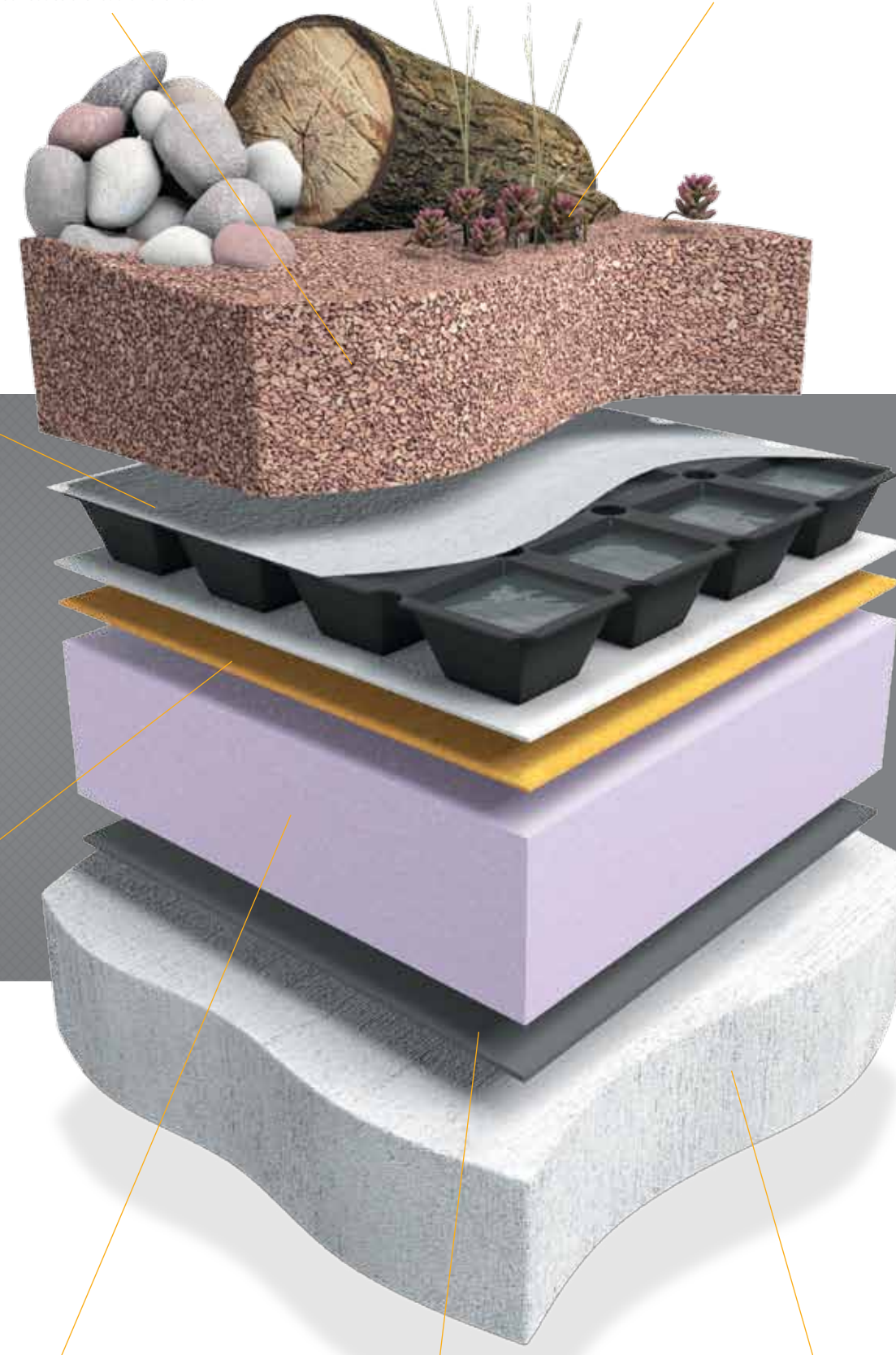
Specified to meet thermal requirements of the roof structure.

## Waterproofing

Waterproofing layer specified according to project requirements and roof type.

## Roof Deck

Roof deck specified by others to meet project requirements.





Access & Maintenance

The British Standards Institution state that all new builds must provide access to the roof area to enable a minimum of two inspections per year, so working at height regulations must be considered. If a building is of a height which can cause an injury from a fall, including roofs under 2m, then edge protection is required.

Even though extensive Green Roofs are relatively self-sustaining, they still require some form of maintenance. ABG recommend this should be dealt with in the form of a maintenance contract. Maintenance for extensive roofs will typically be required twice in the first 12 months, then once annually thereafter. Therefore the overall cost of maintaining a Green Roof can be relatively minimal.

Drainage & Water Retention

Drainage and water retention are key elements to consider when designing a Green Roof. The specific type is entirely dependent upon the proposed landscaping element. Ensuring adequate water retention/drainage requirements are met aids the long-term survival of the vegetation and prevents pooling.

Geographical Location

Geographical location and orientation are also an important part of designing the roof. Which area of the country, the amount of average rainfall in that area and the prevalent wind direction determines the type of uses and needs for the Green Roof. Biodiversity and drainage are then designed into the roof from these requirements. The direction in which the roof faces and amount of sunlight the roof receives helps to determine the types of vegetation for a successful roof.

It is worth noting that green roofs in coastal locations require particular attention in order to ensure any vegetation specified is hardy enough to withstand the specific conditions.

Structural Loadings

The introduction of a Green Roof will have loading implications for the building. It is vital to consult a structural engineer at an early stage especially when designing for a SUDS solution where water may be stored within the roof structure. This will enable you to determine any constraints you may be under and in turn help decide which type of Green Roof system to implement.

Compressive strength

A design consideration more prevalent in podium deck applications is the compressive strength of the drainage layer. The structural requirements of these systems are commonly misinterpreted with erroneous descriptions such as 1000kPa are sometimes mentioned. This is significantly greater than the requirements of the roof and indeed most roofs do not need anything over 150kPa.

Roof Angle

Contrary to popular believe Green Roofs can be constructed on sloping roofs. It is worth bearing in mind that once the angle is over twenty degrees both installation and maintenance may start to become increasingly complex.

Cost

When taking into account factors such as the whole life cost of the building, the reduction in other infrastructure such as stormwater tanks, and the extension in the life of waterproofing membrane, extensive Green Roofs typically provide a positive cost benefit.

As opposed to having a ‘one system fits all’ approach, our supply chain enables us to put forward bespoke systems to help meet the needs of the client, on time and within agreed budget.

Green roofs and food production

It is becoming increasingly common on a local and domestic scale for the green roof to be utilised for the cultivation of fruit and vegetables. This can be done without affecting the structure of the green roof beneath and can yield good results.

Thermal Performance

Any green roof needs to meet the building regulations required to achieve the thermal performance. At the moment the green roof build up cannot be considered as part of the roof build up when calculating thermal performance so insulation specification must be done as per a standard roof.

However, research shows that the introduction of layers of drainage, growing media and vegetation have an impact on the thermal performance and can offer additional benefits on the development including cost benefits and reducing the carbon footprint.

Sound Insulation

Including a green roof can reduce noise levels inside the development by providing additional acoustic protection against rainfall, wind noise and low decibel frequencies.

Water Attenuation

A Green Roof can be designed to provide rainwater storage and form part of the SUDs requirement on the site. This can replace the below ground storage tank of particular interest on sites with tight land use (See pages 18-19).

Fire

There is a misconception about the risks of fire and how this affects the design of a Green Roof. There is less risk of a green roof catching fire than a standard roof.

A minimum firebreak of 300mm is required round penetrations and edges and for continuous runs a maximum length of 20m is permitted followed by a 500mm break.

Aesthetics

It is important to consider the appearance of the selected Green Roof system both in the short term & long term. Planting should be tailored to suit the desired end result.

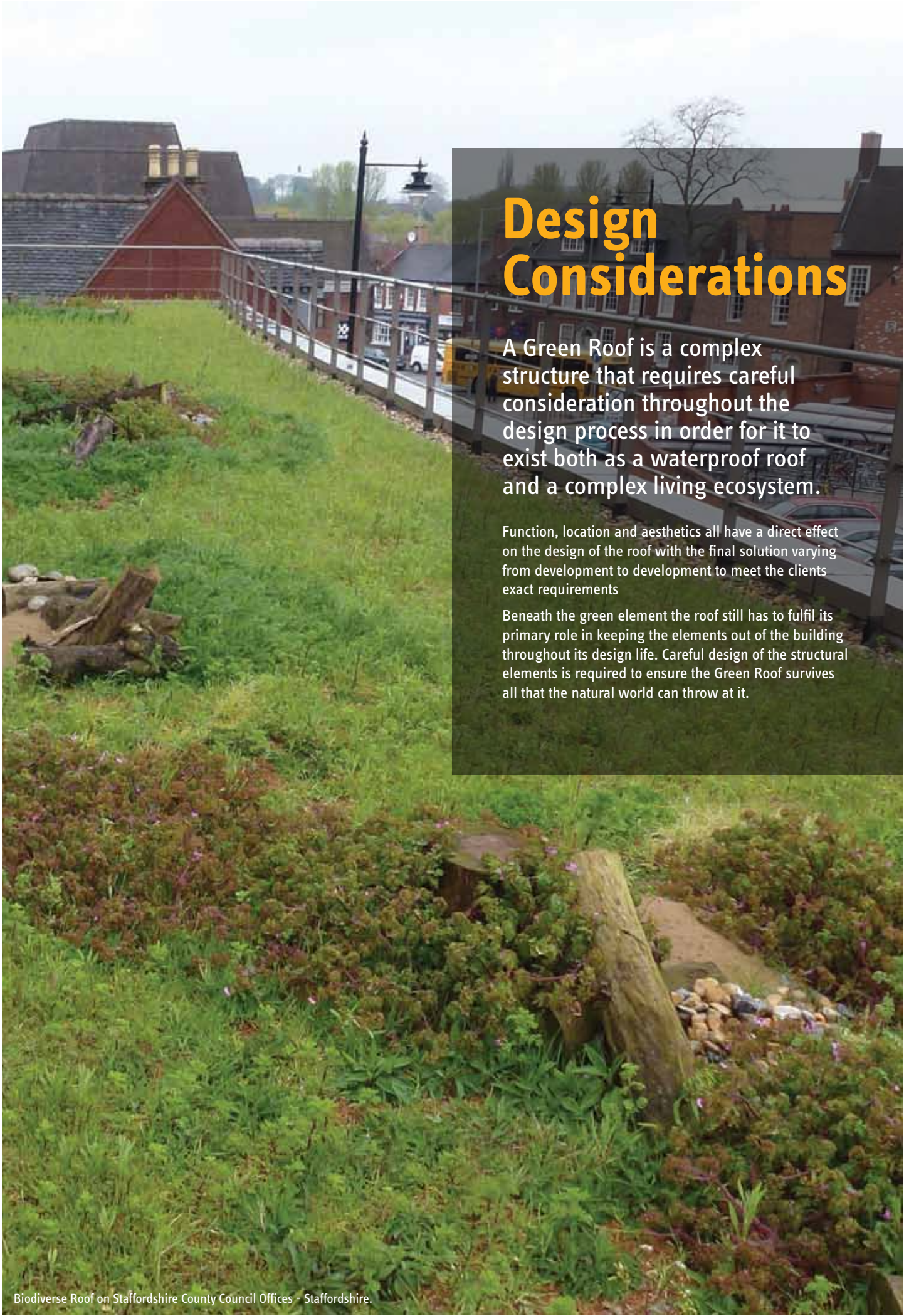
A wide variety of plants are suitable for green roof planting schemes; mosses, sedums and grasses for Extensive though to deeper rooted shrubs and trees and even fruit and vegetables for Intensive Roofs. The decision is entirely dependent on the roof finish required.

Design Considerations

A Green Roof is a complex structure that requires careful consideration throughout the design process in order for it to exist both as a waterproof roof and a complex living ecosystem.

Function, location and aesthetics all have a direct effect on the design of the roof with the final solution varying from development to development to meet the clients exact requirements

Beneath the green element the roof still has to fulfil its primary role in keeping the elements out of the building throughout its design life. Careful design of the structural elements is required to ensure the Green Roof survives all that the natural world can throw at it.



Biodiverse Roof on Staffordshire County Council Offices - Staffordshire.

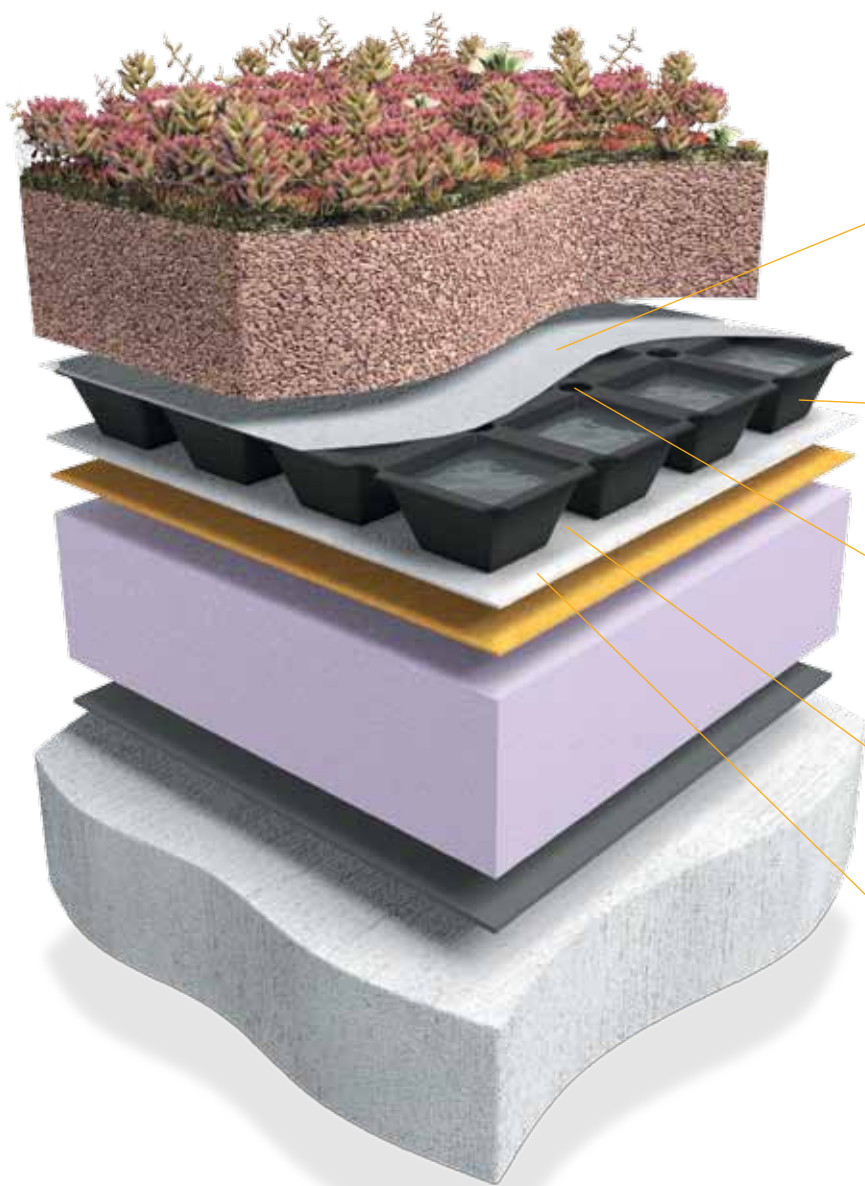


# Roofdrain

The design of intensive green roofs requires a structural drainage layer (Deckdrain); by contrast the modern method of an extensive green roof requires a combination of efficient drainage and water attenuation in order to allow the ecology to flourish.

Roofdrain allows the storage of water within the nodes of the of the HDPE core whilst facilitating the efficient drainage of any excess water away from the roof. This helps prevent the root growing media from drying out during dry periods and from becoming waterlogged during wet periods.

When used within a roof construction Roofdrain provides a versatile system for the collection of surplus seepage water at the base of the growing medium and for the prevention of water pressure on the structural waterproofing.



**Filter Geotextile**  
Filter geotextile allows free drainage of water into the core.

**Attenuation Void**  
Wells formed by cusps of core allow for water storage to feed plants during periods of low rain fall.

**Perforations**  
Perforations in core allow free passage of surcharge water into drainage channels.

**Drainage Channels**  
Channels in core allow free lateral drainage of water to discharge outlets.

**Protection Geotextile**  
Protects underlying elements from damage.

	Thickness	Reservoir Capacity (l/m <sup>2</sup> )	Typical Applications
Roofdrain 20	20mm	5.5	Below substrate layers 75mm down including extensive and brown roofs.
Roofdrain 25	25mm	4.3	Standard grade product. Below substrate layers 150mm down including extensive and brown roofs. It is particularly useful on pitched roofs due to the profile of the cone shaped cusps.
Roofdrain 40	40mm	12	Used to store additional rainwater allowing greater diversity of vegetation.
Roofdrain 60	60mm	23	Used to store large volumes of rainfall and significantly reduce run-off.

For further information of Roofdrain visit [www.abgltd.com/roofdrain](http://www.abgltd.com/roofdrain)



# Deckdrain

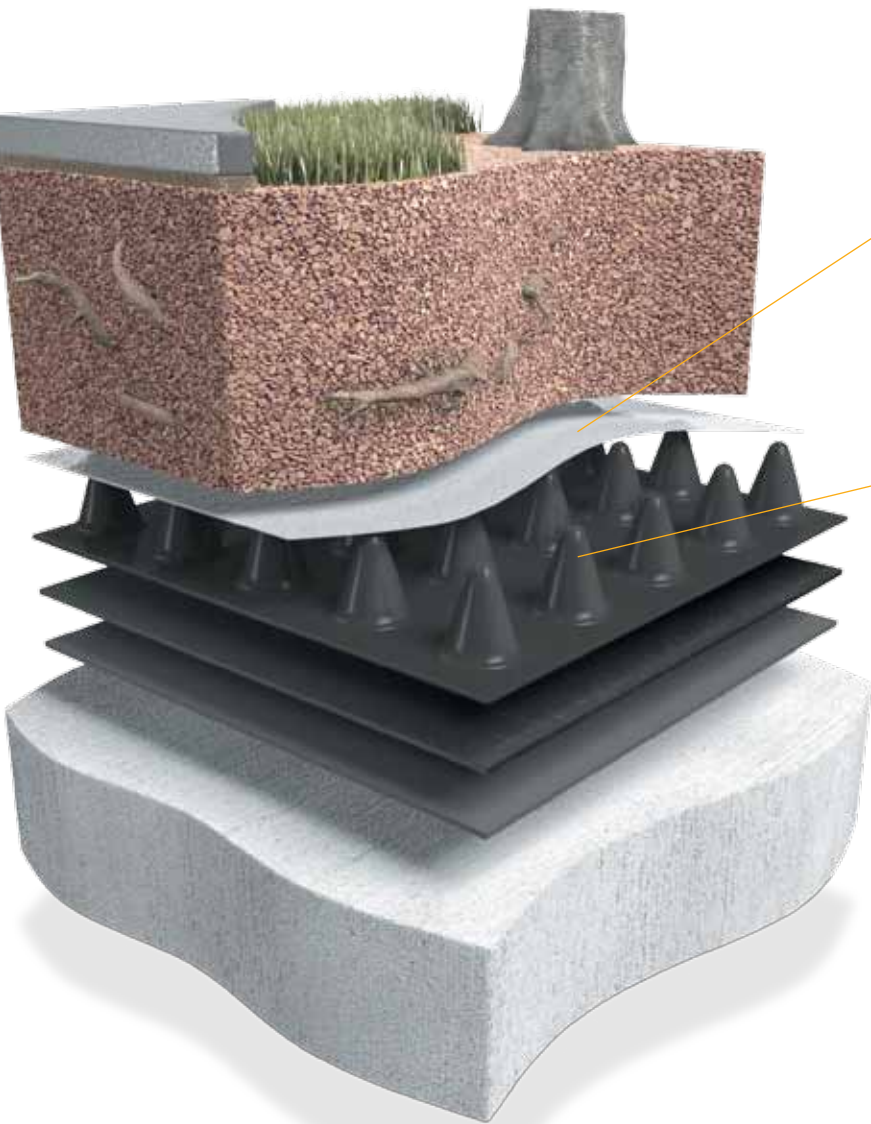
Deckdrain consists of a combination of a cusped core with a geotextile fleece bonded to the upper face.

Deckdrain is manufactured from up to 95% recycled material bonded to the upper face. Deckdrain is manufactured within the UK, making it an environmentally sound choice.

Deckdrain provides excellent drainage over the whole base area of the soil layer as well as providing additional waterproofing protection. With more emphasis on reducing the amount of carbon used in construction, recycled materials can provide additional environmental benefits.

Intensive Green Roofs have a deeper layer of growing medium than extensive roofs. This increased depth has a greater capacity to retain water making it less likely to dry out. Utilising a drainage composite such as Deckdrain, reduces the risk of over saturation of the plants during periods of heavy rainfall.

The high strength core used in Deckdrain allows the product to be used in high load areas such as on podium decks with vehicular traffic.

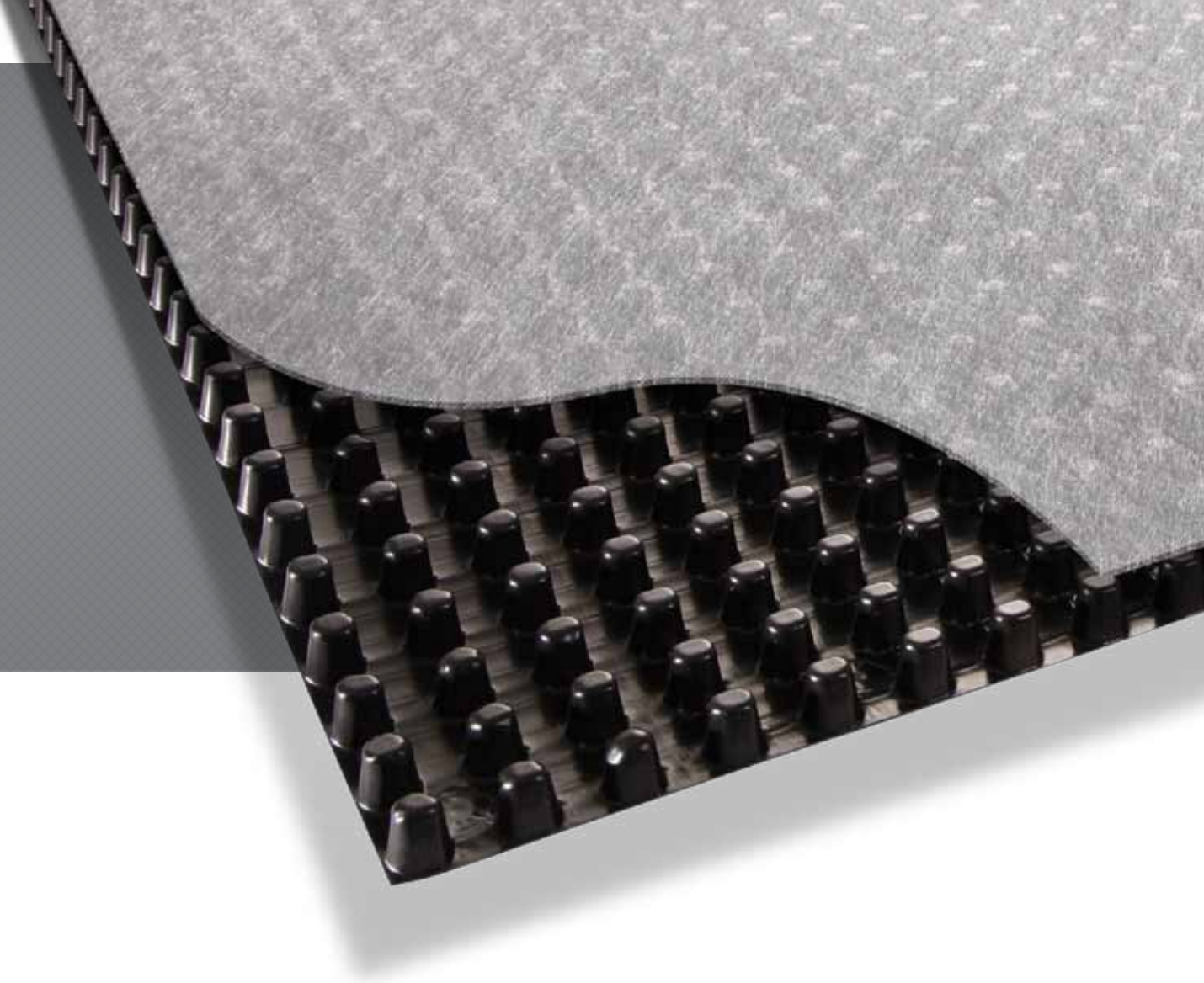


**Filter Geotextile**

Filter fabric allows free drainage into core whilst preventing intrusion of over fill materials.

**Drainage Core**

High strength drainage core allows factory constant drainage capacity and protects waterproofing layer.



	Thickness	Flow Rate*	Puncture Resistance	Typical Applications
Deckdrain 700	7mm	0.67	2400N	Smaller podium decks and car parks where outlets are closely spaced.
Deckdrain 1200	12mm	1.25	2300N	Larger podium decks and car parks where outlets are less frequent.
Deckdrain 2500	25mm	4.30	4800N	Applications where large volumes of water will be travelling over large distances in podium deck and green roofs.
Deckdrain 5000	50mm	29.00	N/A	Used as part of the SUDS attenuation system detailed on page 19.

\*Flow rate determined at HG=0.1 and under 20kPa load which represents the hydraulic gradient typical to a horizontal roof construction. For further flow figures, including at HG=1 - vertical, please contact technical sales for the latest Deckdrain datasheet.

For further information of Deckdrain visit [www.abgltd.com/deckdrain](http://www.abgltd.com/deckdrain)



# Blue Roof System

ABG Blue Roof System has the ability to provide a SUDS attenuation solution for a development. The geocomposite, water attenuation and substrate layers are specifically designed with enhanced water storage capacity in built and the discharge is controlled using a patented outlet designed specifically for this function. Designing a green roof in this way allows storage capacities suitable for a one in a hundred year storm event to be achieved. This stored water, as with a 'traditional' storage system, can be released at controlled rate or even used as grey water or irrigation for the vegetation across the development.

The ABG Blue Roof System consists of 3 key components. A 2 tier drainage geocomposite system, comprising layers of Deckdrain and Roofdrain, integral filter geotextiles and a series of Restrictor Chambers.

Excess water not absorbed by the vegetation, filters through the green roof and builds up in to the drainage void formed by the geocomposite layers below. This water is gradually dispersed through the system to the Restrictor Outlet Chamber and discharged to the roof outlet at the rate permitted for the site.

The storm water attenuation requirements are met within the roof construction, therefore the need for underground storage can be eliminated. The benefits to the overall project include the removal of the disruption, time and cost of installing an underground tank. Placing the storage within the footprint of the building also has advantages in heavily urbanised developments where external space is at a premium and on site working space and materials storage is limited. This reduction in material movements also helps reduce the carbon footprint of the project.

## Engineered Growing Media

Specified according to final vegetation requirements.

## Attenuation Void

Roofdrain layer stores excess water not absorbed by the vegetation that filters through the green roof build-up in to the drainage void below.

## Access Chamber Lid

## Gravel Firebreak

## Aluminium Upstand

## Reservoir Layer

Deckdrain 40 provides storage capacity during storm events.

## Restrictor Chamber

This water is gradually dispersed through the system to the Restrictor Chamber and discharged to the roof outlet at the rate permitted for the site.

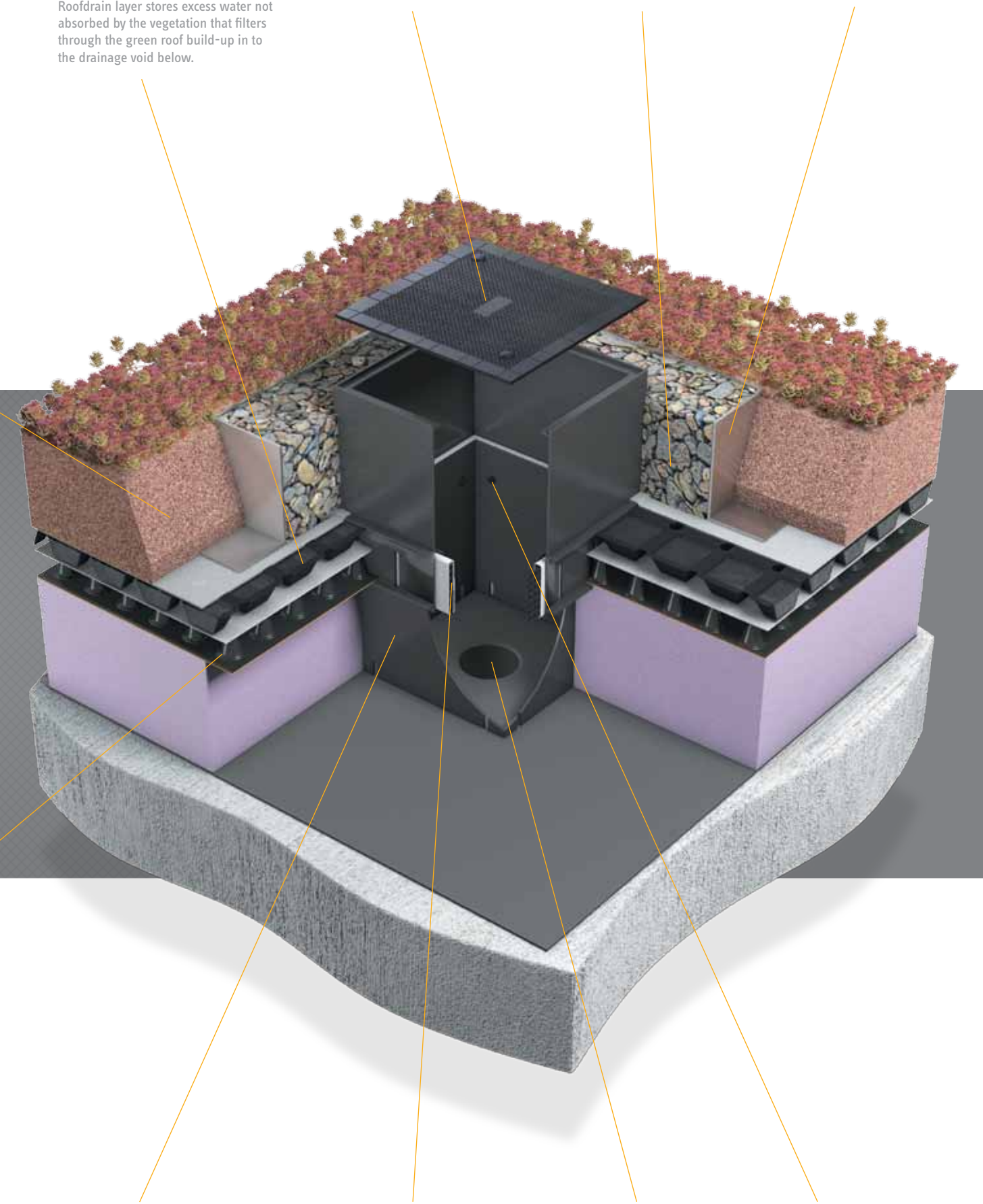
## Fildrain Strip

Prevents outlets becoming blocked by particulate debris.

## Roof Outlet

## Restrictor Valve

Any discharge is controlled using a specifically designed outlet.





# Growing Media

## ABG Sedum Roof Mix

Based on 5-14mm grade brick/tile and 10-25mm green compost. It has very low nutrient content and is engineered specifically for sedums, alpines and low growing drought tolerant plants.



## ABG Lawn Roof Mix

Based on a 2-5mm brick/tile and a 0-10mm green compost and sterilised soil. It is a medium nutrient mix designed to support lawn turf and garden shrub planting.



## ABG Meadow Roof Mix

Based on a 2-5mm grade brick/tile and 0-10mm green compost. With enough nutrients to support a broader range of plant species ranging into wildflowers and meadow grasses.



## ABG Sedum Lite Mix

Light-weight green roof media based on Vitag, an ultra-light, durable, granular clay aggregate manufactured in the UK to an exacting specification.



# Vegetation

## Pre-grown Mat

A vegetation layer where the material is grown to maturity, rolled up and supplied in the form of a mat. This can be either sedum, turf or meadow plants to create an instant green effect.



## Plug Planting

Ideal for smaller projects, involving planting species like sedum & wildflower; typically 10-20 per m². For fuller cover, incorporate cuttings or simply increase the number of sedums per m².



## Self-vegetated

The roof structure is left to vegetate via natural processes. The plant species will be uncontrolled and need checking to ensure no species appear that may damage the underlying structure.



## Food

Green Roofs can be used for the cultivation of fruit and vegetables including lettuce, onions and strawberries. Below is a picture of fruit and vegetables grown on our own warehouse roof.



# Growing Media & Vegetation

The growing media used in Green Roof projects can be designed specifically to suit each project and this can be varied to meet the requirements of the vegetation and surrounding ecosystem.

The growing media can range from low nutrient site specific medium, such as a limestone mix for calcareous grasses and plants, to a composted nutrient mix to support geophytes such as snow drops, daffodils, herbaceous plants and other native perennials.

Plant choice should take into account factors such as air pollution levels, location, structural limitations of the building, and the level of maintenance required. The choice is also dependent upon what the client wants to achieve.

The most common mix for extensive Green Roofs is a free draining formulated layer consisting of organic, inorganic, mineral and recycled components. Sometimes sintered clay, leca or slate is added to aid the absorption of rainwater. This material is lightweight and helps minimise weight on the roof structure.

The most common mix for intensive Green Roofs is a denser and slower draining substrate. This consists of both organic and synthetic materials, which simulate a topsoil type material; this can support a wider variety of vegetation.

Extensive Green Roof - Student accommodation, Oxford



## Erosion Control

These products cover a broad section of erosion control requirements including biodegradable or non-biodegradable and pre-seeded varieties. ABG erosion control products can help with both the surface protection and the structural stability of soil slopes.

Silt laden run-off from exposed soil slopes is a major concern or the Environment who consider it to be a pollutant; ABG erosion control products help ensure that the slope is protected from through construction to the final vegetation being established.

As with all ABG products design advice on which materials are best for your individual application and their specification is available from our experienced technical department.



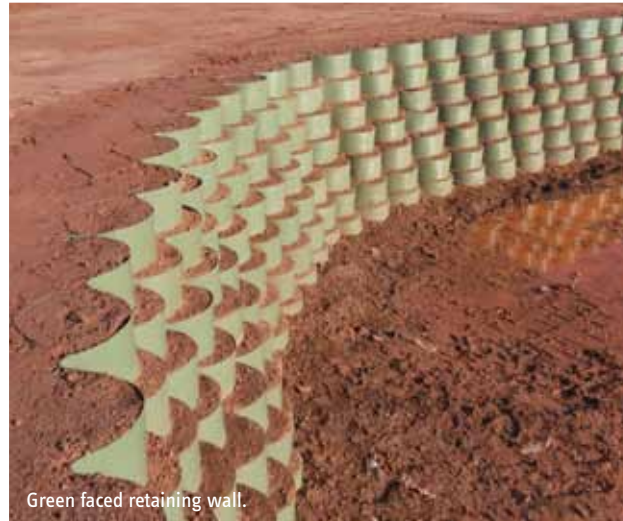
Installing Erosaweb for top-soil retention on steep embankment.

## Retaining Walls

We first became involved in designing retaining walls through reinforced earth over twenty years ago when we developed and launched our own range of ground engineering solutions.

This included Webwall, our own cellular retaining wall system developed as a sustainable green wall solution.

As the number of Webwall projects grows in both number and physical size so does our knowledge on utilising the system. Today ABG are in position to offer full PI covered design, material specification and supply, including advice and specification of the drainage works and then, through carefully selected partner businesses, the installation of the Webwall right through to planting the face with the right plants for your project environment.



Green faced retaining wall.

## Structural Drainage

ABG have vast experience in drainage solutions and the systems have been used globally on major projects in a wide range of sectors including infrastructure, energy, water, waste and many other sub-surface structures.

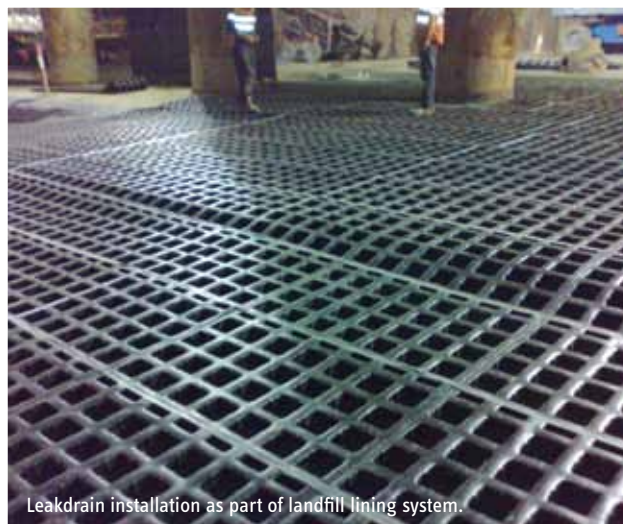
Using preformed drainage systems we offer sub-surface drainage with higher performance, lower environmental impact and lower cost than traditional granular filters. ABG systems have been specifically designed to be compatible with waterproofing systems whilst withstanding the high loads associated with backfilling to give optimum performance over the whole life of the structure.



Applying Fildrain for structural drainage application.

## Other Systems

Our fin drains (Fildrain) offer a high performance, economic alternative to traditional stone groundwater drainage solutions and are used extensively in a wide range of applications from highway edge drainage through to landscape drainage. Sports pitch drainage can be tackled using Pozidrain Sport which is suitable for both retrofit and new build applications. Basement drainage problems can be addressed using Cavidrain below ground Cavity drainage system. ABGs range of cellular confinement systems are proven solutions for use in slope stabilisation, for creating access roads and tree root protection. Root Barriers to prevent the spread of invasive roots to unwanted areas and pond liners are available for all projects.



Leakdrain installation as part of landfill lining system.

# About ABG

ABG are a market leader in the development, manufacture and technical support of high performance geosynthetic solutions for use in a wide range of building and environmental projects.

Formed in 1988, based in Meltham, in the heart of the Pennines, ABG has developed an excellent reputation for developing quality products and outstanding service. The ability for rapid product development ensures that the most innovative, up to date and cost effective solution can be found for many engineering problems including Green Roofs, SUDs, irrigation, reinforced earth and drainage.

Our involvement with Green Roofs goes back over twenty years and we now have a complete range products developed specifically for green roof applications. During this period we have supplied products to projects throughout the UK, Ireland and globally including over 1,000,000m<sup>2</sup> of geocomposite drainage into both extensive and intensive green roof projects.

Technical support is provided by our trained and experienced staff, many of whom are Chartered Civil Engineers. This extensive support includes design, design confirmation, feasibility study, cost advice and meeting regulatory requirements including BREEAM and CFSH.

As part of this technical support much work is Undertaken in developing knowledge within our active markets including working with organisations such as CIRIA (Construction Industry Research and Information Association) on a number of guidance documents and working closely with leading universities on a number of research projects, including the installation and monitoring of our very own Green Roof with The University of Sheffield and work with The University of East London on developing biodiversity in Green Roofs and also management of storm water.

To complement this product range and knowledge base ABG have recently created an installation business allowing a complete package solution to be offered from design to installation to on-going maintenance, all working in partnership with the client to deliver bespoke project solutions.

Biodiverse Green Roof on ABG distribution centre - Meltham, West Yorkshire.



This literature together with technical data, specifications, design guidance, technical advice, installation instructions or material can be obtained by contacting ABG Ltd. All information in this brochure is supplied in good faith, and without charge, to enable a reasonable assessment of the practical performance of our products. Final determination of the suitability of any information or material for the use contemplated and the manner of its use is the sole responsibility of the user. As design and installation is beyond our control no warranty is given or implied and the information does not form part of any contract. The right is reserved to update the information at any time without prior notice.

## Further reading

### **The GRO Green Roof Code**

Green Roof Organisation, Groundwork Sheffield, 2011

### **Building Greener.**

Guidance on the use of green roofs, green walls and complementary features on buildings (C644), Early P, Gedge D, Newton J & Wilson S, CIRIA, 2007

### **Living Roofs and Walls**

Technical Plan, Supporting London Plan Policy, Design for London, Greater London Authority, 2008

### **Planting Green Roofs and Walls**

Dunnet, N, & Kingsbury, N, Timber Press, Oregon, 2004

### **Building Green**

Johnston, J & Newton, J, Greater London Authority, 2004

### **Green roofs**

their status and potential for supporting biodiversity in urban areas English Nature Research Report 498, English Nature, Peterborough, 2003.

### **The International Green Roof Journal**

Published by the International Green Roof Institute, Sweden

### **The Green Roof Infrastructure Monitor**

Published by Green Roofs for Healthy Cities, Canada

### **Work at Height Regulations, 2005**

## Useful Websites

[www.livingroofs.org](http://www.livingroofs.org)

[www.thegreenroofcode.co.uk](http://www.thegreenroofcode.co.uk)

[www.thegreenroofcentre.co.uk](http://www.thegreenroofcentre.co.uk)

[www.groundwork-sheffield.co.uk](http://www.groundwork-sheffield.co.uk)

[www.greenroof.se](http://www.greenroof.se)

[www.greenroofs.org](http://www.greenroofs.org)

[www.ciria.org/buildinggreener](http://www.ciria.org/buildinggreener)

[www.uel.ac.uk/erg/BarkingRiversideGreenRoof.htm](http://www.uel.ac.uk/erg/BarkingRiversideGreenRoof.htm)



**abg** | creative  
geosynthetic  
engineering

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## Appendix I – Maintenance Strategy





## Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

### GENERAL DESCRIPTION

The responsibility for the performance and maintenance of SuDS components will depend on the nature of the component and the number of properties it serves. Areas of permeable paving will become the responsibility of the individual homeowner, while shared features such as the detention basins, ponds etc will become the responsibility of either Local Water Authority (subject to a Section 104 agreement) or a Management Company, following completion of the development.

The SuDS scheme is designed to accommodate a 100 year rainfall event plus a 40% allowance for the effects of climate change, with no on-site flooding, plus a 10% allowance for 'Urban Creep' (future extensions).

Flood routes (exceedance routes) – indicate the direction which overland flows will travel IF the surface water system fails or water volumes exceed the capacity of the system. These routes must be kept clear of obstructions at all times, to prevent damage to property.

SuDS techniques include landscape features and control structures will manage runoff as it flows from site.

The following lists the SuDS features included in the design for this site:

**Blue Roofs** – a blue roof is designed to attenuate storm water within a void which sits directly above the waterproofing layer and beneath a surface finish surface. All outlets should be visually inspected and be clear of debris and free draining.

**Green Roofs** – a green roof or living roof is a roof that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane. It is designed to absorb heat, CO<sub>2</sub> and a large proportion of surface water. They also provide a degree of insulation together with providing a wildlife habitat.

**Existing Attenuation Tank** - Attenuation tanks can help reduce flow rates from a site by providing attenuation storage. The available storage volume is provided by the void space in the tank structure:

### GENERAL OPERATION AND MAINTENANCE REQUIREMENTS

- Collect all litter or other debris and remove from site at each visit;
- Avoid use of weed killers and pesticides to prevent chemical pollution;
- Avoid de-icing agents wherever possible to allow bio-remediation of pollutants in permeable surfaces;
- Protect all permeable and infiltration surfaces from silt, sand and other fine particles.

### SPILLAGE – EMERGENCY ACTION

Most spillages are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown. Therefore, small spillages of known organic substances should be removed where possible using soak mats as recommended by the Environment Agency with residual spillage allowed to bio-remediate in the drainage system.





## Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage and block outlet pipes from chamber(s) downstream of the spillage with a bung(s).

Contact the Environment Agency immediately.

### SPECIFIC OPERATION AND MAINTENANCE REQUIREMENTS

Maintenance activities & frequencies associated with the site drainage are outlined in the following tables.

<b>TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks</b>			
<b>Maintenance schedule</b>	<b>Required action</b>	<b>Typical frequency</b>	
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	
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually	
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required	
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required	
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually	
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required	

<b>Table Operation and maintenance requirements for blue roofs</b>			
<b>Maintenance schedule</b>	<b>Required action</b>	<b>Typical frequency</b>	
Monitoring	Inspect outlet structures, and storage areas for trash and sediment accumulation.	Monthly in the first year and then 6 monthly/annually dependant on general leaf litter	
Cleaning	Remove debris from drainage outlets and outlet screens to prevent clogging.  Remove debris from secondary drainage/overflows.  Remove excessive build-up of sediment around the outlet controls or within the storage cells	During inspections or as needed	
	Break up ice formation around outlets and overflows.	As needed during the winter months.	





## Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

**TABLE 12.5 Operation and maintenance requirements for green roofs**

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

### MAINTENANCE RESPONSIBILITY

The maintenance required by all unadopted, but shared drainage features maintenance will be undertaken by a management company who will coordinate the maintenance on behalf of the Client.





## Appendix J – SuDS Designers Risk Assessment



## Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

### SuDS Risk Assessment

Based on CIRIA RP002 – The SuDS Manual

Based on CIRIA 662 – The SuDS Manual

SITE/SYSTEM OVERVIEW		
Location	Travelodge, Drury Lane, Covent Garden, WC2B 5RE	
SuDS Component	Blue/Green Roofs	
	Into existing attenuation tank in basement	
Date of Assessment	30 January 2024	
Date of next assessment	Prior to construction	
ESTABLISH CONTEXT		
General description of component and its operation	3 No. green/blue roofs at differing heights (1 attenuating surface water)	
IDENTIFY POTENTIAL HAZARDS	Yes/no	
Drowning through ice in winter	No	Blue roof/ Green roof
Slips, trips and falls	Yes	Blue roof/ Green roof
Entry into pipes/confined spaces (note this is for inadvertent public access. Follow relevant legislation and guidance for worker access)	No	Blue roof/ Green roof
Water Quality – health risk	No	Blue roof/ Green roof



## Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

### DROWING OR FALLING THROUGH ICE IN WINTER - N/A

Consider factors that might affect: (a) the likelihood of people entering the water/accessing the ice (b) the potential consequence of entering the water/accessing the ice	Summary of influence of factor on likelihood of entry/access, including justification (Consider for children < 5 years, children ≥ 5 years, adults)	Summary of influence of factor on consequence of entry/access, including justification (Consider for children < 5 years, children ≥ 5 years, adults)
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### SLIPS TRIPS & FALLS

Factors that might affect likelihood of people slipping/tripping/falling	Summary of influence of factor on likelihood of Slip/trip/fall including justification (Consider for children < 5 years, children ≥ 5 years, adults)	Summary of influence of factor on consequence of Slip/trip/fall including justification (Consider for children < 5 years, children ≥ 5 years, adults)
<b>DESIGN FACTORS – SURFACES</b>		<b>RISK</b>
Level changes	<i>Suitable edge protection/Fall arrest system designed by others</i>	<b>Low</b>
Surfacing materials	<i>Possible slips or trips in icy weather</i>	<b>Low</b>

### SUMMARY OF RISK ASSESSMENT FOR SLIPS TRIPS AND FALLS

Group	Likelihood of slips/trips/falls/other injury	Likely consequence of slips/trips/falls/other injury	Overall level of risk posed by the design	Additional mitigation measures required	Action date	Final level of risk
Children under 5 years	Rare	Minor	Low Risk	None		Low
Children over 5 years	Rare	Minor	Low Risk	None		Low
Adults	Occasional	Major	High Risk	Edge protection/fall arrest system		Low





## Appendix K – Camden Drainage Proforma v2019.02



**1. Project & Site Details**

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Travelodge,
Address & post code	10 Drury Lane, High Holborn, London WC2B 5RE
OS Grid ref. (Easting, Northing)	E 530273 N 181320
LPA reference (if applicable)	
Brief description of proposed work	The proposal will create an additional 55 bedrooms replacing the existing service yard and undercroft areas together with reception area over 4 floors, which will be linked into the existing Travelodge Hotel.
Total site Area	3900 m <sup>2</sup>
Total existing impervious area	3900 m <sup>2</sup>
Total proposed impervious area	3900 m <sup>2</sup>
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	The site is not on the Historic flooding and Local Flood Risk Zones Map within Camden Policy CC3 Water and flooding
Existing drainage connection type and location	Pumping station discharges to combined sewer via restricted rate
Designer Name	Robin Crowther
Designer Position	Director
Designer Company	J P Chick & Partners Limited

**2. Proposed Discharge Arrangements**

2a. Infiltration Feasibility		
Superficial geology classification	Lynch Hill Gravel Member - Sand And Gravel	
Bedrock geology classification	London Clay Formation - Clay, Silt and Sand	
Site infiltration rate	0	m/s
Depth to groundwater level	0	m below ground level
Is infiltration feasible?	No	
2b. Drainage Hierarchy		
	Feasible (Y/N)	Proposed (Y/N)
1 store rainwater for later use	N	N
2 use infiltration techniques, such as porous surfaces in non-clay areas	N	N
3 attenuate rainwater in ponds or open water features for gradual release	N	N
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	N	N
6 discharge rainwater to a surface water sewer/drain	N	N
7 discharge rainwater to the combined sewer.	N	Y
2c. Proposed Discharge Details		
Proposed discharge location	SW into existing within Short's Gardens FW into existing within Drury Lane	
Has the owner/regulator of the discharge location been consulted?	No	



## 3. Drainage Strategy

## 3a. Discharge Rates &amp; Required Storage

	Greenfield (GF) runoff rate (l/s)	Existing discharge rate (l/s)	Required storage for GF rate (m <sup>3</sup> )	Proposed discharge rate (l/s)
Q <sub>bar</sub>				
1 in 1		3.74		3.74
1 in 30		7.856		4.667
1 in 100		10.216		4.667
1 in 100 + CC				4.667
Climate change allowance used		40%		

## 3b. Principal Method of Flow Control

Restrictor valve within blue roof

## 3c. Proposed SuDS Measures

	Catchment area (m <sup>2</sup> )	Plan area (m <sup>2</sup> )	Storage vol. (m <sup>3</sup> )
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	207	178	0
Blue roofs	207	178	11.5
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	0	0	0
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		0
<b>Total</b>	<b>414</b>	<b>356</b>	<b>11.5</b>

## 4. Supporting Information

## 4a. Discharge &amp; Drainage Strategy

Page/section of drainage report

Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results

N/A - page 17

Drainage hierarchy (2b)

page 30

Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location

Appendix D - COMMERCIALDDW report  
Appendix G - CCTV Survey

Discharge rates &amp; storage (3a) – detailed hydrologic and hydraulic calculations

Appendix H - Pre &amp; post runoff rates

Proposed SuDS measures &amp; specifications (3b)

Section 6 &amp; Appendix H

## 4b. Other Supporting Details

Page/section of drainage report

Detailed Development Layout

Appendix B

Detailed drainage design drawings, including exceedance flow routes

Appendix H

Detailed landscaping plans

n/a

Maintenance strategy

Appendix I

Demonstration of how the proposed SuDS measures improve:

a) water quality of the runoff?

Section 6.03

b) biodiversity?

Section 6.04

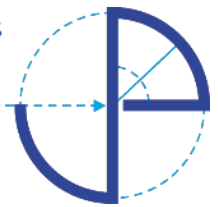
c) amenity?

Section 6.05



## Appendix L – Flood Risk Emergency Plan





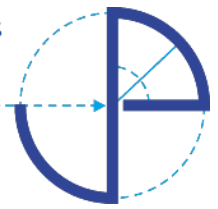
## BUSINESS FLOOD PLAN CHECKLIST

Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

Checklists to help you prepare for flooding in the event of failure of pump stations at the time of a severe storm event.

### Before a flood

Actions	Done	Notes
Check your insurance covers for flood damage & business interruption/lost revenue.		Annual
Check flood warning systems function properly.		Monthly
Use your existing maintenance procedures as an opportunity to reduce your flood risk.		
Include potential impacts of a flood on staff in your health and safety assessments.		Annual
Agree flood contingency plans with suppliers and customers and contract management.		
Plan for preventing business disruption and assisting recovery (known as business continuity)		Annual Review
Trigger Points	Done	What should Happen if flood gets worse
Water on access road		Delay deliveries.
Failure of pumps		1. Evacuate rooms on Level 1 to Cafeteria area until pumps reinstated. – Provide map of emergency routes and evacuation points.
		2. Shut off points for gas, electricity and water and details of any emergency power source.
		3. Protective measures, put in place for example hazardous or refrigerated materials, and what to do with them.
Data & Information	Done	NOTES
Staff & Customer Records - Safe storage above level 1.		

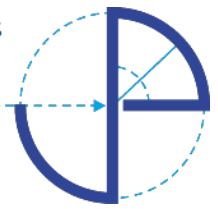


## BUSINESS FLOOD PLAN CHECKLIST

Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

Emergency contact information, including out of normal hours?		
<b>Staff</b>	<b>Done</b>	<b>Notes</b>
Note of staff who may need assistance when flooding happens.		
Details of rooms which are for Disabled Access.		
Details of where a first aid kit, safety equipment or medical supplies are located.		
Details of actions for your staff to take and the training they may need to carry out these roles and responsibilities.		
<b>Responsibilities for Managing Flood Emergency – including:</b>		<b>Who:</b>
Carry out your flood plan.		
Making decisions.		
Contacting relevant people on and off site.		
Speaking with public authorities.		
Managing other staff.		
Managing evacuation from Level 1.		
<b>Important Contacts including</b>		<b>Who:</b>
Building Services.		
Utilities.		
Suppliers.		
Evacuation Staff Contacts.		
Local Authority – Flood.		





## BUSINESS FLOOD PLAN CHECKLIST

Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

**Immediately before a flood** – If flooding is about to happen check:

Actions	Done	Notes
Staff & Hotel residents are safe.		
Know what to do in a flood.		
Know their role and responsibilities.		
Know how to communicate in an emergency.		

### If Level 1 is about to be flooded

Actions	Done	Notes
Turn off your gas, electricity and water supplies, if it's safe to do so - do not touch an electrical switch if you're standing in water.		
Move hotel residents and staff to safety, for example upstairs to Cafeteria.		
If you have them, use flood protection products.		
Move important items to safety.		

### When Level 1 floods

Actions	Done	Notes
Follow warnings, information and advice issued by authorities.		
Do not walk or drive through flood water as it may conceal hidden dangers.		
Do not put yourself or others at risk.		
Let family or friend know you are safe.		



## BUSINESS FLOOD PLAN CHECKLIST

Proposed Extension, Travelodge, Drury Lane, Covent Garden, WC2B 5RE

### After a flood

Actions	Done	Notes
Do not return to level 1 until safe to do so.		
Wear appropriate waterproof or protective clothing when cleaning up.		
Contact your insurance company to start the claims process.		
Suitably dispose of items damaged by flood water, after your property and items have checked by a loss adjuster.		
Employ a suitably qualified gas or electricity engineer to check services located within the flooded area before turning them back on.		