1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	295 Green Lanes
Address & post code	295 Green Lanes, London, N13 4XS.
OS Grid ref. (Easting, Northing)	E 530981 N 192636
LPA reference (if applicable)	23/03349/FUL
Brief description of proposed work	Refer to the DAS. However, in summary the proposed redevelopment on the site comprises the re-use, conversion and extension of the existing upper floors of the public house building to provide sleeping accommodation and the re-use of and construction within the existing rear yard area to provide a new build block containing accessible bedrooms together with associated landscaping.
Total site Area	900 m²
Total existing impervious area	900 m²
Total proposed impervious area	500 m²
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	No
Existing drainage connection type and location	Re-use of the existing sewer connection.
Designer Name	Tom Quigg
Designer Position	Director - Civil Engineer
Designer Company	Flume Consulting Engineers

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	Boys Hill Gravel Member
Bedrock geology classification	London Clay
Site infiltration rate	0.0000026 m/s
Depth to groundwater level	Not observed in GI m below ground level
Is infiltration feasible?	Yes

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	Y	Y
2 use infiltration techniques, such as porous surfaces in non-clay areas	Y	Y
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	N
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.	Y	Y

2c. Proposed Discharge Details

Proposed discharge location	Existing sewer connection
Has the owner/regulator of the discharge location been consulted?	Existing connection remains unchanged and overall flow rates will be reduced. However, a Section 106 application will be made following planning permission and prior to construction commencing.

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m³)*	*Proposed discharge rate (l/s)*
Qbar	0.40	9.83	-	
1 in 1	0.34	8.26	-	4.26
1 in 30	0.93	20.76	-	8.05
1 in 100	1.27	26.52	-	12.27
1 in 100 + CC	N/A	N/A	-	16.38
Climate change allowance used	40%			

3b. Principal Method of Flow Control: Green/Blue Roofs and Permeable Paving

3c. Proposed SuDS Measures

	Catchment area (m²)	*Plan area (m³)*	*Storage vol. (m³) allowance for void ratios included in calculations*
Rainwater harvesting	0	0	0
Infiltration systems	0	0	0
Green roofs	16	16	0.72
Blue roofs	222	222	33.3
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	400	400	42
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		0
Total	638	638	76.02

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	Appendix B
Drainage hierarchy (2b)	Page 8
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Appendix A
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Appendix A
Proposed SuDS measures & specifications (3b)	Appendix A

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix A
Detailed drainage design drawings, including exceedance flow routes	Appendix A
Detailed landscaping plans	Appendix A
Maintenance strategy	Page 17
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	Page 14
b) biodiversity?	Page 15
c) amenity?	Page 15

295 Green Lanes

Flood Risk and SuDS Assessment

Job Number: 1256

Date	Version	Notes/Amendments
September 2022	1	Issued for Information
November 2023	2	Updated scheme

Contents **Page**

Acronyms	
CIRIA	Construction Industry Research and Information Association
EA	Environment Agency
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
NSTS	Non-Statutory Technical Standards

Introduction

Flume Consulting Engineers have been appointed to undertake a Flood Risk and Sustainable Drainage Systems (SuDS) Assessment for the proposed development at 295 Green Lanes, London, N13 4XS.

This report has been carried out in accordance with the National Planning Policy Framework (NPPF) and the Planning Practice Guidance 'Flood Risk and Coastal Change' (PPG). This report also incorporates advice and guidance from the Environment Agency (EA), the Strategic Flood Risk Assessment (SFRA) produced by the London Borough of Enfield, Enfield's SuDS Design and Evaluation Guide, DEFRA's Non-statutory technical standards (NSTS) for sustainable drainage systems and CIRIA documents.

The EA's indicative floodplain map (Figure 3) shows that the site is located in Flood Zone 1, however a SuDS Assessment has been carried out to assess the available options for SuDS use for the proposed development.

Site Description and Location

The application site comprises a part two, part three-storey building, which fronts onto Green Lanes. The ground floor is occupied by the Green public house. There is a covered passage on the northern side of the building which provides pedestrian and vehicle access to a substantial rear area, which is currently in use for informal parking by customers (approximately 5 spaces) and for open storage, with a constrained boundary between the adjacent properties which is set against the boundary line.

The New River and Pymmes Brook (upstream of the Salmon Brook confluence), flows within 0.50 kilometres from the development, although this does not impact the proposed development.

The site postcode is N13 4XS and the OS grid reference is TQ 30981 92636.

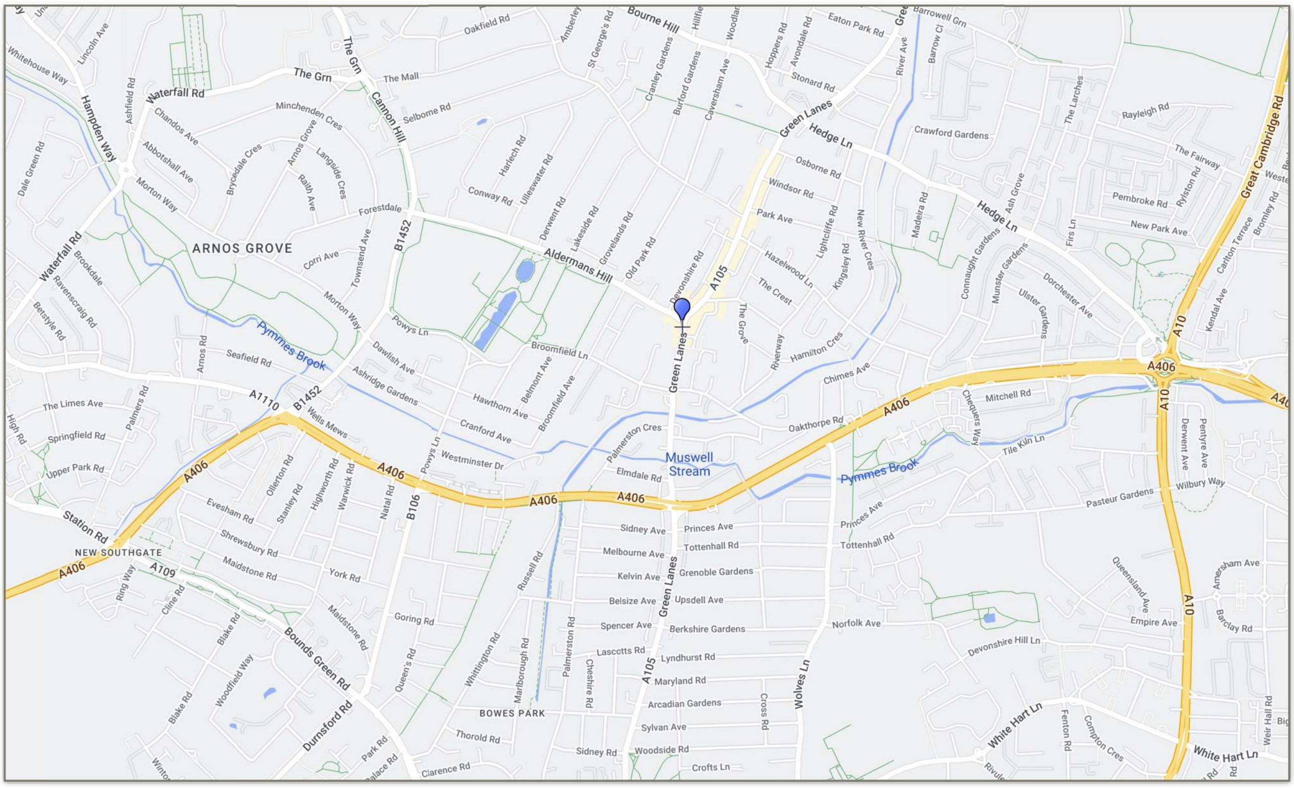


FIGURE 1. SITE LOCATION

Development Proposal

The ground floor of the development will retain current A4 use and operate as a public house with associated back of house spaces for the public house, as well as a reception for the guest house.

The proposed redevelopment on the site comprises the re-use, conversion and extension of the existing upper floors of the public house building to provide sleeping accommodation and the re-use of and construction within the existing rear yard area to provide a new build block containing accessible bedrooms together with associated landscaping - Figure 2.

The guest house accommodation will support the commercial A4 use and enable the property to continue to use floorspace for a public house. Although the floorspace will be reduced the marketing of the property has established that the existing footprint is too large to be sustained in the current commercial market.

The aim of the scheme is to ensure the continued retention of a public house as a social function in the community on the site by supporting it through the guest accommodation proposed.

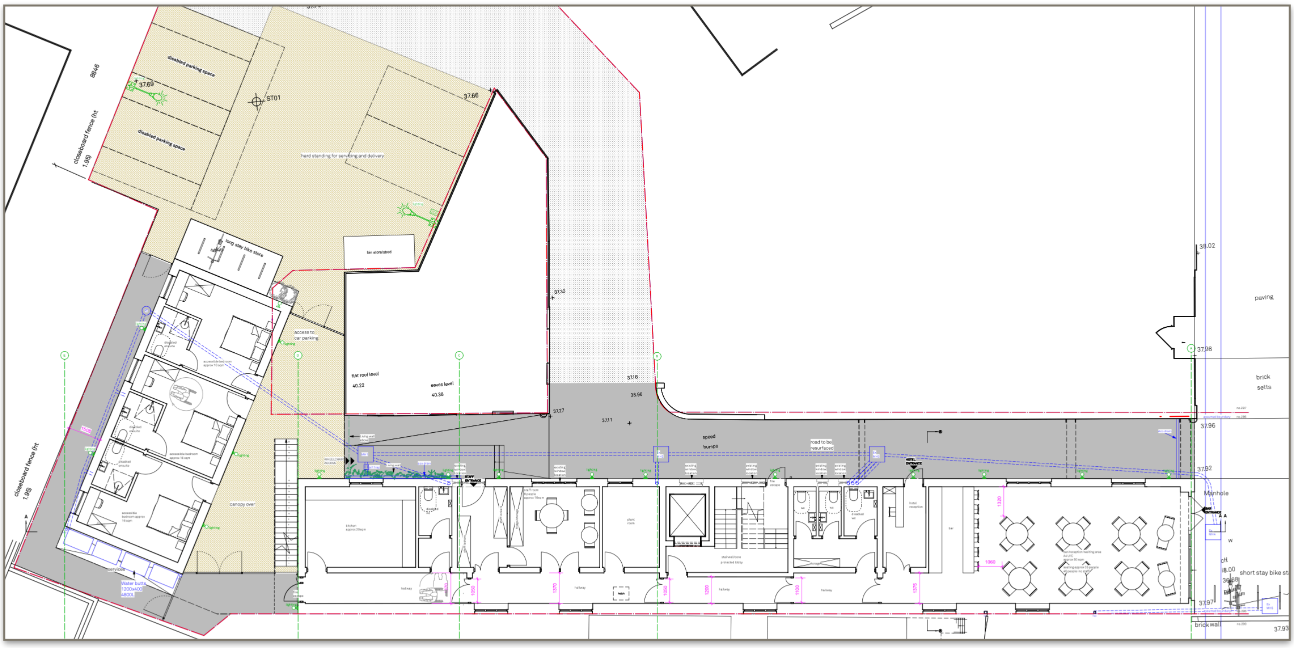


FIGURE 2. PROPOSED DEVELOPMENT

Flood Risk

The EA's indicative floodplain map shows that the site is located in Flood Zone 1 and is not at risk of flooding (Figure 3). Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.

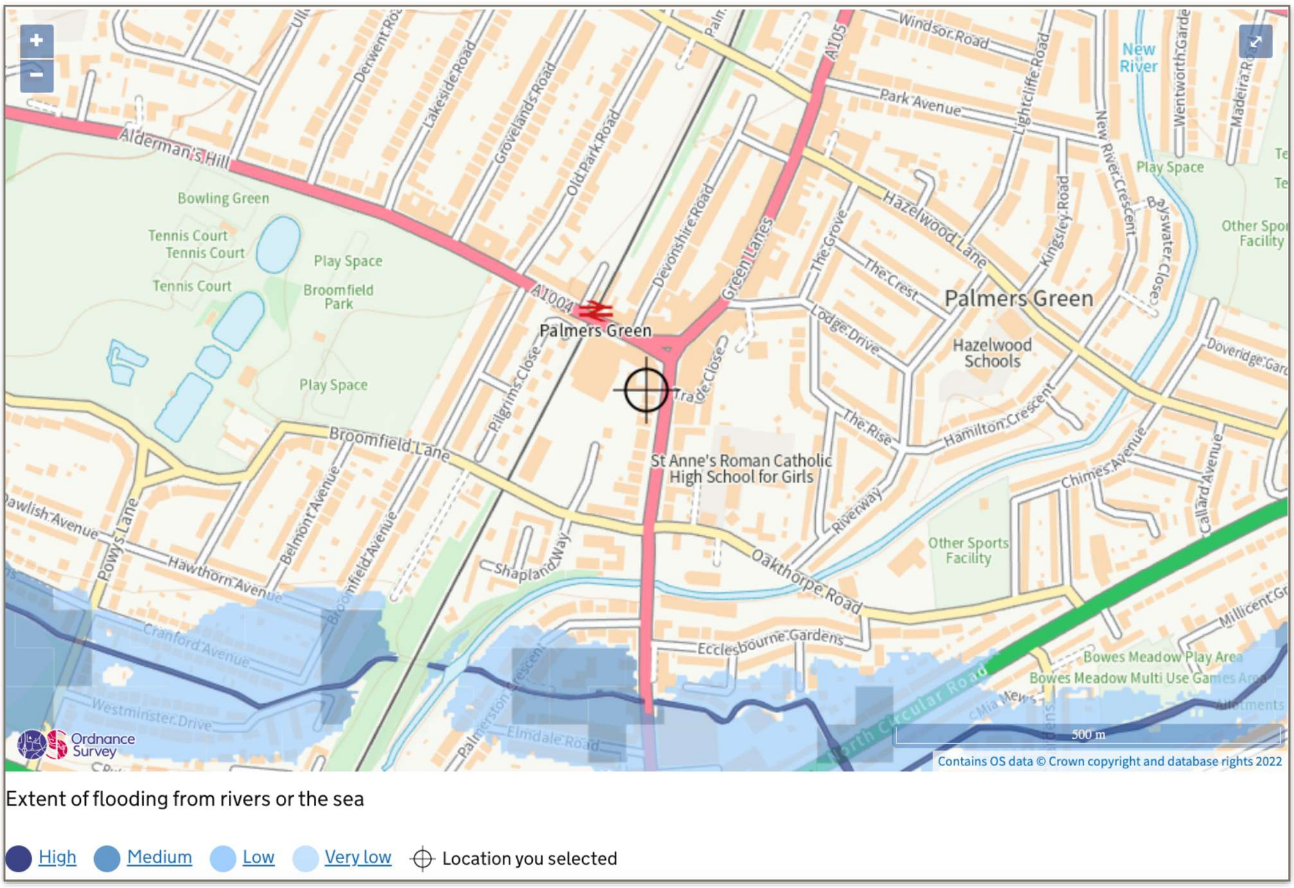


FIGURE 3. ENVIRONMENT AGENCY FLOOD RISK FROM RIVERS OR SEA MAP (GOV.UK, 2022)

Surface Water Run-off Assessment

Existing Run-off

The total site area which includes the existing building and associated external landscaping, is approximately 900m^2/0.09ha, and all of which is impermeable hardstanding areas.

The existing peak run-off rate for the design storm event (1 in 1, 1 in 30 and 1 in 100 year) was calculated using the Modified Rational Method | Wallingford Procedure as shown below:
as shown below:
$Q = 2.78 \times i \times A$

Where 'A' is the catchment area in ha and 'i' is the rainfall intensity in mm/hr as estimated using the relevant maps presented in the Flood Studies Report.

$Q_{1ex} = 2.78 \times 33 \times 0.09 =$ 8.26 l/s
$Q_{30ex} = 2.78 \times 83 \times 0.09 =$ 20.76 l/s
$Q_{100ex} = 2.78 \times 106 \times 0.09 =$ 26.52 l/s

Proposed Run-off (Unmitigated without SuDS Measures)

According to Planning Practice Guidance (PPG), *"generally the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable: 1. Into the ground (infiltration) 2. To a surface water body; 3. To a surface water sewer, highway drain or another drainage system; 4. To a combined sewer",* whilst ensuring that surface water run-off is managed as close to its source as possible.

The proposed development does not introduce any additional hardstanding areas compared with the existing case, and will therefore not generate any additional surface water run-off. An allowance for a future increase in rainfall intensity is provided below:

$Q_{100+40cc} = 2.78 \times 148 \times 0.09 =$ 37.13 l/s

The following chapters aims to outline the possibility of incorporating SuDS features in the design. Figure 4 outlines the possibility of incorporating SuDS into the scheme to reduce the surface water run-off and volumes further.

SuDS Assessment

It is recommended that SuDS be introduced to mimic natural drainage pathways as close to source as possible, reducing the impact of urbanisation on watercourse flows, and ensures the protection and enhancement of water quality, while encouraging the recharge of groundwater.

To effectively manage surface water run-off, it is crucial to implement SuDS as close to its source as possible, as per the guidance provided. By adopting this approach, the proposed SuDS will work towards achieving the desired rates for reducing surface water run-off whenever feasible and practical. This initiative is in line with Sustainable Infrastructure Policy 13 (SI13) of the London Plan, which specifically emphasises the importance of sustainable drainage practices.

The NSTS states stormwater flows off site should achieve the greenfield runoff rate as best practicably possible, or are at least a 50% betterment of the existing flow rates for all periods.

CIRIA SuDS Manual (C753) states that a development should utilise SuDS unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

I. Use infiltration techniques, such as porous surfaces in non-clay areas,
II. attenuate rainwater in ponds or open water features for gradual release,
III. attenuate rainwater by storing in tanks or sealed water features for gradual release,
IV. discharge rainwater direct to a watercourse,
V. discharge rainwater to a surface water sewer / drain,
VI. discharge rainwater to the combined sewer.

The possibility of implementing SuDS at the site was assessed using a hierarchy of preferred surface water management methods, and in line with comments received from the LLFA. The following paragraphs discuss the various methods in order of that hierarchy and evaluate the site's suitability for each method.

The SuDS site suitability table (Figure 4) has been used to determine the suitability for each SuDS element for this development.

SuDS Component	Site Suitability	Comments
Green|Blue Roofs & Rainwater Reuse	✓	Green|Blue Roofs will be incorporated on the flat roofs at various levels on the upper levels of the building. The first floor terrace will also incorporate a series of Trees, shrubs and planting beds. These SuDS features will reduce both the surface water run-off for smaller storm events and reduce water demand.
Soakaways	✗	Not feasible in this instance due to the requirement for a minimum 5m easement from adjacent structures and 2.5m easement from boundaries which restricts their use.
Filter Strips	✗	Not feasible to use throughout the scheme in this instance due to the requirement for a minimum 5m easement from adjacent structures and 2.5m easement from boundaries which restricts their use.
Infiltration Trenches	✗	Not feasible to use throughout the scheme in this instance due to the requirement for a minimum 5m easement from adjacent structures and 2.5m easement from boundaries which restricts their use.
Swales	✗	Not suitable due to site layout and size of the development.
Bioretention	✗	Not suitable due to site layout and size of the development.
Porous Pavements	✓	Permeable Paving will be introduced to the proposed hard landscaped areas.
Geocellular Systems	✗	Permeable Paving is preferred to the introduction of a below ground drainage attenuation tank.
Infiltration basins	✗	Not suitable due to site layout and size of the development.
Detention basins	✗	Not suitable due to site layout and size of the development.
Ponds	✗	Not suitable due to site layout and size of the development.
Stormwater wetlands	✗	Not suitable due to site layout and size of the development.

FIGURE 4. SUDS SITE SUITABILITY

Green Roofs

When feasible, priority should be placed on establishing blue-green infrastructure over hardscape or subterranean options because it offers broader advantages for biodiversity, recreational spaces, and local climate conditions.

The SuDS Manual C753 states *“Green roofs can provide benefits in terms of reducing peak flow rates to the site drainage system – principally for small and medium-sized events.”.*

Green Roofs are proposed on the second and third floor flat roofs with smaller localised ‘intensive’ Green Planters used as part of the the first floor terrace, contributing to a reduction of proposed peak flow rates, reducing the overall run-off by **16m²** for small-medium storm events. An overflow will be provided, which will drain back into the existing surface water drainage system. Figure 5 provides a schematic of the Green Roof.

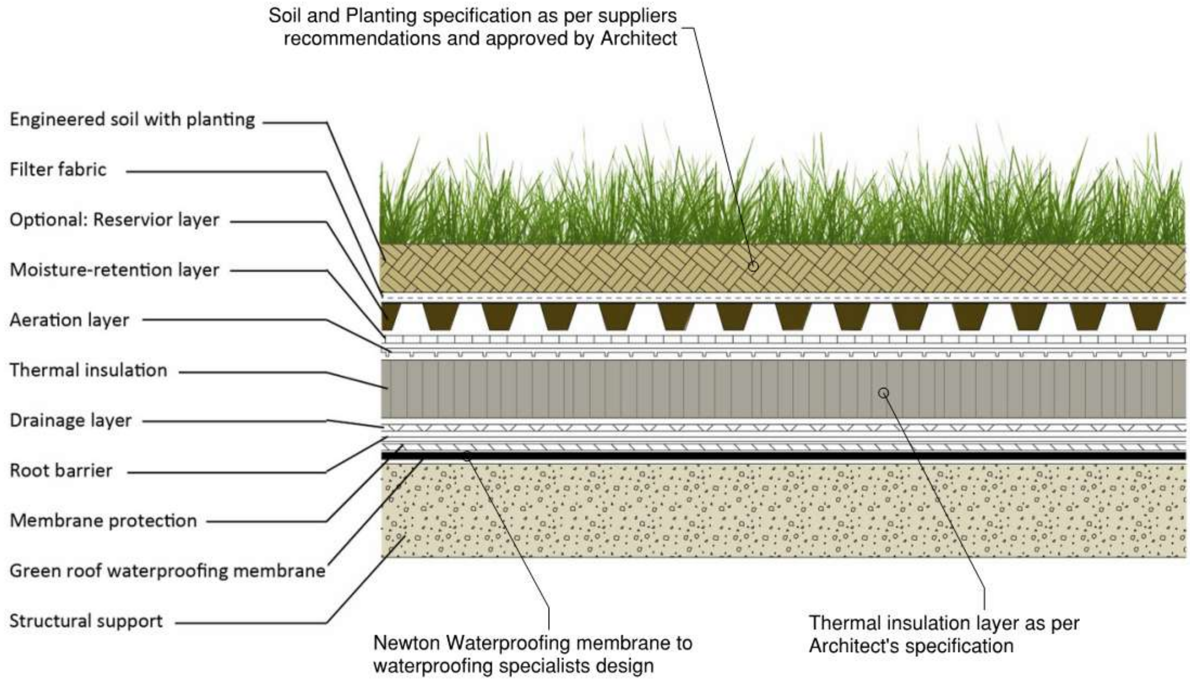


FIGURE 5. GREEN ROOF DETAIL

Blue Roofs

Blue roofs replicate natural hydrological processes in urban settings. A "blue roof" is a system intended to temporarily hold and manage stormwater, facilitating a controlled release into the drainage system, thereby mimicking the functions of natural water bodies. Designing a blue roof involves shaping the roof surface to capture and store stormwater by creating depressions, channels, or reservoirs for temporary containment.

The advantages of blue roofs include effective stormwater management through the retention and gradual release of water, which lessens the burden on traditional drainage systems during periods of heavy rain. Blue roofs also contribute to flood prevention by managing the rate of stormwater outflow, thereby reducing both the volume and rate of flow entering public sewer systems. Moreover, by storing stormwater on rooftops, these systems promote the natural breakdown of pollutants, improving water quality before it is discharged into the drainage network.

Blue roofs must be equipped with appropriate overflow mechanisms to avoid excessive water buildup, which could otherwise harm the building's structure. These mechanisms are designed to reroute surplus water into the conventional drainage system when necessary.

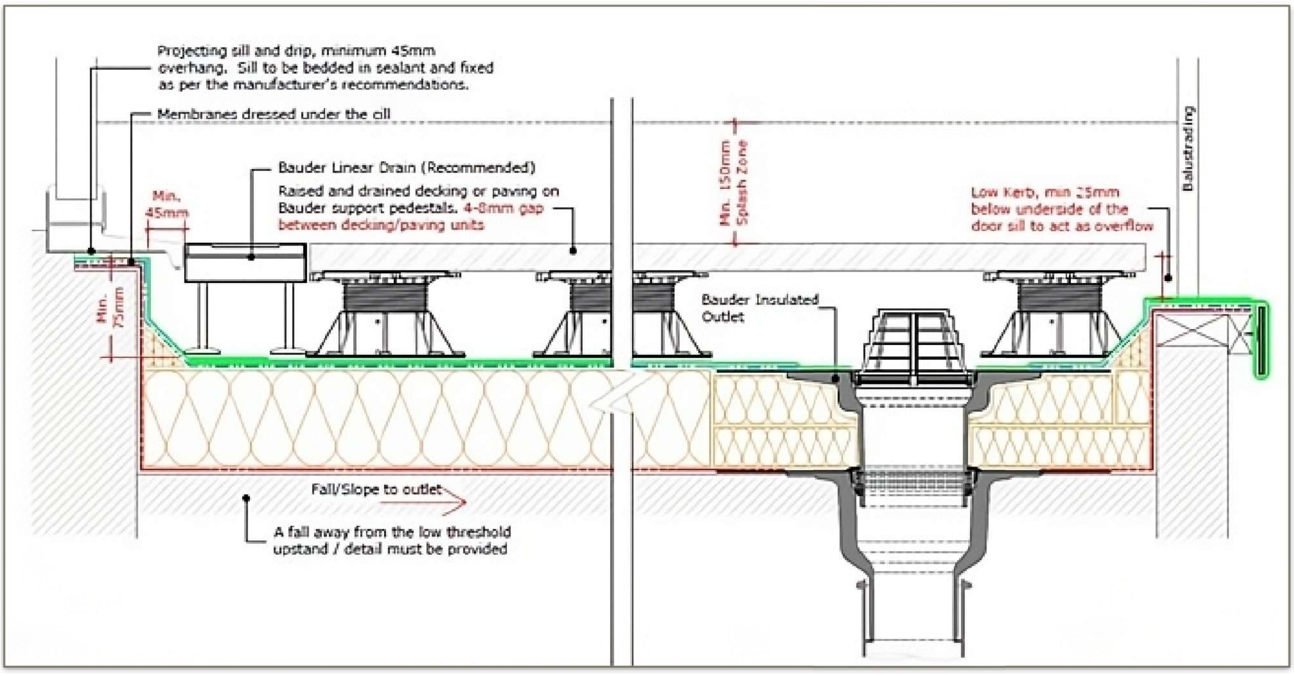


FIGURE 6. BLUE ROOF DETAIL

Threshold levels may incorporate a 150mm upstand height beneath an overhanging door sill (minimum 45mm) provided that the roof slopes away from the doorway and that suitable outlets and overflow pipes are installed. Alternatively, a balcony curb could be set to a minimum of 25mm below the door threshold.

It is proposed that the Blue Roof, when paired with a properly sized flow control device like an orifice plate, will cap the peak outflow from the roof at a manageable rate of 1 litres per second. Tools such as HR Wallingford's Run-off tool, and guidance from EA/DEFRA, suggest that for flow rates under 5.0 l/s, discharge consent is commonly granted at 5.0 l/s, taking into account potential blockages from vegetation and debris. Nevertheless, BS8582:2013 indicates that a further reduction to below 5 l/s may be negotiated with the future owner, and control measures of 25mm are feasible with appropriate safeguards.

The initial design of the Blue Roof and its corresponding outflow was conceived to handle a 1 in 100-year return period storm plus a 40% climate change, limiting surface water discharge to 1 l/s using a 18mm orifice plate. This very small flow control was thought to be acceptable, so long as an appropriate overflow is incorporated to ensure a fail-safe solution is provided, allowing the blue roof to act as a traditional roof in the event of a blockage.

Infiltration

The preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration system. The EA/DEFRA's maps confirm that infiltration may be feasible in this instance due to the presence of the Boyn Hill Gravels. Infiltration through permeable paving is considered to be a practical solution to reduce surface water run-off rates and volumes. It is proposed to utilise permeable paving for the hardstanding area, infiltrating to ground and reducing the run-off by **400m^2**. An overflow may also be incorporated to mitigate against overland flooding.

Infiltration through permeable paving is considered to be a practical solution to reduce surface water run-off rates and volumes. It is proposed to utilise permeable paving for the external hardstanding areas, infiltrating to ground and reducing the run-off by approximately **400m^2**.

Centralised '3d' soakaways are not feasible due to the proximity to adjacent structures, and the necessary 1m easement from the groundwater table. The requirement for a minimum 5m easement from adjacent structures and 2.5m from any adjacent boundary restricts their use.

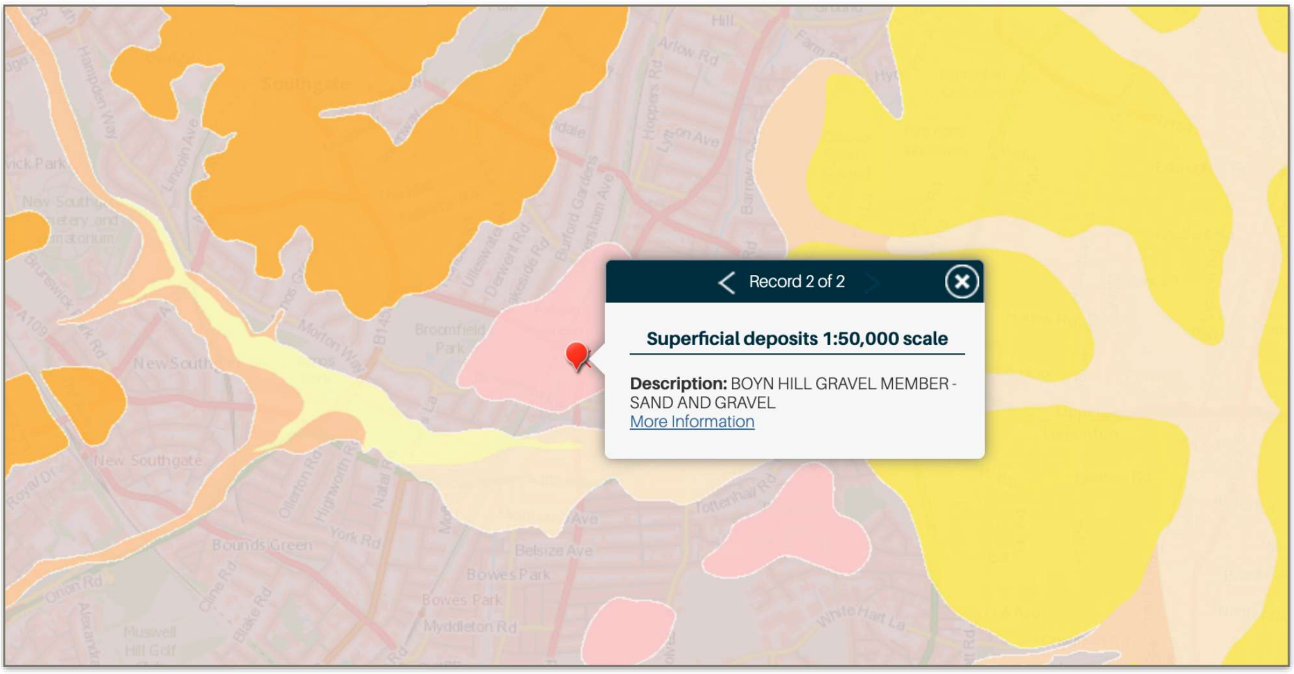


FIGURE 7. BGS GEOLOGICAL MAPS

Permeable Pavements

Ground Investigation (2.6x10^{-6} m/s) confirms that Infiltration is suitable to permit surface water run-off from the hardstanding areas to ground. Infiltration through permeable paving is considered to be a practical solution to reduce surface water run-off rates and volumes. An overflow will also be incorporated as a failsafe due to the inherent variability of the infiltration properties of the underlaying ground, which will be connected to the surface water drainage. Infiltration through Permeable Pavements (2D plane only) can also be utilised closer to structures. Permeable Pavements serving themselves behave in a similar way to soft landscaping and can be placed directly against the edge of structures.

Capacity of the Permeable Pavement

The surface water run-off from the permeable paving will self-attenuate and infiltrate into the ground. A conservative infiltration rate of 1x10^{-7} m/s was used to define the paving thicknesses.

Infiltration rate = 1 x 10^{-7}m/s

		1 in 10	1 in 30	1 in 100	1 in 100 + 20%	1 in 100 + 30%
M5-60	**r**	**10**	**3.33**	**1**	**0.5**	**0.25**
20	0.4	90	120	160	210	225
	0.3	100	140	190	240	270
	0.2	135	180	250	310	370
17	0.4	70	100	140	180	190
	0.3	80	110	160	210	225
	0.2	105	150	210	270	305
14	0.4					
	0.3	60	90	130	170	180
	0.2	75	110	160	220	245

FIGURE 8. MINIMUM PAVING THICKNESSES REQUIRED - HYDRAULIC CAPACITY (INTERPAVE, 2018)

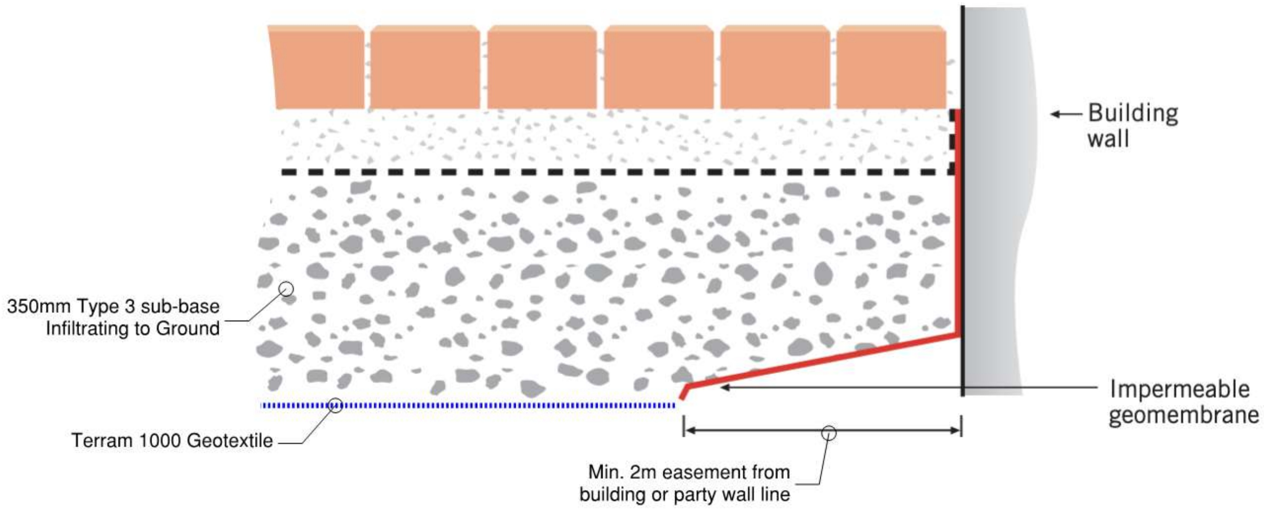


FIGURE 9. PERMEABLE PAVEMENT USED FOR THE HARDSTANDING AREAS

Attenuation (Below Ground)

Attenuation via modular attenuation tanks, ponds or swales is not considered a feasible option due to the site's space constraints (among others, as previously noted). Furthermore, the existing building would require the complete reconstruction of the existing drainage network to facilitate attenuation in the hard paved areas. This would then require surface water to chase below the existing buildings before discharging into the public sewers at restricted rates. To restrict to reduced surface water run-off rates this would also require complicated conveyancing to ascertain ownership of the prospective shared attenuation tank and associated drainage systems in third-party land.

Finally, deep excavation works associated with draining the existing RWPs to a below ground tank next to the existing building and the adjacent existing buildings would risk undermining the adjacent structure of the building. By draining the RWPs from the existing building into a below ground tank, pumps would be needed to reconnect into the existing outfall. It was concluded that this would not be appropriate for the size or scale of the development proposals.

Water Quality Improvements through SuDS Design

The Surface Water Run-off Assessment indicates no additional hardstanding areas in the proposed development, which means the potential for increased surface water run-off is minimised. Nonetheless, the design includes measures for managing run-off, notably in response to a potential future increase in rainfall intensity.

The inclusion of Sustainable Urban Drainage Systems (SuDS) is essential for mimicking natural drainage and reducing urbanisation impacts on watercourses. By prioritising these measures, the design addresses the greenfield runoff rates and meets Sustainable Infrastructure Policy requirements.

1. Green Roofs: Planned for upper levels to reduce peak flow rates, enhancing water absorption and aiding biodiversity.
2. Blue Roofs: Designed to temporarily store water and slowly release it, thereby easing pressure on drainage systems and improving water quality.
3. Infiltration through Permeable Paving: This approach will be used for the hardstanding areas, reducing run-off by allowing water to percolate into the ground, while also providing a contingency for overflow.
4. Permeable Pavements: Confirmed as a viable solution for managing run-off closer to the building structures.

The design excludes soakaways due to site constraints, instead focusing on source control SuDS solutions. The careful application of these measures, such as green and blue roofs and permeable pavements, enhances the site's water management and supports local biodiversity, offering a sustainable approach to development.

Amenity and Biodiversity Enhancements

Given the space constraints of the site, it is crucial to select enhancements that make the most of the available space while providing meaningful amenities and biodiversity improvements. Through a thorough evaluation of potential enhancements, the following six additions have been identified as particularly well-suited for this setting:

Selected Enhancements

1. **Vertical Gardens and Green Walls**: Vertical space on walls, fences, or trellises can be harnessed for the creation of vertical gardens or the installation of green walls. This approach will enhance aesthetics, introduce greenery, and maximise space efficiency, resulting in the establishment of a visually captivating and environmentally-conscious setting. The integration of vertical gardens or planters on walls or fences presents a feasible option for future additions. Notably suitable for compact areas, vertical gardens will offer a visually pleasing verdant atmosphere that complements the limited site.
2. **Native Plant Landscaping**: A strategic approach involving the use of native plants for landscaping is recommended. Native plants have demonstrated their ability to thrive in confined spaces and, concurrently, contribute to the preservation of local biodiversity.
3. **Green|Blue Roofs**: The integration of green and blue roofs is identified as a key component for the site. Green roofs, with their soil and vegetation layers, offer habitats for diverse plant and animal species, enhancing urban biodiversity. They also contribute to improving air quality, insulating buildings, and reducing the urban heat island effect. Blue roofs are engineered to manage rainwater by temporarily holding it and then releasing it slowly, thereby reducing the impact on the drainage system during heavy rainfall. Together, these green and blue roof systems can maximise the limited space by creating a multifunctional landscape overhead. This dual approach not only enriches the urban ecosystem but also provides a resilient strategy for stormwater management and climate adaptation.
4. **Micro Habitats and Wildlife Features**: Enhancing the site's ecological value can be achieved by incorporating features like birdhouses, bat boxes, or insect hotels on walls or in corners. These microhabitats provide support for local wildlife without significantly encroaching on available space.
5. **Permeable Paving and Pathways:** Use permeable materials for pathways and driveways to allow rainwater to infiltrate and reduce runoff. This combines functionality with sustainable stormwater management, contributing to groundwater recharge.
6. **Sustainable Drainage Systems**: To enhance water management and habitat creation, the design of sustainable drainage systems is proposed. These systems will effectively filter and clean runoff water, contributing to improved water quality and the establishment of small aquatic habitats.

The careful selection of these six amenity and biodiversity enhancements aligns with the context of the proposed site. By adopting these strategies, the development proposals provide a more sustainable and ecologically rich environment while optimising the limited space available.

SuDS Run-off Summary

Return Period	Greenfield - interpolated (l/s)	Existing (l/s)	Proposed - without additional Mitigation Measures (l/s)	Proposed with SuDS Measures (l/s)
1 in 1 Year	0.34	8.26	8.26	4.26*
1 in 30 Year	0.93	20.76	20.76	8.05**
1 in 100 Year	1.27	26.52	26.52	12.27**
1 in 100 Year + 40%cc	-	-	37.13	16.38**

*The proposed surface water run-off from the development considers 16m^2 of the Green Roofs will be retained within the drainage medium.

** Calculations include surface water run-off that cannot be attenuated, plus the combined 2 l/s restricted rates from Blue Roofs.

In conclusion, the easements from boundaries and from structures limits the options in regards to centralised '3d' infiltration systems. However, the incorporation of source control features including Green| Blue Roofs and Permeable Paving, will reduce the development's surface water run-off rates for the 1 in 100 year return period plus an allowance for climate change. These SuDS elements provide an overall reduction in surface water run-off rates for all storm events compared to the unmitigated scenario by up to **56%**. The proposed SuDS features also offer significant improvements in 'Water Quality' in accordance with the SuDS Manual C753.

Surface Water Maintenance Strategy

The drainage design will be designed to be fully maintainable in accordance with building regulations and the recommendations of CIRIA C753 – SuDS Manual, outlined below. The applicant or their appointed management team will be responsible for the management and maintenance of the respective SuDS systems in perpetuity.

Green Roof | Rain Gardens

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Weed spray with environmentally friendly chemicals	Half yearly
	Clear leaves and litter	Half yearly
	Plants to be pruned	Half yearly
Occasional maintenance	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Remove silt build-up from outlets and surface and replace mulch as necessary	Annually, or as required
Remedial Actions	Repair of overflow erosion damage or damage to outfall	As required

Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Monitoring/Inspections	Initial Inspection.	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required take remedial action.	Annually (and after severe storms)
Regular Maintenance	Rubbish and litter removal	As required
	Brushing and vacuuming - standard cosmetic sweep across surface	Once a year after Autumn leaf fall
Remedial Actions	Remedial work to any depressions or rutting considered detrimental to the structural performance.	As required
	Rehabilitation of surface with remedial sweeping	Every 10-15 years or as required.

Blue Roof

Maintenance Schedule	Required Action	Typical Frequency
Monitoring / Inspections	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are working as they should	Annually or after severe storms
Regular Maintenance	Inspect and identify any elements that are not operating correctly.	Monthly for three months, then Half yearly or as required.
	Remove sediments / debris from catch pits / gullies and control structures	Annually, after severe storms or as required
Remedial Actions	Repair inlets, outlets, vents, overflows and control structures.	As required

Effective SuDS design must assess all foreseeable risks during construction and maintenance. These must be mitigated during the detailed design stages where effective design will aim to avoid, reduce and mitigate risks. This process will also require input from the principal contractor who will ensure the construction of SuDS components are carried out in a safe and sustainable manner. The CDM Regulations place specific Health and Safety duties on those commissioning, planning and undertaking construction works. If you are uncertain what this means you should seek the advice of your architect, builder or other competent professional. Flume does not provide health and safety advisory services, but we are required to advise you of your general responsibilities under CDM.

Conclusions

- The site resides in Flood Zone 1 where there is less than 1 in 1000 annual probability of river or sea flooding (<0.1%). Developments in this flood zone have no restrictions other than ensuring surface water drainage proposals do not increase the flood risk on site and the surrounding areas.

- The existing development discharges surface water at unrestricted rates to the public sewer. The proposed development will reduce the overall hardstanding areas compared to the existing scenario. The proposals will therefore not increase the flood risk from surface water, as there will be no increase in the surface water run-off rate or volumes.

- Infiltration will be prioritised on site where feasible, with the use of permeable paving serving the external hardstanding areas infiltrating to ground. A combination of Green|Blue Roofs, Vertical Green Walls and permeable paving for hardstanding areas, will be used to reduce surface water run-off rates from the proposed development. These SuDS proposals will reduce the surface water run-off by up to 56% compared to existing - exceeding the NSTS 50% betterment of the existing flow rates for all periods.

- Site constraints prevent reducing surface water run-off rates further. The existing building's below ground drainage system would have to be reconfigured in order to limit surface water run-off rates for the entire site boundary further and would not be appropriate for the size or scale of the development proposals. However, peak surface water run-off rates have been reduced where possible and practical in line with the London Plan, NSTS and Enfield's SuDS guidance.

- Permeable Pavements and Green Roofs are placed highly in the SuDS Hierarchy, and will ensure that water quality, water quantity, amenity and biodiversity are all promoted in the SuDS design.

- A SuDS Maintenance Plan will also be in place to ensure efficient operation and prevent failure of the system.

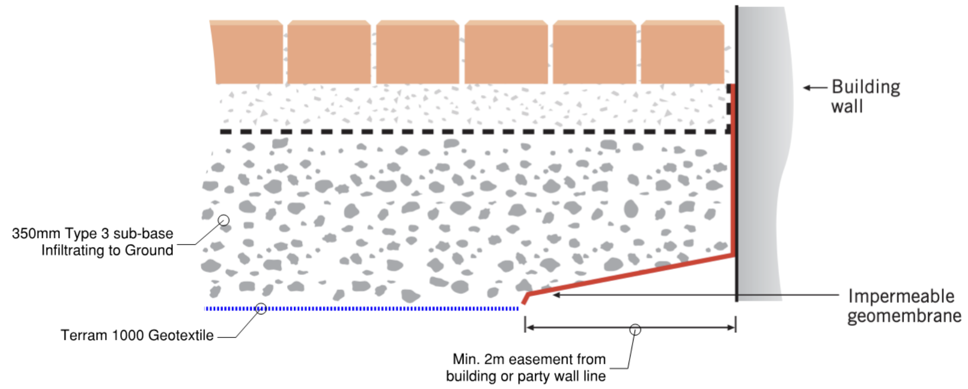
Note:

	Prepared By	Checked By	Approved for issue
Name	Tom Quigg BSc MSc CEng MICE	Magaly Sedeño BA	Tom Quigg BSc MSc CEng MICE
Signature	TQ	MST	TQ
Date	8 November 2023	8 November 2023	8 November 2023

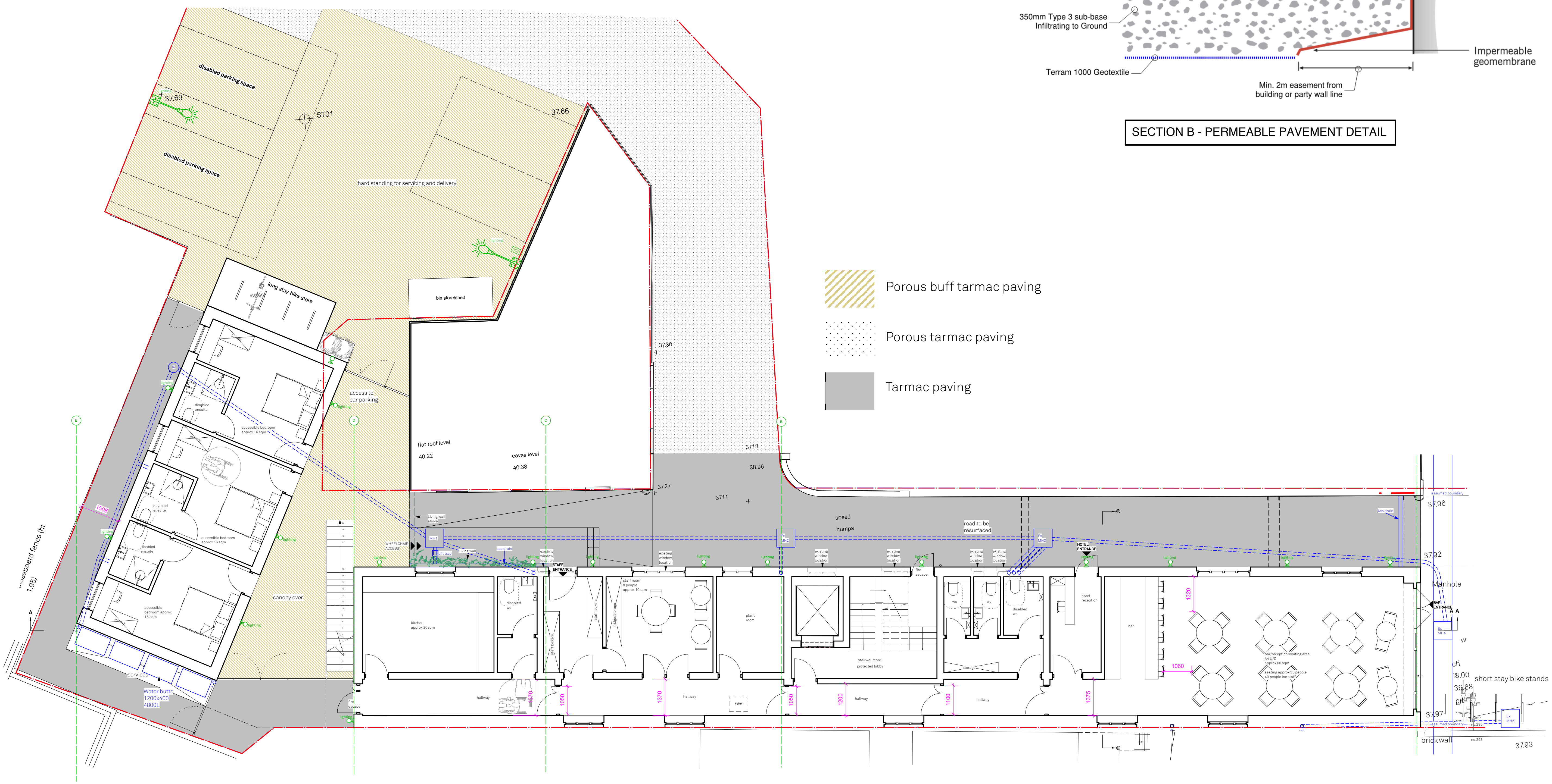
Appendix A - SuDS Strategy and Hydraulic Calculations

flume

Job No.	1256	Page	SK 100	Rev	1
Date	22.09.22	Eng	TQ	Chd	MST
Job	295 Green Lanes - SuDS Strategy				



SECTION B - PERMEABLE PAVEMENT DETAIL

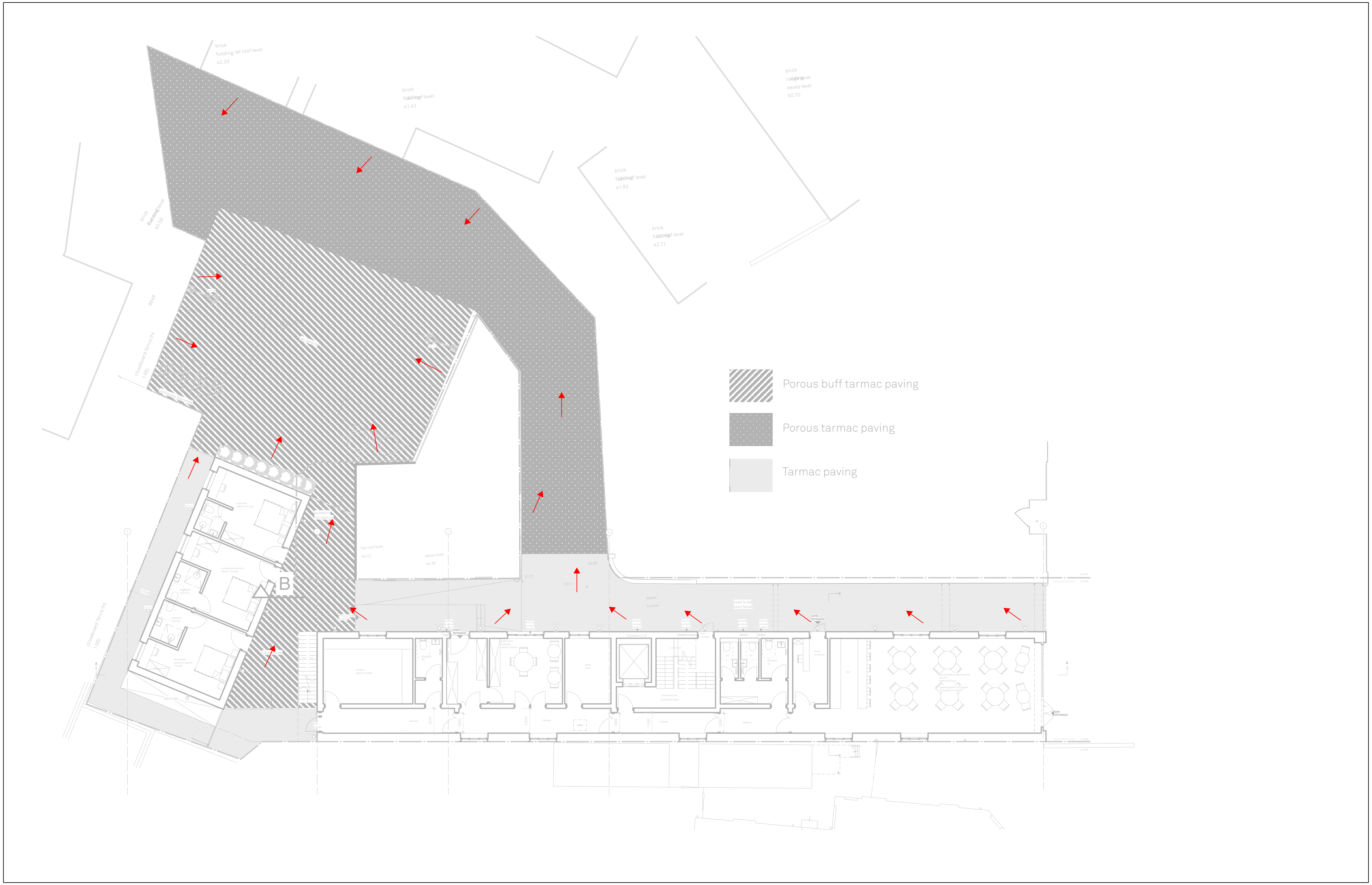


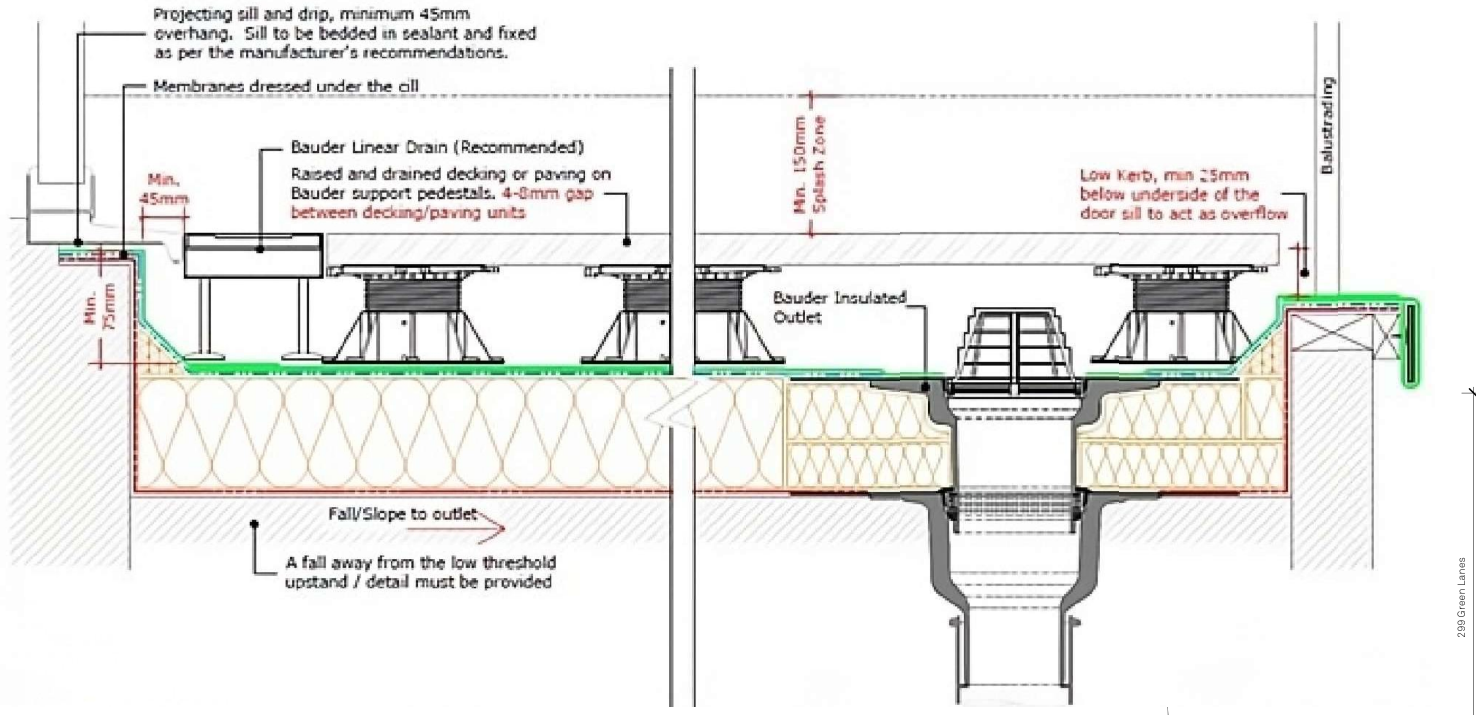
Porous buff tarmac paving

Porous tarmac paving

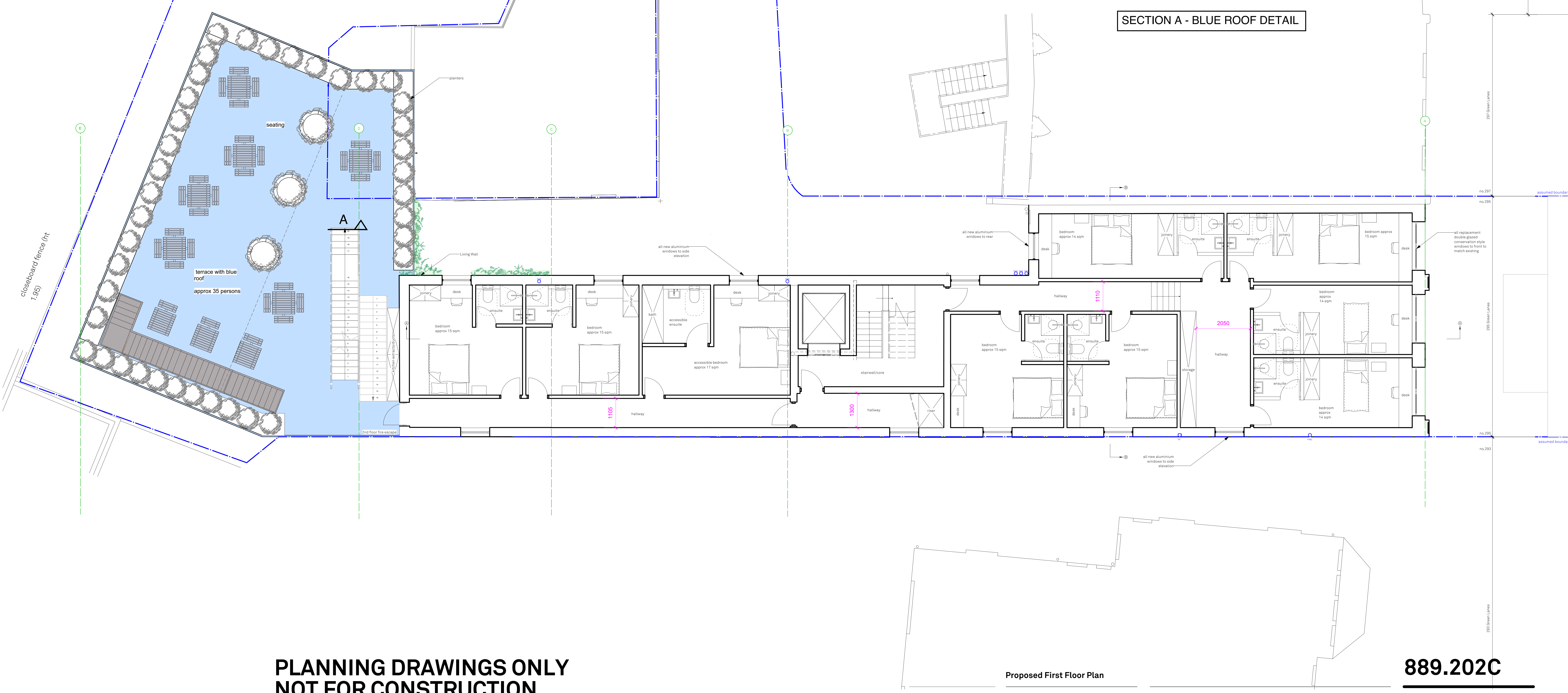
Tarmac paving

Job No.	1256	Page	SK 110	Rev	1
Date	27/02/2023	Eng	TQ	Chd	MST
Job	295 Green Lanes - Overland flow routes for exceedance events				





SECTION A - BLUE ROOF DETAIL



PLANNING DRAWINGS ONLY
<u>NOT</u> FOR CONSTRUCTION.
CONTRACTOR RESPONSIBLE FOR
ALL SITE DIMENSIONS AND COORDINATION

0 1 2 3 4 5M

Key
- Green roof
- Living wall
- Blue roof

Proposed First Floor Plan

Green Lanes

295 Green Lanes, N13	
Drawn By	SJ
Scale	1:100@A2
Status	Information
Project Stage	PLANNING

Paul Archer Design Ltd

Issue	Notes	Date
B	Issued for comments	02/09/2022
C	Planning Application	14/09/2022
D	issued for comments	01/06/2023

889.202C

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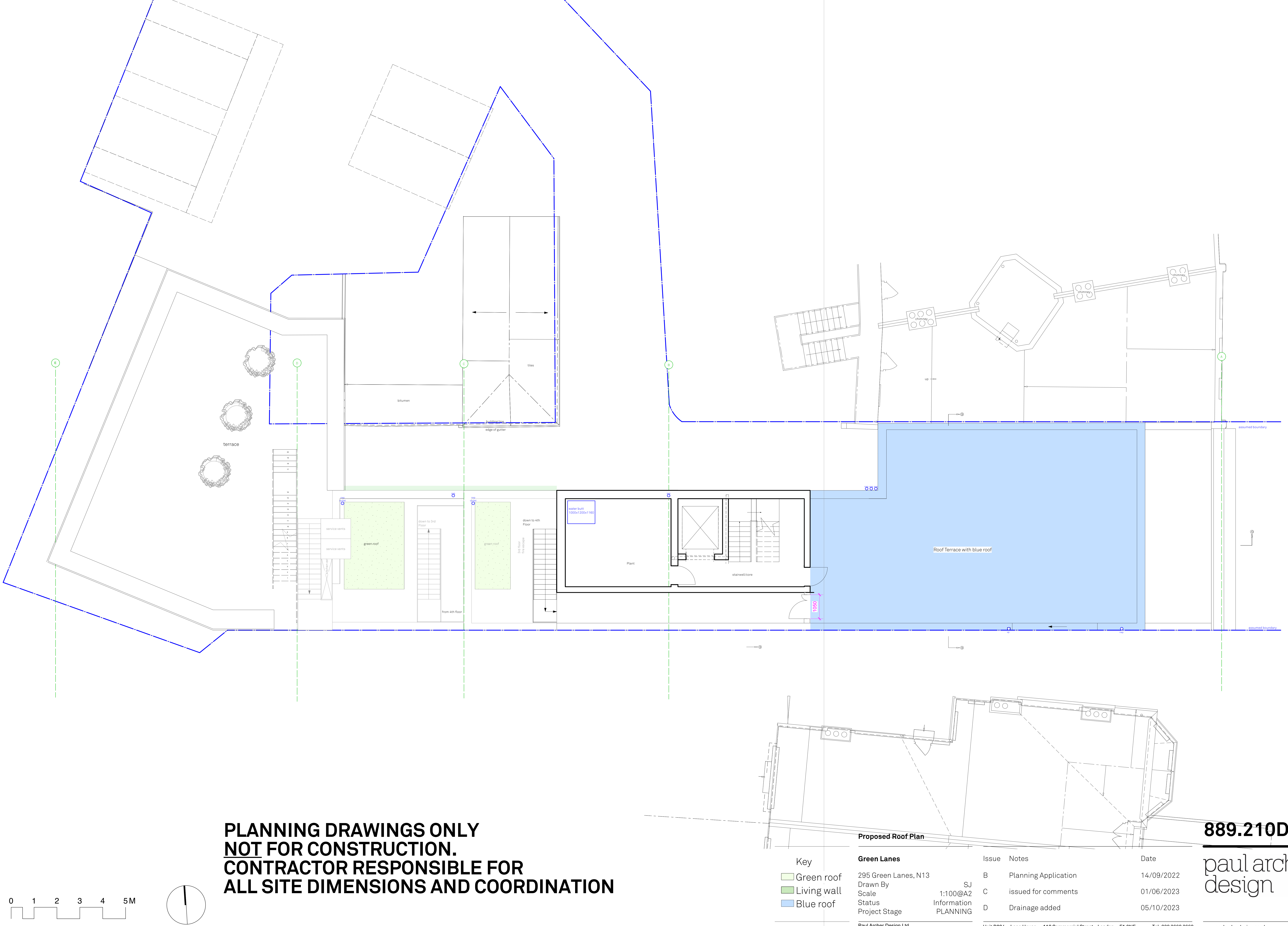

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Proposed Roof Plan

Key
- Green roof
- Living wall
- Blue roof

Green Lanes

295 Green Lanes, N13

Drawn By	SJ
Scale	1:100@A2
Status	Information
Project Stage	PLANNING

Paul Archer Design Ltd

Issue	Notes	Date
B	Planning Application	14/09/2022
C	issued for comments	01/06/2023
D	Drainage added	05/10/2023

889.210D

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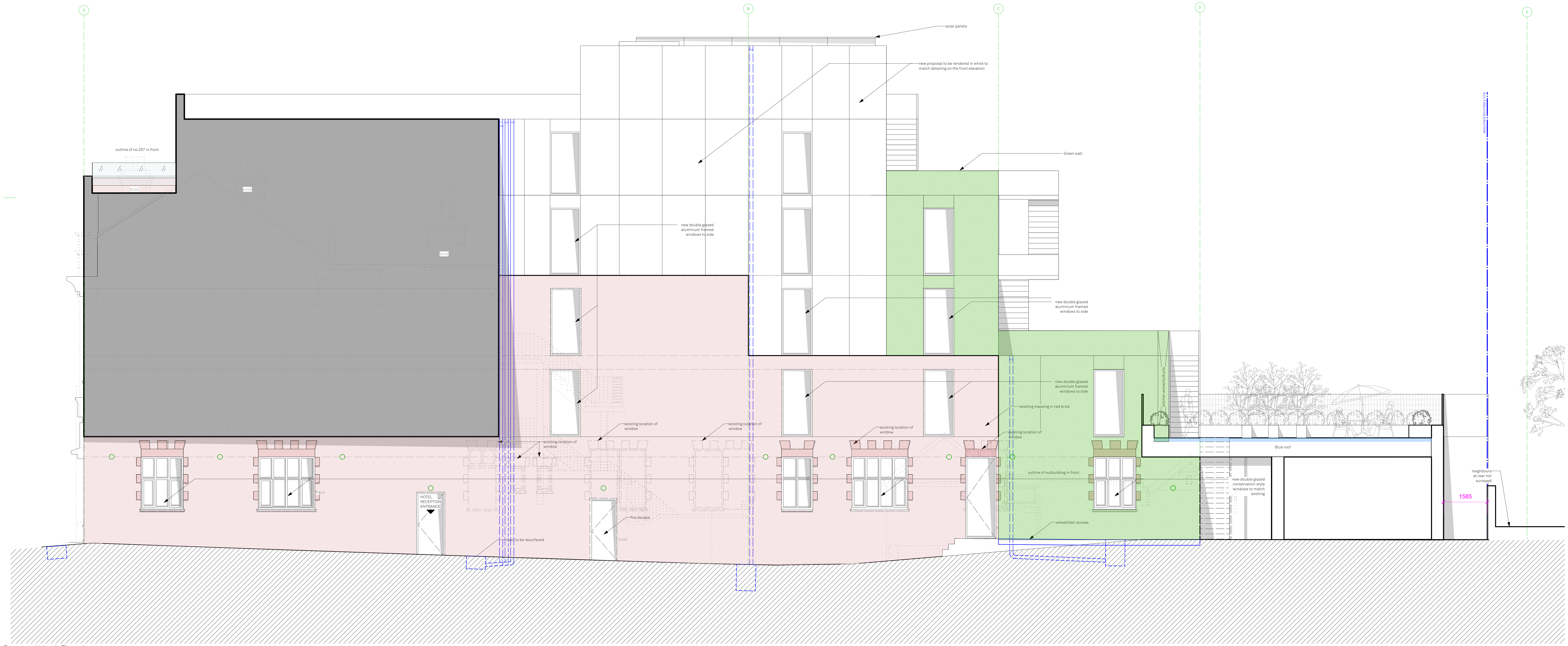
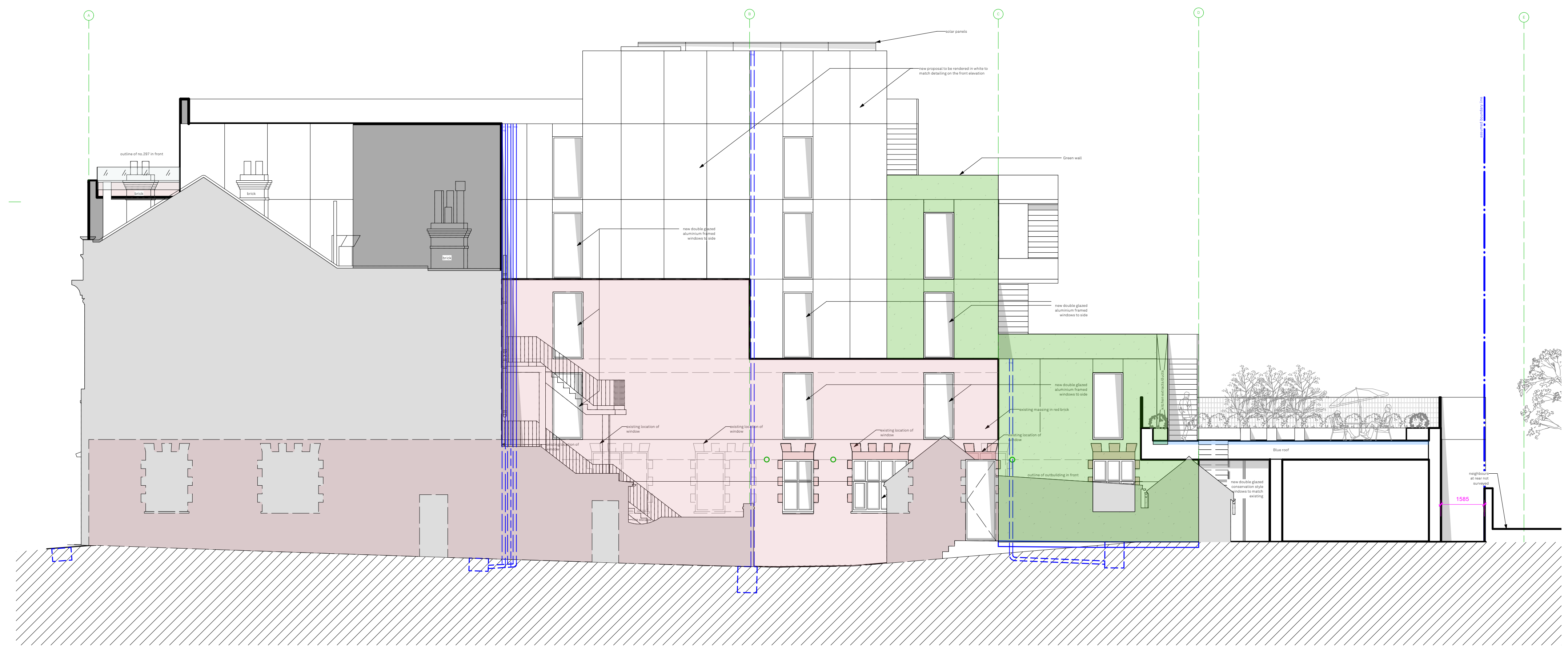


Proposed North Elevation
Scale 1:100



Proposed Elevation showing 297 Green Lanes in grey
Scale 1:200

PLANNING DRAWINGS ONLY
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ALL SITE DIMENSIONS AND COORDINATION

0 1 2 3 4 5M

Key
Green roof
Living wall
Blue roof

Proposed North Elevation

Green Lanes

295 Green Lanes, N13

Drawn By	SJ
Scale	1:100@A2
Status	Information
Project Stage	PLANNING

Paul Archer Design Ltd

Issue	Notes	Date
B	Planning Application	14/09/2022
C	issued for comments	01/06/2023
D	Drainage added	05/10/2023

889.206D

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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Tom Quigg
Site name:	295 Green Lanes
Site location:	Enfield

Site Details

Latitude:	51.61740° N
Longitude:	0.10986° W
Reference:	3241249384
Date:	Sep 26 2022 01:16

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

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.1

Methodology

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

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	654	654
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.45	0.45
1 in 1 year (l/s):	0.38	0.38
1 in 30 years (l/s):	1.03	1.03
1 in 100 year (l/s):	1.42	1.42
1 in 200 years (l/s):	1.67	1.67

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Permeable Paving	0.040	5.00	0.500	450	0.500
Outfall	0.000		0.500	450	0.500

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Permeable Paving	Outfall	3.000	0.600	0.000	0.000	0.000	0.0	100	5.05	54.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.000	7.9	7.9	0.400	0.400	0.040	0.0	0	∞

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.000	0.0	100	Circular	0.500	0.000	0.400	0.500	0.000	0.400

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Permeable Paving	450	Manhole	Adoptable	Outfall	450	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Permeable Paving	0.500	0.500	450	0	1.000	0.000	100
Outfall	0.500	0.500	450	1	1.000	0.000	100

Simulation Settings

Rainfall Methodology	FSR	Summer CV	1.000	Drain Down Time (mins)	1440
FSR Region	England and Wales	Winter CV	1.000	Additional Storage (m³/ha)	0.0
M5-60 (mm)	20.000	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.400	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	0	0	0	100	40	0	0
30	0	0	0				

Node Permeable Paving Online Depth/Flow Control

Flap Valve	x	Invert Level (m)	0.000	Design Flow (l/s)	0.2
Replaces Downstream Link	✓	Design Depth (m)	1.000		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	0.500	0.000

Node Permeable Paving Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Porosity	0.30	Width (m)	20.000	Depth (m)	0.350
Side Inf Coefficient (m/hr)	0.03600	Invert Level (m)	0.000	Length (m)	20.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	300.0		

Results for 5 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
60 minute summer	Permeable Paving	42	0.071	0.071	7.8	4.4666	0.0000	OK
15 minute summer	Outfall	1	0.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m^3)
60 minute summer	Permeable Paving	Depth/Flow	Outfall	0.0	0.0
60 minute summer	Permeable Paving	Infiltration		2.0	

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	Permeable Paving	46	0.096	0.096	11.6	7.5731	0.0000	OK
15 minute summer	Outfall	1	0.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
60 minute summer	Permeable Paving	Depth/Flow	Outfall	0.0	0.0
60 minute summer	Permeable Paving	Infiltration		2.0	

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Permeable Paving	59	0.173	0.173	15.5	16.7896	0.0000	SURCHARGED
15 minute summer	Outfall	1	0.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
60 minute winter	Permeable Paving	Depth/Flow	Outfall	0.0	0.0
60 minute winter	Permeable Paving	Infiltration		2.1	

Appendix B - Ground Investigation Report - BRE 365 Infiltration Tests

Jaxx Engineering Consultancy

12 Colville Close
Stanford-le-Hope, Corringham, Essex
Telephone/Fax: 020 3576 2390 **Mobile:** 07508 853739
Email: info@jaxxeng.com **Website**: www.jaxxeng.com

Factual Report

Client : Naem Ishak

Site Name : 295 Green Lanes, London, N13 4XS

Client Reference : JEC3445

Laboratory Reference : -

Date of Completion : 28-Jul

Content Summary

Lab Reference :	JEC3445
Client Reference :	295 Green Lanes, London, N13 4XS
For the attention of :	Naem Ishak
This report comprises of the following :	1 Site Plan
	1 Material Logs
	1 Infiltration Testing
	1 Limitations

Notes :

General

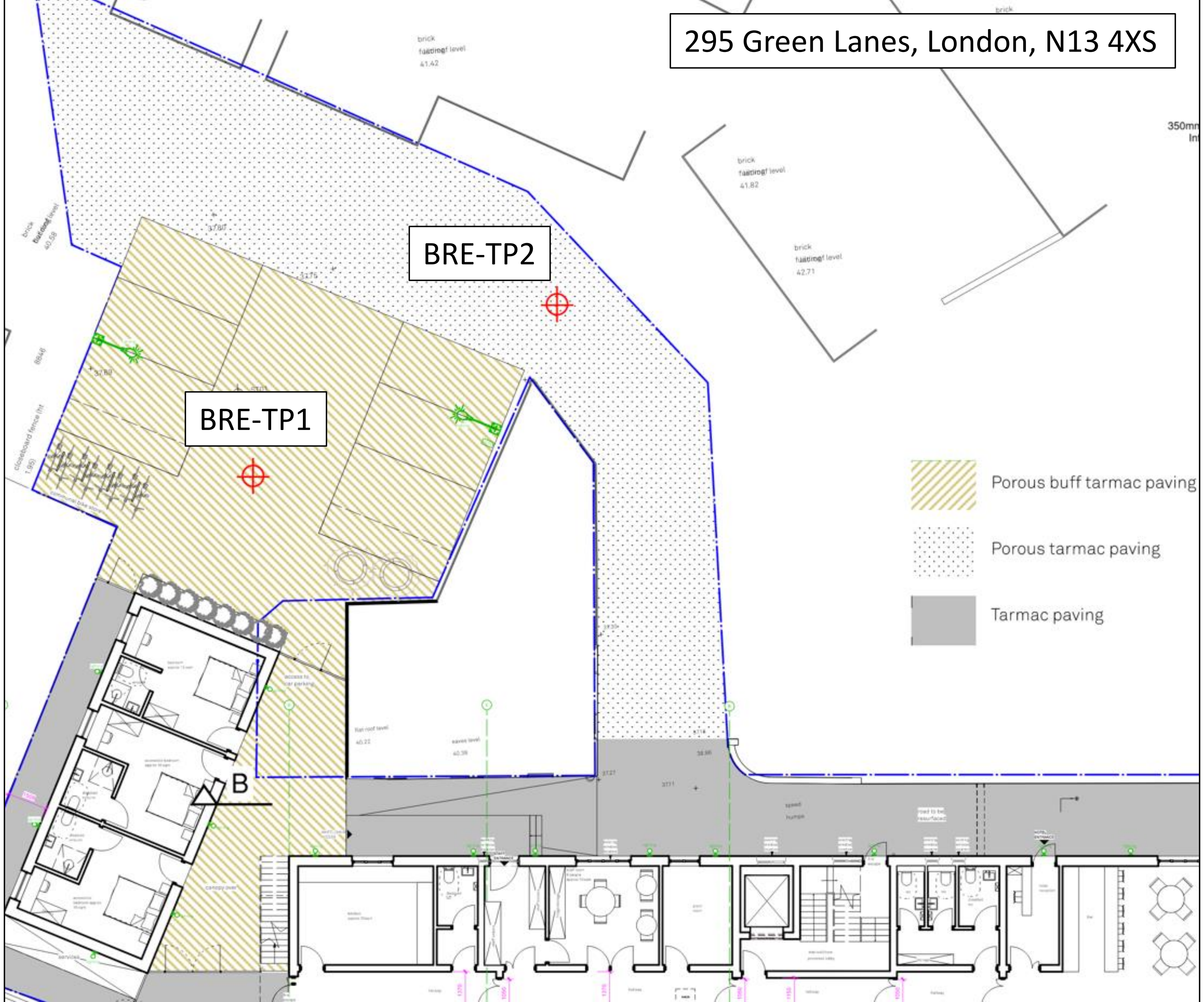
Please refer to report summary notes for details pertaining to methods undertaken and their subsequent accreditations

Samples were supplied by Customer

All tests performed in-house unless otherwise stated

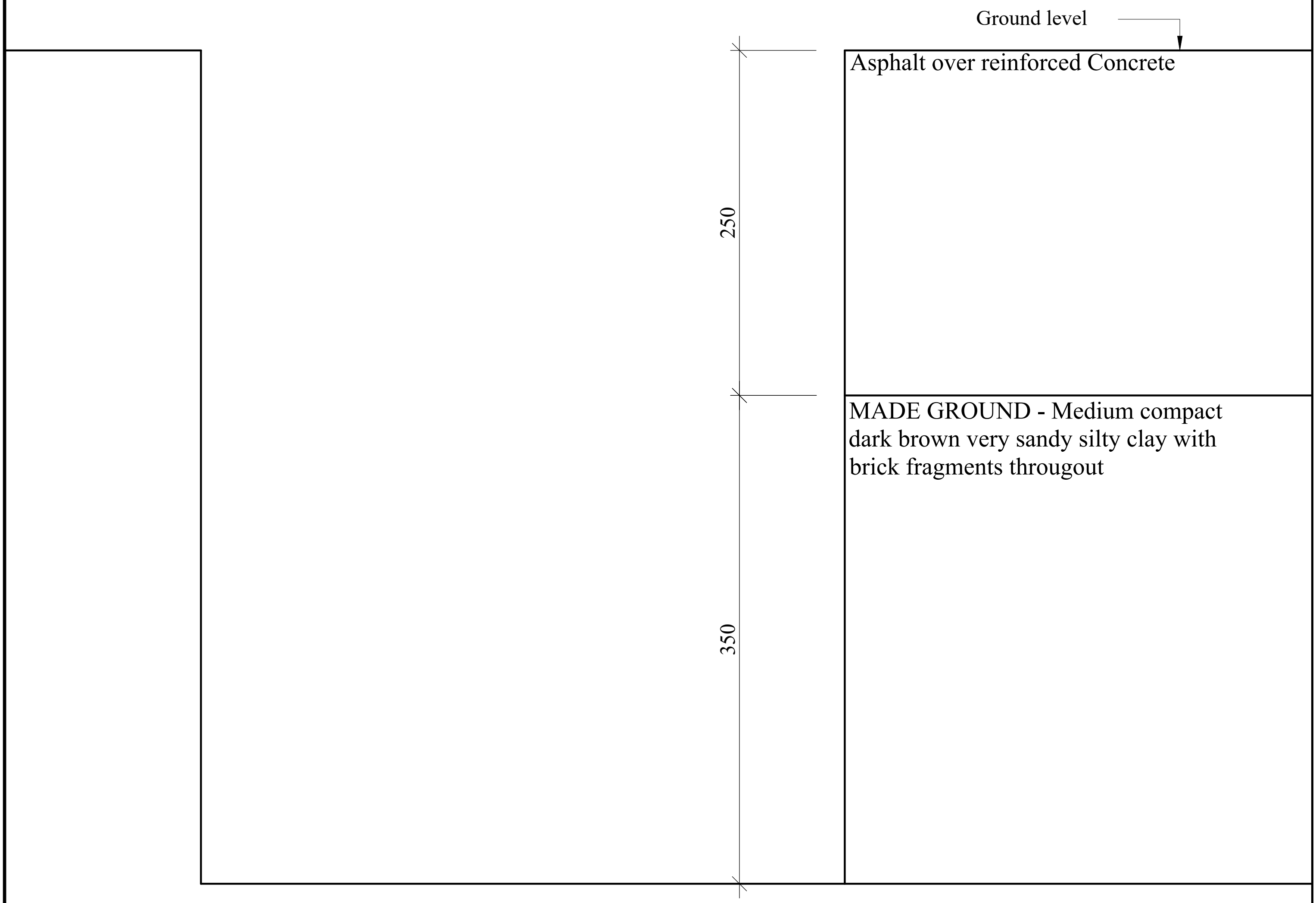
Deviant Samples

Samples were received in suitable containers	Yes
A date and time of sampling was provided	Yes
Arrived damage/denaturing free	Yes


295 Green Lanes, London, N13 4XS
BRE-TP2
BRE-TP1
B
Porous buff tarmac paving
Porous tarmac paving
Tarmac paving

Jaxx Engineering Consultancy
12 Colville Close
Stanford le Hope, Essex, SS17 7RS
Telephone: 0203 576 2390 Mob: 07508 853739
Email: engineering@jaxxeng.com Website: www.jaxxeng.com

Client: Naem Ishak	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Date:** 27/07/23
Location: 295 Green Lanes, London, N13 4XS	**Job No:** 3445	**Trial Pit No:** TP1	**Weather:** Overcast
Excavation Method: Mechanical & Hand		**Drawn by:** MB	**Checked by:** GW



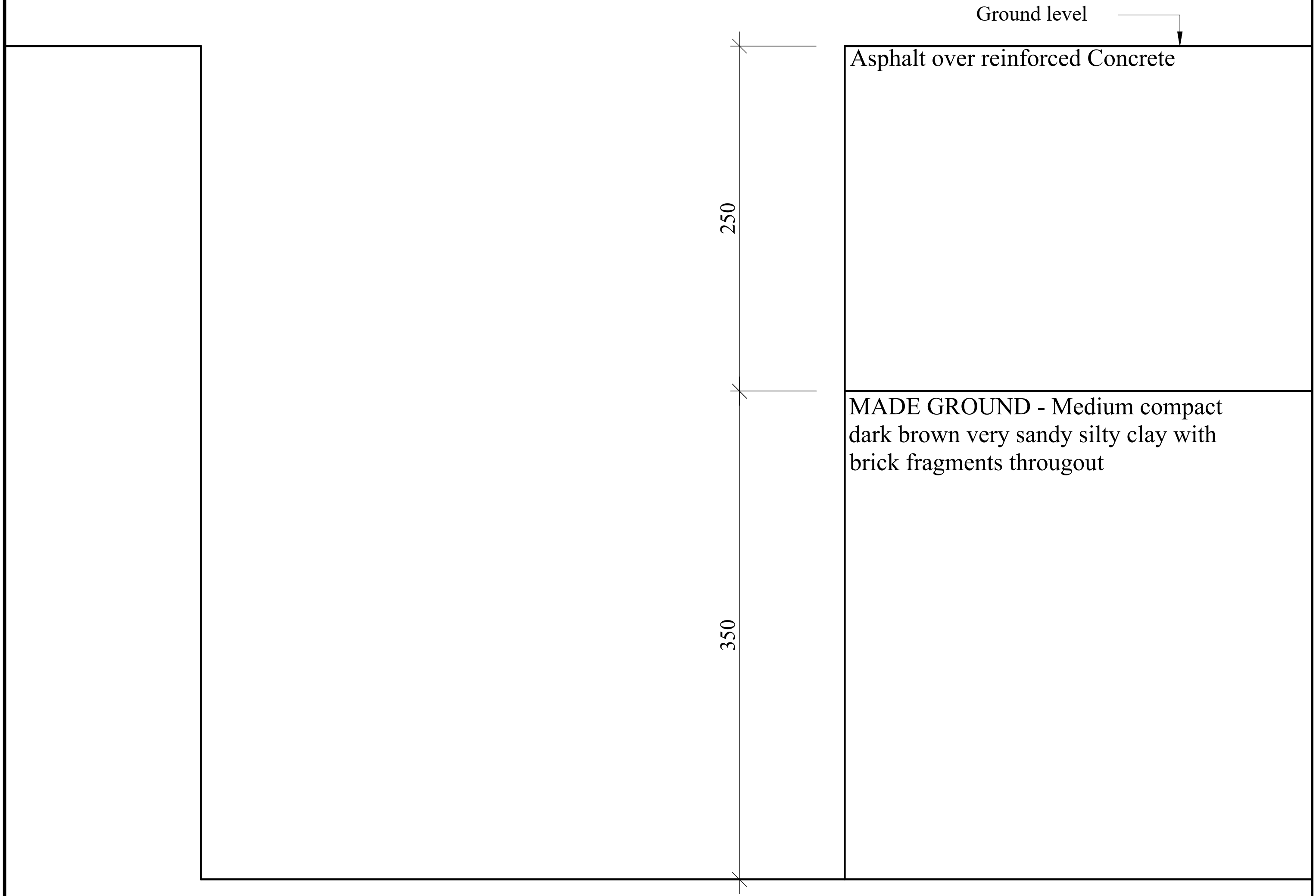
TRIAL PIT ENDS AT 600mm

Remarks: Trial Pit completed to 0.6m

Key:
- **D** Small disturbed sample
- **B** Bulk disturbed sample
- **U** Undisturbed sample (U100)
- **N** Standard Penetration Test Blow Count
- **J** Jar sample
- **V** Pilcon Vane (kPa)
- **M** Mackintosh Probe
- **W** Water Sample

Jaxx Engineering Consultancy
12 Colville Close
Stanford le Hope, Essex, SS17 7RS
Telephone: 0203 576 2390 Mob: 07508 853739
Email: engineering@jaxxeng.com Website: www.jaxxeng.com

Client: Naem Ishak	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Date:** 27/07/23
Location: 295 Green Lanes, London, N13 4XS	**Job No:** 3445	**Trial Pit No:** TP2	**Weather:** Overcast
Excavation Method: Mechanical & Hand		**Drawn by:** MB	**Checked by:** GW



TRIAL PIT ENDS AT 600mm

Remarks: Trial Pit completed to 0.6m

Key:
D Small disturbed sample
B Bulk disturbed sample
U Undisturbed sample (U100)
N Standard Penetration Test Blow Count
J Jar sample
V Pilcon Vane (kPa)
M Mackintosh Probe
W Water Sample

JAXX ENGINEERING CONSULTANCY

Infiltration Rate Testing - BIA BRE 365

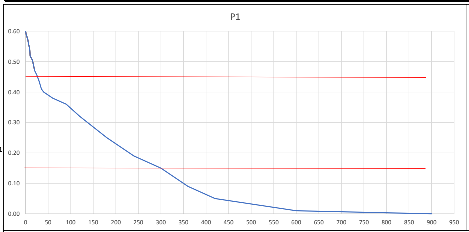
Project Name : 295 Green Lanes, London, N13 4XS

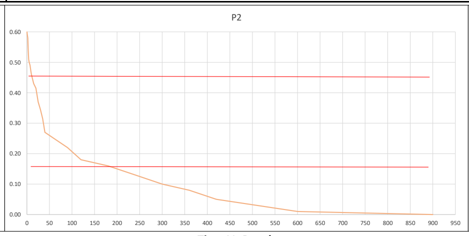
Job No : TGT3445 | Performed By : NI

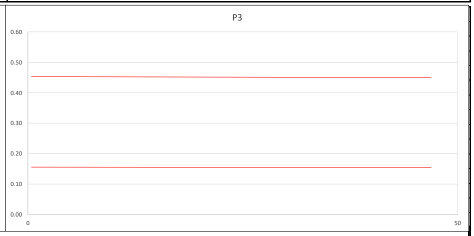
Date : 27/07/23 | Checked By : GW

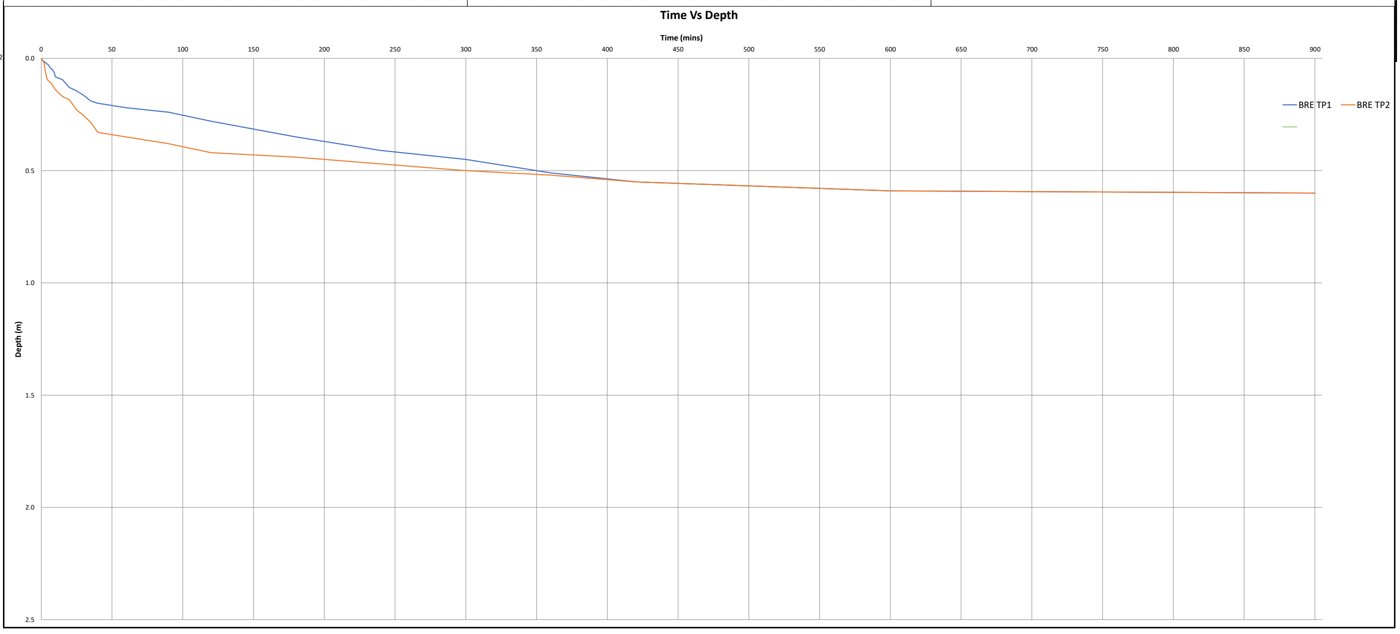
BRE TP1				BRE TP2			
Test Dimensions		H_0 =		Test Dimensions		H_0 =	
1.0m (w) x 1.0m (l) x 0.6m (d)		0.60		1.0m (w) x 1.0m (l) x 0.6m (d)		0.60	
Depth to Water (m)	Time (mins)	H	H/H_0	Depth to Water (m)	Time (mins)	H	H/H_0
0.000	0	0.60	1.00	0.000	0	0.60	1.00
0.010	1	0.59	0.98	0.010	1	0.59	0.98
0.014	2	0.59	0.23	0.020	2	0.58	0.97
0.019	3	0.58	0.23	0.060	3	0.54	0.90
0.024	4	0.58	0.23	0.090	4	0.51	0.85
0.029	5	0.57	0.23	0.100	5	0.50	0.83
0.039	6	0.56	0.22	0.105	6	0.50	0.83
0.046	7	0.55	0.22	0.110	7	0.49	0.82
0.051	8	0.55	0.22	0.120	8	0.48	0.80
0.061	9	0.54	0.22	0.130	9	0.47	0.78
0.082	10	0.52	0.21	0.140	10	0.46	0.77
0.095	15	0.51	0.20	0.170	15	0.43	0.72
0.130	20	0.47	0.19	0.185	20	0.42	0.69
0.145	25	0.46	0.18	0.230	25	0.37	0.62
0.165	30	0.44	0.17	0.255	30	0.35	0.58
0.190	35	0.41	0.16	0.285	35	0.32	0.53
0.200	40	0.40	0.16	0.330	40	0.27	0.45
0.220	60	0.38	0.15	0.350	60	0.25	0.42
0.240	90	0.36	0.14	0.380	90	0.22	0.37
0.280	120	0.32	0.13	0.420	120	0.18	0.30
0.350	180	0.25	0.10	0.440	180	0.16	0.27
0.410	240	0.19	0.08	0.470	240	0.13	0.22
0.450	300	0.15	0.06	0.500	300	0.10	0.17
0.510	360	0.09	0.04	0.520	360	0.08	0.13
0.550	420	0.05	0.02	0.550	420	0.05	0.08
0.590	600	0.01	0.00	0.590	600	0.01	0.02
0.600	900	0.00	0.00	0.600	900	0.00	0.00

	BRE TP1	BRE TP2	
Volume of Excavation (m^3) =	0.60	0.60	
Storage volume between 75-25% 'Vp' [m^3] =	0.30	0.30	
Time for water to fall from 75-25% 'tp' [min] =	275	195	
50% Internal Surface Area (as50) =	2.20	2.20	
Soil infiltration rate 'f' [m/s] =	2.06E-06	2.23E-06	












JAXX ENGINEERING CONSULTANCY

Where our involvement consists exclusively of testing samples, the results and comments (if provided) relate only to the samples tested.

Any samples that are deemed to be subject to deviation will be recorded as such within the test summary.