

29-35 STATION ROAD
READING

SUSTAINABLE DRAINAGE SYSTEMS STRATEGY

TITAN PROPERTY DEVELOPMENTS

REV A

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This Sustainable Drainage Systems Strategy was commissioned by Andmore Planning on behalf of Titan Property Developments in July 2015 to satisfy the requirements of the Reading Borough Council regarding sustainable drainage for the site at 29-35 Station Road, Reading.

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for and on behalf of Water Environment Limited

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GLOSSARY

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Survey
CDA	Critical Drainage Area
DEFRA	Department for Environment Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
FRA	Flood Risk Assessment
GI	Ground Investigation
GIA	Gross Internal Area
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RP	Return Period
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

1 INTRODUCTION

General Information

- 1.1 The site is located on the west side of 29-35 Station Road in Reading, at the junction with Garrard Street, nearest postcode RG1 1NR. The site boundary encloses an area of approximately 555m², 100% of which is currently hardstanding.
- 1.2 At present, the building's upper floors are comprised of vacant office space with commercial space on the ground floor that is still operational. The site boundary also encloses an alley at the rear of the building.
- 1.3 The site area is less than 1ha and, according to the latest online Environment Agency (EA) flood zone maps, lies within Flood Zone 1. Therefore a site specific Flood Risk Assessment (FRA) is not required, in accordance with the National Planning Policy Framework (NPPF)¹.

Scope of Study

- 1.4 The main objectives of this study are to:
 - Contact relevant statutory authorities and Thames Water to gather information on local drainage systems;
 - Consideration of the pre- and post-development drainage schemes and calculation of pre- and post- development runoff rates based on standard methodologies;
 - Provide design details for drainage system elements and appropriate connection locations;
 - Confirmation of future management and maintenance requirements for proposed sustainable drainage system (SuDS) elements,
 - Provide advice on the site layout and design that will ensure safe operation of the site in an extreme flood event,
 - Provide advice and guidance on the management of surface water runoff at the site to ensure the risk of surface water flooding on the site and on nearby sites does not increase following development.

¹ National Planning Policy Framework, Communities and Local Government, March 2012

2 SITE DESCRIPTION

Location

- 2.1 The site is located on the intersection of Station Road and Garrard Street in Reading and lies within the jurisdiction of Reading Borough Council.
- 2.2 The site is bounded to the north by Garrard Street, to the east by Station Road, to the west by The Garrard House development and to the south by a commercial building. The location of the site is presented in Figure 1.

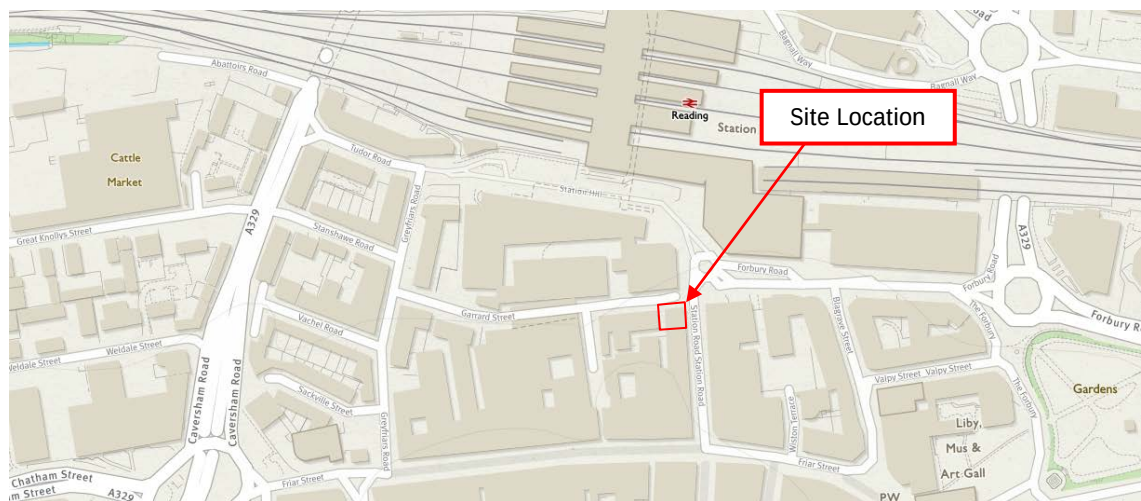


Figure 1 – Location of proposed development site²

Existing Development

- 2.3 The site covers an area of approximately 555m² (not including a small area of approximately 66m² indicated within the red line boundary which is highways department land and only included as an area for hoarding along the pavement) and is currently occupied by an existing building. The existing building is comprised of commercial space at ground floor level with vacant office space above. The site boundary also encloses the alley at the rear of the building which provides access to buildings and parking spaces behind Garrard House.
- 2.4 At present, the site area is entirely impermeable.

Proposed Development

- 2.5 The proposed development is to demolish the existing building on site and construct a building of 23 storeys plus basement. Drawings of the proposals can be found in Appendix A.
- 2.6 The development will incorporate a green roof that will serve to reduce the rainfall runoff rate and volume from the site as well as providing multiple additional

² Contains Ordnance Survey information © Crown copyright and database rights 2015

environmental benefits such as improving the quality of runoff and biodiversity. The development will also contain areas of raised planters on the amenity space on the roof, totalling approximately 12m². These planters will not be formally drained and therefore runoff from these areas will not enter the drainage system.

3 NATIONAL AND LOCAL PLANNING POLICY

National Planning Policy Framework

- 3.1 The National Planning Policy Framework³ (NPPF) was published in March 2012 and sets out the Governments' planning policies for England and how these are expected to be applied. In terms of flooding, the NPPF states that:

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere."

- 3.2 The latest online Environment Agency (EA) flood zone maps indicate that the site lies within Flood Zone 1 and therefore a site specific Flood Risk Assessment (FRA) is not required to consider the risk of flooding on the site from all sources as the site is less than 1ha, in accordance with the NPPF.
- 3.3 In accordance with the NPPF, as a minimum requirement, runoff rates and volumes should not increase from any site following development, to prevent an increase in flood risk elsewhere as a result of the development.
- 3.4 According to The Town and Country Planning (Development Management Procedure) (England) Order 2015, the Lead Local Flood Authority (LLFA) is now the statutory consultee regarding surface water drainage of a major development. The LLFA for the site is Reading Borough Council.
- 3.5 The proposed development falls under the classification of major development, as it involves the provision of more than 10 dwellings.

National Guidance

- 3.6 The Non-statutory Technical Standards for Sustainable Drainage Systems⁴ was published in March 2015, to be used in conjunction with NPPF and Planning Practice Guidance⁵ (PPG).
- 3.7 The document sets out the requirements for the provision of sustainable drainage within development, from design to construction and maintenance. The specific technical criteria considered within this SuDS strategy are as follows:

Peak Flow Control

~~***S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event***~~

³ Communities and Local Government, National Planning Policy Framework, 2012

⁴ Department for Environment, Food and Rural Affairs, Sustainable Drainage Systems - Non-statutory Technical Standards for Sustainable Drainage Systems, 2015

⁵ Communities and Local Government, Planning Practice Guidance, 2014

~~and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.~~ (Not applicable as existing site is developed)

S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

Volume Control

~~S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.~~ (Not applicable as existing site is developed)

S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

- 3.8 The wording of the requirements are such that the post development runoff rates and volumes, over the lifetime of the development, need to be considered against the present day conditions.

Local Planning Policy and Guidance

- 3.9 Policy CS1 (Sustainable Construction and Design) of the Reading Core Strategy⁶ requires that developments incorporate sustainable urban drainage facilities and techniques as part of the layout of a development. It encourages the reduction of surface water runoff where possible, and requires as a minimum that surface water runoff is no greater than the original conditions of the site.

⁶ Reading Borough Council, Reading Borough Local Development Framework: Core Strategy, Revised January 2015

4 SURFACE WATER MANAGEMENT

Existing Site Runoff

- 4.1 The existing site is developed and considered “Brownfield”. The site is currently 100% impermeable and the site boundary encloses an area of approximately 555m². This includes the area of existing adopted road to the rear of the current building, which has accordingly been included in the rainfall runoff calculations.
- 4.2 Design rainfall intensities have been calculated using the Wallingford Procedure⁷ and the resulting runoff was calculated using the Modified Rational Method. Calculation sheets are provided in Appendix B.
- 4.3 A 5.0 minute critical storm (M5-60 of 17mm and an ‘R’ value of 0.4) has been applied to calculate design rainfall intensities and peak rates of runoff for the existing site. The existing design rainfall intensities and peak runoff rates for the 1-year and 100-year return period rainfall events are presented in Table 1.

Return Period (years)	Intensity (mm/hr)	Discharge Rate (l/s)
1	48.3	7.1
100	141.9	20.8

Table 1 – Existing design rainfall intensities and surface water runoff rates

- 4.4 The additional volume of rainwater runoff above the Greenfield runoff volume for the 100 year return period, 6 hour duration storm from the existing site is calculated as 20.5m³.

Existing Site Drainage

- 4.5 The existing on-site drainage is most likely located beneath the footprint of the existing building and connects to the public Thames Water sewer. However, the Thames Water asset plans do not show a connection of the existing building to a surface water sewer.
- 4.6 All surface water sewer pipes are discontinued on the asset plans around the intersection of Station Road and Garrard Street where the site is located. However, a number of gullies can be seen on imagery from Station Road and Garrard Street. The site most probably connects to the network on one of these streets and runoff is either discharged by gravity down Garrard Street towards the connection on Merchants PI or down Station Road to the north or south.

⁷ HR Wallingford (2000) The Wallingford Procedure for Europe – Best Practice Guide to urban drainage modelling (CD)

- 4.7 Therefore, a drainage survey of the buildings sewer network will need to be conducted to determine the location of the existing connection to the surface water sewer network.
- 4.8 The Thames Water asset plans have been included in Appendix A of the report.

Greenfield Runoff Rate

- 4.9 The Greenfield runoff rates from the site were calculated using IoH124 methodology.
- 4.10 The site has a soil index of 0.1, a standard average annual rainfall of 642mm and lies within Hydrological Area 6. Qbar for the site has been calculated to be 0.01 l/s.
- 4.11 The 1-year, 30-year and 100-year return period events result in a discharge rate of 0.01 l/s, 0.02 l/s and 0.03 l/s respectively.

Ground Conditions

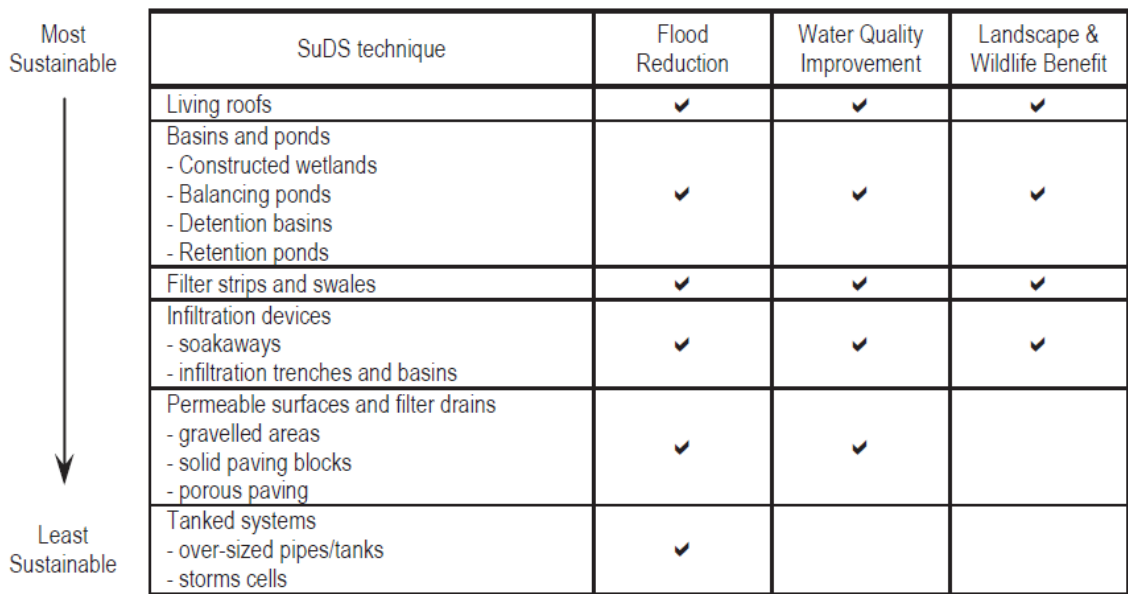
- 4.12 According to the British Geological Survey (BGS) online geology maps, the bedrock at the site is classified as Seaford Chalk Formation and Newhaven Chalk Formation. This is overlain by superficial deposits classified as Taplow Gravel Formation – Sand and Gravel. Historical borehole logs in the vicinity of the site support the BGS maps, noting Made Ground of between 5 foot and 12 foot below ground level (bgl) directly overlaying Chalk in some places, while lenses of sand and gravel were observed above the bedrock in others.
- 4.13 The EA online groundwater map indicates that the site is not located within a groundwater source protection zone. According to the EA aquifer maps, the superficial geology at the site is designated Secondary A aquifer, while the bedrock geology is designated as a Principal Aquifer. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
- 4.14 Titan Property Developments commissioned REC Ltd to undertake a Geo-Environmental Assessment for the Garrard House development, located adjacent to the site in question. The assessment was completed in March 2015. Made Ground was encountered within all intrusive locations at depths varying from 2.0m to 4.6m below ground level (bgl). Taplow Gravels were encountered in two locations, to depths of 3.0m bgl and 4.8m bgl. The Seaford and Newhaven Chalk Formation was encountered to a depth of 36.9m bgl with the base of the formation not encountered. The findings of this assessment provide the best representation of the ground conditions at the site in question.
- 4.15 REC Ltd recommended that soakaway systems are not adopted at the Garrard House site based on the substantial depths of made ground encountered and the potential of chalk dissolution occurring if soakaway systems were to be adopted within the formation. Chalk dissolution has the potential to cause reduction in stability. Therefore, soakaway systems would also not be appropriate at the site in question.

Sustainable Drainage Principles

4.16 The aim of Sustainable Drainage Systems (SuDS) is to emulate natural processes with the result that watercourses and storage areas receive the hydrological profiles under which they evolved, and that water quality in local ecosystems is protected or improved. The best practice guide states that a sustainable drainage system will⁸:

- reduce the impact of additional urbanisation on the frequency and size of floods;
- protect or enhance river and groundwater quality;
- be sympathetic to the needs of the local environment and community; and
- encourage natural groundwater recharge

4.17 The Reading Strategic Flood Risk Assessment⁹ encourages that SuDS measures be specified to maximise the aforementioned multi-functional benefits by following the hierarchy in Figure 2.



SuDS technique	Flood Reduction	Water Quality Improvement	Landscape & Wildlife Benefit
Living roofs	✓	✓	✓
Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
Filter strips and swales	✓	✓	✓
Infiltration devices - soakaways - infiltration trenches and basins	✓	✓	✓
Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paving	✓	✓	
Tanked systems - over-sized pipes/tanks - storms cells	✓		

Figure 2 - The multi-functional benefits of SuDS (Source: Reading SFRA)

4.18 The ground conditions at the site are not appropriate for infiltration SuDS. Space on site is also very limited, so attenuation using open water features is not practicable. Therefore, the drainage design will instead aim to meet the objectives of Reading County Council by incorporating a green roof to allow the attenuate rainfall runoff from the roof. The application of the SuDS hierarchy to the proposed development is summarised in Table 2.

⁸ CIRIA C523 – Sustainable Urban Drainage Systems – Best Practice Manual

⁹ Jacobs, Reading Borough Council Strategic Flood Risk Assessment: Level 1, March 2009

Most Sustainable	SuDS Technique	Suitability	Justification
	Living Roofs 1. Green Roofs	✓	Adequate roof space – will be incorporated
	Basins and ponds 2. Constructed wetlands 3. Balancing ponds 4. Detention basins 5. Retention ponds	✗ ✗ ✗ ✗	Insufficient space Insufficient space Insufficient space Insufficient space
	Filter strips and swales	✗	Inappropriate ground conditions and insufficient space
	Infiltration devices 6. Soakaways 7. Infiltration trenches & basins	✗ ✗	Inappropriate ground conditions and insufficient space
	Permeable surfaces and filter drains 8. Gravelled areas 9. Solid block paving 10. Porous paviers	✗ ✗ ✗	Insufficient space Insufficient space Insufficient space
	Tanked Systems 11. Over-sized pipes/tanks 12. Box storage systems	✓ ✓	Will be incorporated
Least Sustainable			

Table 2 – Application of SuDS hierarchy to the proposed development.

4.19 Green roofs are considered amongst the most sustainable of all the SuDS techniques, providing similar benefits as green roofs such as:

- reduced rainwater runoff
- enhanced roof insulation properties
- attractive visual appearance
- reduction in urban heat island effect
- enhanced roof lifespan by protecting underlying waterproofing system

- provision of green space in urban areas and encouragement of biodiversity

Proposed Surface Water Drainage System

- 4.20 As mentioned above, the new development will incorporate a green roof in the main building roof area. The green roof will cover a total area of approximately 74m² and will serve to attenuate rainfall runoff. The development will also contain areas of raised planters on the amenity space on the roof, totalling approximately 12m². These planters will not be formally drained and therefore runoff from these areas will not enter the drainage system.
- 4.21 The new development will most probably use the existing connection to the Thames Water network. Discharge rates are to be agreed upon with Thames Water.
- 4.22 A pre-development enquiry was submitted to Thames Water regarding the discharge of foul and surface water from the site to the Thames Water network. The subsequent correspondence is attached in Appendix C. In relation to the discharge of surface water, Thames Water stated that:

"Only when it can be proven that soakage into the ground or a connection into the adjacent watercourse is not possible would we consider a restricted discharge into the public surface water sewer network. A reduction of at least 50% on existing flows from the same site area would be sought for a range of storm conditions."

- 4.23 As discussed previously, infiltration devices are not feasible at the site due to a lack of space, the presence of made ground, and the potential for dissolution of the underlying chalk bedrock. There are no watercourses in the vicinity of the site to discharge into. Therefore, a restricted discharge to the Thames Water network is the appropriate option for the surface water runoff from the site.

Proposed Site Runoff

- 4.24 As the site is currently 100% hardstanding, the proposed development itself will not increase surface water runoff rates or volumes from the site. Any potential increase in runoff rates or volumes would solely result from the allowance for climate change, therefore these increases would occur regardless of the proposed development.
- 4.25 As discussed previously, the developed site will contain raised planters (approximately 12m²) and a green roof at the top of the main building. The planters will not be formally drained and, therefore, runoff from these planted areas will not enter the drainage network.
- 4.26 The green roof will encompass an area of approximately 74m². As well as having the ability to improve the quality of runoff, green roofs have the ability to attenuate rainfall runoff, depending on the depth of substrate and gradient of the roof. Runoff coefficients for the green roof areas have been adapted accordingly in accordance with

the guidelines found in Table 10.1 of CIRIA C644¹⁰ *“Building Greener: Guidance on the use of green roofs, green walls and complementary features on buildings”*.

- 4.27 The depth of substrate of the green roof has been assumed to be between 100mm and 150mm, with a roof gradient less than 15°, resulting in a runoff coefficient of 0.4 for the green roof area. Therefore, the site's area weighted rational method runoff coefficient post-development will be 0.88. This represents an improvement on the site's existing area weighted rational method runoff coefficient of 0.95, which results from its present entirely impermeable state.

Peak Flow Control

- 4.28 A 5.0 minute critical storm (M5-60 of 17mm and an 'R' value of 0.4) has been applied to calculate design rainfall intensities and peak rates of runoff for the proposed site. To allow for the effects of climate change over the lifetime of the development, a 30% increase in the peak rate of runoff has been applied to the post-development calculations.
- 4.29 If no mitigation measures were to be taken, the unrestricted runoff rate post-development would be 7.1l/s and 20.8l/s (same as pre-development as the area was 100% hardstanding) and would increase to 9.2 l/s and 27.0 l/s in the 1-year and 100-year return period rainfall events respectively as a result of climate change.
- 4.30 As a result of the integration of the green roof and raised planters, discharge rates will be reduced post development to 6.4l/s and 18.7l/s for the 1-year and 100-year return period rainfall events respectively. However, allowing for an increase in rainfall intensities of 30% over the lifetime of the development the runoff rates for the post-development site would increase to 8.3l/s and 24.4l/s in the 1-year and 100-year return period events respectively.
- 4.31 The post development discharge rates from the site with the green roof and raised planters incorporated can be seen on Table 3. These are included for proposed site under both present day and future (with climate change) scenarios, and include a comparison to existing discharge rates shown in brackets.

Return Period (years)	Intensity (mm/hr)	Peak Runoff Rate (l/s) and change from existing rates
1	48.3	6.4 (-0.7)
1 plus climate change	62.8	8.3 (+1.2)
100	141.9	18.7 (-2.1)
100 plus climate change	184.5	24.4 (+3.6)

Table 3 – Post development discharge rates (with and without the impact of climate change)

¹⁰ CIRIA, C644 Building Greener – Guidance on the use of green roofs, green walls and complementary features on buildings, 2006

- 4.32 In order to satisfy the requirements outlined by Thames Water in the Pre-Development enquiry, surface water discharge to the public sewer will be restricted to 5l/s. In order to accommodate this restriction, preliminary calculations indicate that an attenuation tank with a volume of 7.6m³ will be required beneath the basement of the proposed development.
- 4.33 Depending on the level of the public sewer, a pump may be required to discharge surface water to the Thames Water network. If the surrounding sewer infrastructure is sufficiently low as to allow the site to drain by gravity, then a Hydrobrake or similar control device will be required to restrict the rates to 5l/s. This is commonly accepted as the lowest practicable discharge rate, as to restrict to lower rates would result in an unacceptably high risk of blockage.
- 4.34 The strategy is therefore considered compliant with regards to peak flow control.

Volume Control

- 4.35 As well as attenuating the peak rate of runoff, the green roof will also serve to reduce the runoff volume post-development through interception storage and absorption of rainfall by the vegetation and substrate.
- 4.36 The additional volume of rainwater runoff above the Greenfield runoff volume for the 100 year return period, for a critical 6 hour duration storm from the post-development site is calculated as 26m³. This represents an increase of 5.5m³ compared to the volume produced from the existing site, and is solely as a result of the allowance for a 30% increase in rainfall intensities as a result of climate change. However, the incorporation of the green roof will decrease the runoff volume to 24.3m³ via interception and absorption by the vegetation and substrate.
- 4.37 Infiltration is not viable at the site. The raised planters and the green roof will therefore serve to reduce the post-development runoff volume as much as is reasonably practicable.
- 4.38 The site does not lie in a critical drainage area, known to suffer from surface water volume issues, nor is it served by a public sewer which experiences tide locking. As such, it is considered that the reduction of the post-development runoff rates and volume will be sufficient to provide a betterment to the current situation and mitigate flood risk.
- 4.39 The strategy is therefore considered compliant with regards to volume control.

SuDS Management and Maintenance

- 4.40 Management and maintenance of the drainage network, including the green roof areas, will be the responsibility of the freeholder of the site. Management and maintenance agreements and plans will be arranged prior to completion of development.
- 4.41 Management and maintenance of the green roof should be carried out in accordance with the green roof supplier's guidance and specification.

5 CONCLUSIONS AND RECOMMENDATIONS

- 5.1 The proposed development will not increase the impermeable area on site. As such, any potential increase in surface water runoff rates post-development would solely be as a result of the allowance for climate change over the lifetime of the development.
- 5.2 The most appropriate SuDS option identified for the development is the incorporation of a green roof and raised planters on the building's roof area. Infiltration is not appropriate at the site and open watercourses are not feasible due to a lack of space.
- 5.3 The post-development runoff rates will be restricted to 5l/s, the lowest practicable rate of discharge, through the incorporation a control device and attenuation storage beneath the basement. This represents a reduction of existing peak runoff rates from the site.
- 5.4 The green roof and raised planters will aid in the attenuation of peak surface water runoff rates and runoff volumes via interception and absorption of rainfall. Green roofs also provide biodiversity and water quality improvement benefits.
- 5.5 The site does not lie in a critical drainage area, known to suffer from surface water volume issues, nor is it served by a public sewer which experiences tide locking. The reduction of the post-development runoff rates will provide a betterment to the existing situation and therefore reduce flood risk.
- 5.6 The sustainable drainage strategy is considered compliant with the DEFRA SuDS guidance, issued in March 2015.
- 5.7 Management and maintenance of the green roof should be carried out in accordance with the green roof supplier's guidance and specification.

APPENDIX A – DRAWINGS

Drawing 1 – Existing Topographical Survey

WCEC Architects Drawing No. PL-03

This drawing is a topographical survey that illustrates the existing site location and boundary.

Drawing 2 – Roof Plan

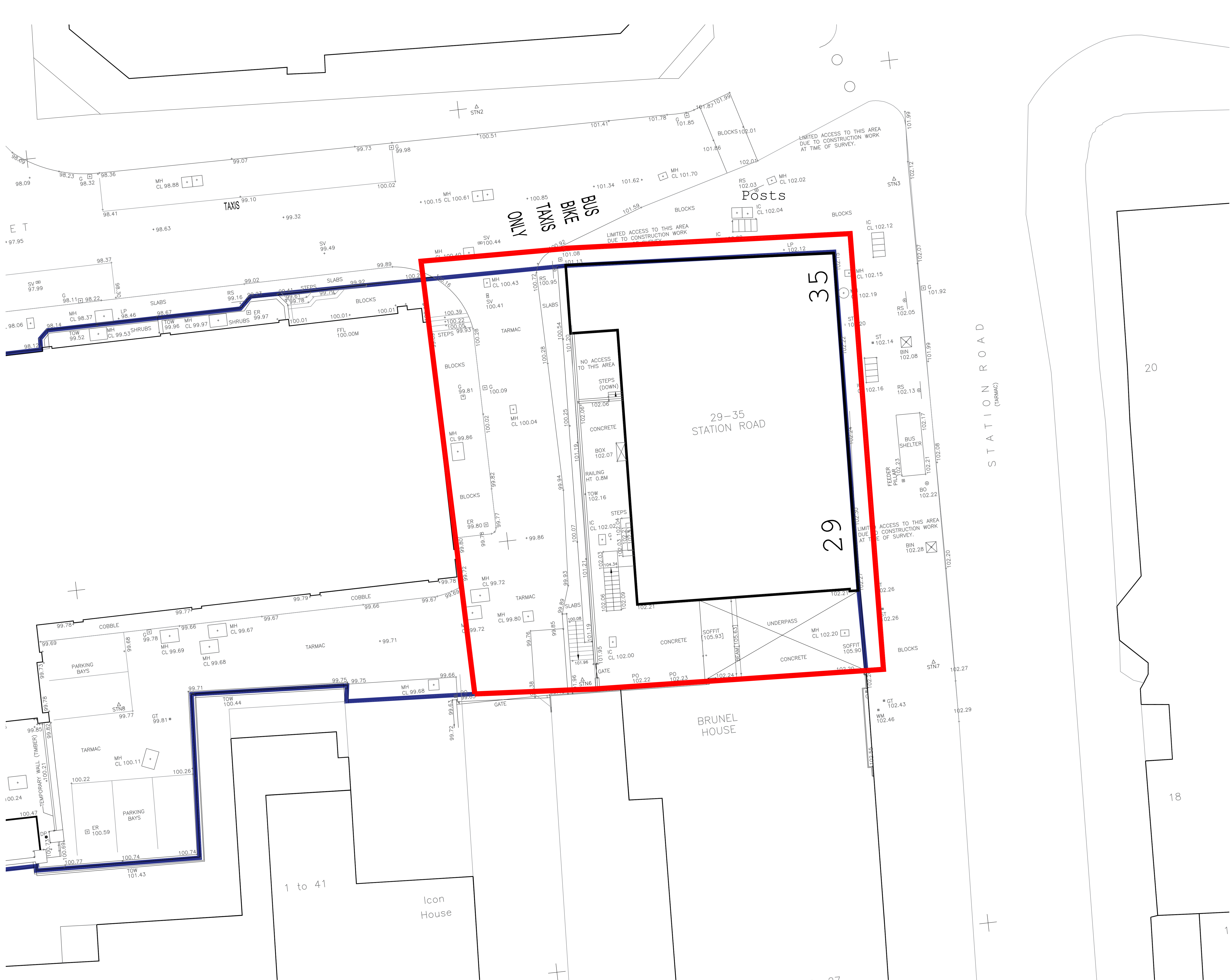
WCEC Architects Drawing No. PL-141C

This drawing illustrates the roof plan of the proposed development with the green roof.

Drawing 3 – Thames Water Asset Location Plan

Thames Water Asset Location Plan

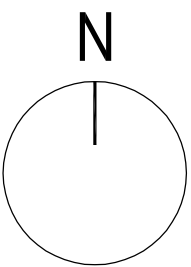
Thames Water map showing the location of any surface water, foul water, and combined sewers in the vicinity of the site.



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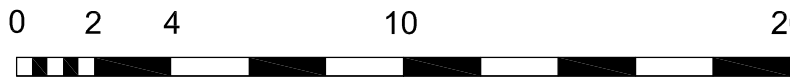
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SITE BOUNDARY



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SURVEY

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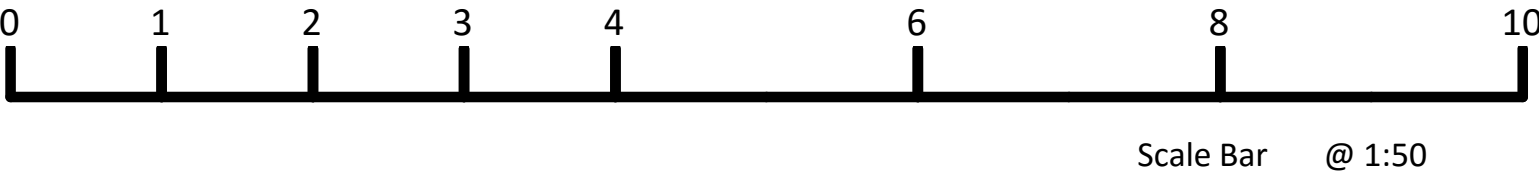
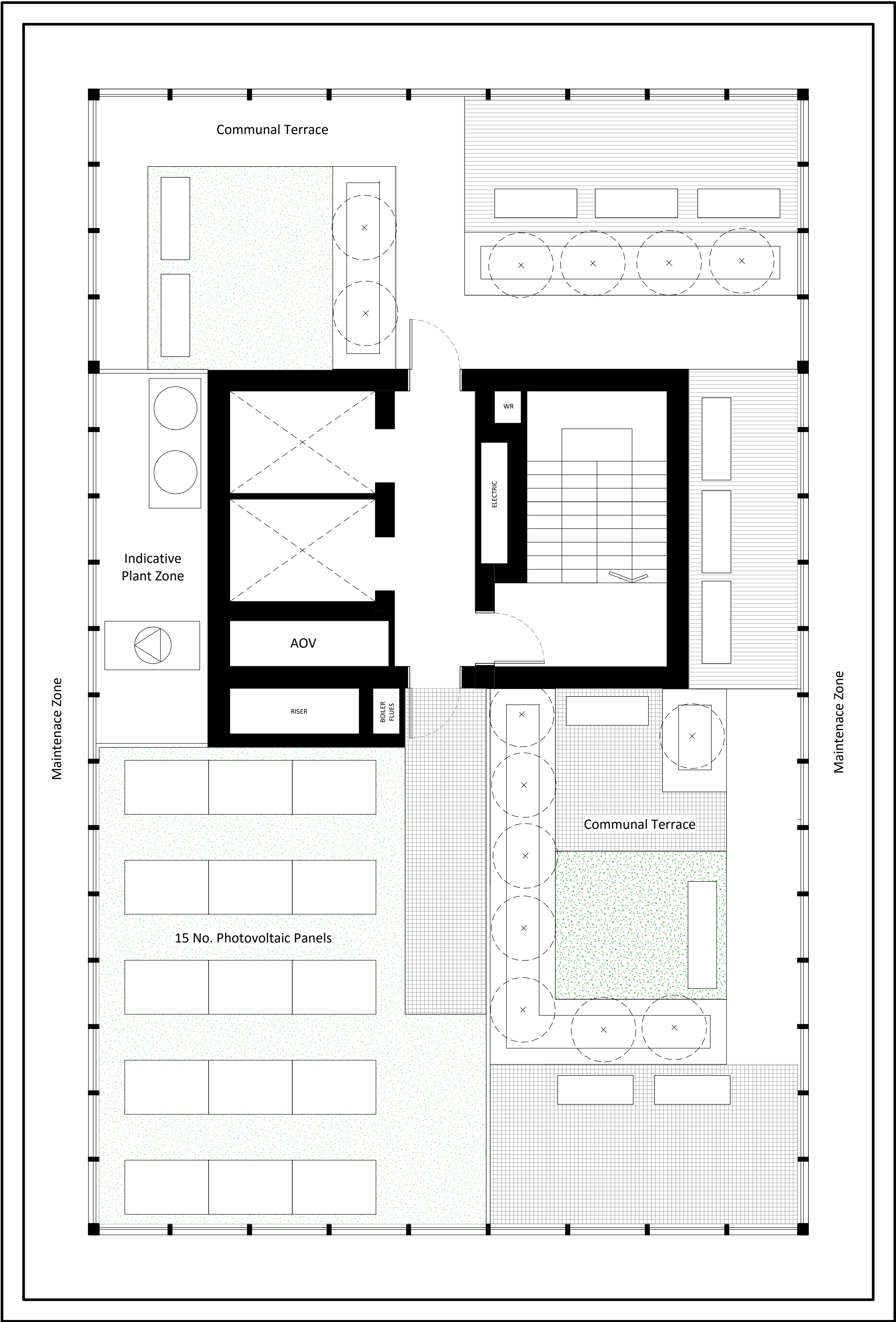
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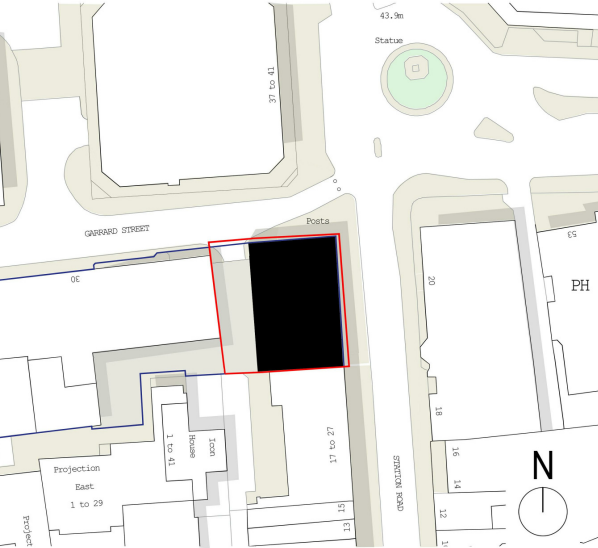
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PROPOSED ROOF PLAN



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Materials known to contain asbestos contaminated materials (ACM's) in the manufacture or installation process have not been specified and must not be used on this project



KEY PLAN

C	16.09.16	PV array amended based on Energy Statement requirements	PD
B	14.07.16	Planning Issue	CHP D
A	08.07.16	Amendments following pre-application scoping meeting	PD
No	Date	Description	By Ckd

CLIENT
TITAN PROPERTIES

PROJECT
29-35 STATION ROAD

TITLE
Roof Plan

DRAWING STATUS
FOR PLANNING

DRAWN	PD	CHECKED	JA
SCALE	As indicated @ A1		
DATE	26/05/16		

WCECarchitects

4th Floor, South Building, Staple Inn Buildings,
High Holborn, London, WC1V 7PZ
Carnwood Court, Carnwood Road,
Sheepbridge, Chesterfield, S41 9QB

t: 020 3388 0019, e: email@wcec.co.uk, www.wcec.co.uk

JOB NO.	DRAWING NO.	REV
15-211	PL141	C

Asset Location Search



Hydrock
Third Floor Merchants House North
Wapping Road
BRISTOL
BS1 4RW

Search address supplied 29-35
Station Road
Reading
RG1 1NR

Your reference N/A

Our reference ALS/ALS Standard/2014_2859505

Search date 9 September 2014

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk



Asset Location Search



Search address supplied: 29-35, Station Road, Reading, RG1 1NR

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This search provides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk

Web: www.thameswater-propertysearches.co.uk

Asset Location Search



Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and

Asset Location Search



pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Asset Location Search



Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
461B	n/a	n/a
471A	n/a	n/a
4756	n/a	n/a
4757	n/a	n/a
571A	n/a	n/a
5701	44.08	39.83
4707	44.01	39.53
4758	n/a	n/a
4705	44.01	34.08
5702	42.51	33.45
4751	43.65	40.84
4704	n/a	n/a
4702	n/a	n/a
4752	n/a	n/a
4701	n/a	n/a
4753	n/a	n/a
551A	n/a	n/a
56EN	n/a	n/a
561C	n/a	n/a
56MM	n/a	n/a
561B	n/a	n/a
56MN	n/a	n/a
461A	n/a	n/a
5602	45.13	n/a
5604	n/a	n/a
5603	n/a	n/a
561A	n/a	n/a
46NL	n/a	n/a
5601	44.61	40.83
4659	n/a	n/a
461D	n/a	n/a
4653	42.67	41.26
461G	n/a	n/a
461C	n/a	n/a
4606	41.29	39.93
4654	39.53	n/a
4655	39.49	38.06
4706	38.12	n/a
4652	44.08	42.78
4656	n/a	n/a
4657	n/a	n/a
461E	n/a	n/a
461F	n/a	n/a
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		



ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

	Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Trunk Surface Water
	Trunk Foul
	Storm Relief
	Trunk Combined
	Vent Pipe
	Bio-solids (Sludge)
	Proposed Thames Surface Water Sewer
	Proposed Thames Water Foul Sewer
	Gallery
	Foul Rising Main
	Surface Water Rising Main
	Combined Rising Main
	Sludge Rising Main
	Proposed Thames Water Rising Main
	Vacuum

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
- 5) 'na' or '0' on a manhole level indicates that data is unavailable.

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

	Air Valve
	Dam Chase
	Fitting
	Meter
	Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

	Control Valve
	Drop Pipe
	Ancillary
	Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

	Outfall
	Undefined End
	Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

	Public/Private Pumping Station
	Change of characteristic indicator (C.O.C.I.)
	Invert Level
	Summit

Areas

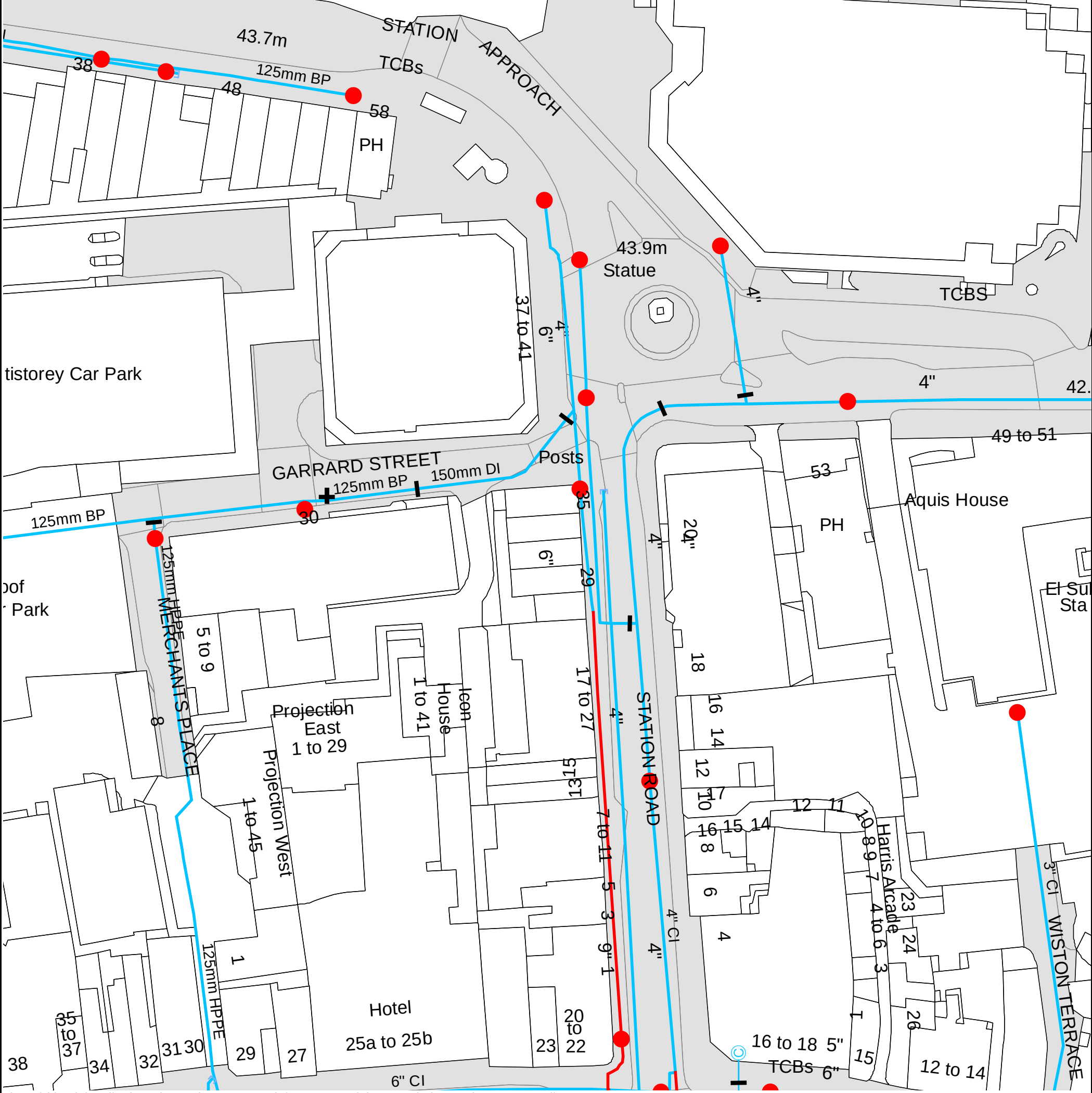
Lines denoting areas of underground surveys, etc.

	Agreement
	Operational Site
	Chamber
	Tunnel
	Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

	Foul Sewer
	Surface Water Sewer
	Combined Sewer
	Gully
	Culverted Watercourse
	Proposed
	Abandoned Sewer

- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 471492, 173692.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.



ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

- 4"** **Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- 16"** **Trunk Main:** A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.
- 3" SUPPLY** **Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.
- 3" FIRE** **Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- 3" METERED** **Metered Pipe:** A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.
- Transmission Tunnel:** A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.
- Proposed Main:** A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

- Other Water Company Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
- Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL's terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking	Cheque
Call 0845 070 9148 quoting your invoice number starting CBA or ADS.	Account number 90478703 Sort code 60-00-01 A remittance advice must be sent to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW. or email ps.billing@thameswater.co.uk	By calling your bank and quoting: Account number 90478703 Sort code 60-00-01 and your invoice number	Made payable to ' Thames Water Utilities Ltd ' Write your Thames Water account number on the back. Send to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW or by DX to 151280 Slough 13

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.



Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

APPENDIX B – DRAINAGE CALCULATIONS

ANNEX A: CALCULATIONS		COVER SHEET																																							
Job No. Job Name Engineer Checked By Date	15040 29-35 Station Rd, Reading Brendan Twomey BT Guy Laister GL 06-09-2016																																								
Site Characteristics																																									
Site Area (ha) Existing Pervious Surfaces (ha) Existing Impervious Surfaces (ha) Total: 0.0555	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">Overall</td> <td colspan="2" style="text-align: center;">Discharging from site</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0%</td> <td style="text-align: center;">0</td> <td style="text-align: center;">β 0%</td> </tr> <tr> <td style="text-align: center;">0.0555</td> <td style="text-align: center;">100%</td> <td style="text-align: center;">0.0555</td> <td style="text-align: center;">α 100%</td> </tr> </table> Total: 0.0555	Overall		Discharging from site		0	0%	0	β 0%	0.0555	100%	0.0555	α 100%																												
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Green Roof Type: sedum-herbaceus-grass plants >10-15 cm Course Depth Construction Depth: 100-150mm Gradient: of up to 15°,																																									
Peak Rate of Runoff																																									
Existing Site Detailed Modelling Used? Runoff Calculation Method (Existing) Runoff Calculation Method (Proposed) Allowance for Future Climate Change Surface Water Management Strategy	BROWNFIELD No e.g. Microdrainage, HydroCAD, Multiple Catchments Wallingford/Modified Rational Calculation Sheets Attached Wallingford/Modified Rational Calculation Sheets Attached To 2115 30% Attenuated on Site																																								
Existing Discharge Rate IoH Greenfield Discharge Rate (full site) Detailed modelling output/FEH: Limiting Discharge Rate Post-Development Discharge Rate Detailed modelling output: including allowance for climate change Proposed Discharge Rate Bespoke Limiting Discharge Rate Design discharge rate: Minimum Storage Required	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">1yr</th> <th style="text-align: center;">30yr</th> <th style="text-align: center;">100yr</th> <th></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">7.1</td> <td style="text-align: center;">16.5</td> <td style="text-align: center;">20.8</td> <td style="text-align: center;">l/s</td> </tr> <tr> <td style="text-align: center;">0.0</td> <td style="text-align: center;">0.0</td> <td style="text-align: center;">0.0</td> <td style="text-align: center;">l/s</td> </tr> <tr> <td style="text-align: center;">7.1</td> <td style="text-align: center;">16.5</td> <td style="text-align: center;">20.8</td> <td style="text-align: center;">l/s</td> </tr> <tr> <td style="text-align: center;">6.4</td> <td style="text-align: center;">14.9</td> <td style="text-align: center;">18.7</td> <td style="text-align: center;">l/s</td> </tr> <tr> <td style="text-align: center;">8.3</td> <td style="text-align: center;">19.3</td> <td style="text-align: center;">24.4</td> <td style="text-align: center;">l/s</td> </tr> <tr> <td style="text-align: center;">7.1</td> <td style="text-align: center;">16.5</td> <td style="text-align: center;">20.8</td> <td style="text-align: center;">l/s</td> </tr> <tr> <td style="text-align: center;">5.0</td> <td style="text-align: center;">5.0</td> <td style="text-align: center;">5.0</td> <td style="text-align: center;">l/s</td> </tr> <tr> <td style="text-align: center;">5.0</td> <td style="text-align: center;">5.0</td> <td style="text-align: center;">5.0</td> <td style="text-align: center;">l/s</td> </tr> <tr> <td style="text-align: center;">0.6</td> <td style="text-align: center;">4.6</td> <td style="text-align: center;">7.6</td> <td style="text-align: center;">m³</td> </tr> </tbody> </table> Bespoke Rate	1yr	30yr	100yr		7.1	16.5	20.8	l/s	0.0	0.0	0.0	l/s	7.1	16.5	20.8	l/s	6.4	14.9	18.7	l/s	8.3	19.3	24.4	l/s	7.1	16.5	20.8	l/s	5.0	5.0	5.0	l/s	5.0	5.0	5.0	l/s	0.6	4.6	7.6	m ³
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Volume of Runoff																																									
Additional Volume (above Greenfield) of Runoff Generated																																									
Existing Site Proposed Site (unmitigated) Rainwater retained on-site for re-use (where limited) Long Term Storage Required Proposed Site (including soakaways/infiltration SUDS)	20.5 m ³ 26.0 m ³ 0.0 m ³ 5.5 m ³ 24.3 m ³																																								
Off-site discharge must be restricted and storage provided Justification for not using infiltration or preventing discharge: Ground conditions inappropriate																																									
<table style="width: 100%;"> <tr> <td style="width: 30%;">1yr</td> <td style="width: 15%;">Qbar</td> <td style="width: 15%;">2 l/s/ha</td> <td style="width: 40%;">Min Flow*</td> </tr> <tr> <td>Limiting discharge rates:</td> <td>7.1</td> <td>0.01</td> <td>0.111 5 (l/s)</td> </tr> </table> *as stated in the Code for Sustainable Homes		1yr	Qbar	2 l/s/ha	Min Flow*	Limiting discharge rates:	7.1	0.01	0.111 5 (l/s)																																
1yr	Qbar	2 l/s/ha	Min Flow*																																						
Limiting discharge rates:	7.1	0.01	0.111 5 (l/s)																																						
Preferred Limiting Discharge Rate: 7.1 l/s Design and model outputs attached																																									

IH124 : Greenfield Peak Runoff		15040	29-35 Station Rd, Reading																						
		Calculations By: BT	Checked By: GL	Date: 06-09-16																					
Catchment Area Standard average annual rainfall 1941 - 1970 Soil Index (from FSR or Wallingford Procedure WRAP maps)*	AREA SAAR SOIL	ha mm	0.0555 642 0.1																						
*SOIL is the SPR for the soil type, and for larger sites is a weighted sum of the individual soil classes for the site, where: $SOIL = \frac{0.1A_{SOIL1} + 0.3A_{SOIL2} + 0.37A_{SOIL3} + 0.47A_{SOIL4} + 0.53A_{SOIL5}}{AREA}$ For smaller sites, use the SPR for the local soil type, as follows: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 15%;">SOIL TYPE</th> <th style="width: 10%;">1</th> <th style="width: 10%;">2</th> <th style="width: 10%;">3</th> <th style="width: 10%;">4</th> <th style="width: 10%;">5</th> </tr> </thead> <tbody> <tr> <td>AREA</td> <td>0.0555</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>SPR</td> <td>0.1</td> <td>0.3</td> <td>0.37</td> <td>0.47</td> <td>0.53</td> </tr> </tbody> </table> SOIL: 0.1					SOIL TYPE	1	2	3	4	5	AREA	0.0555	0	0	0	0	SPR	0.1	0.3	0.37	0.47	0.53			
SOIL TYPE	1	2	3	4	5																				
AREA	0.0555	0	0	0	0																				
SPR	0.1	0.3	0.37	0.47	0.53																				
QBAR = 0.00108 . (0.01AREA)^{0.89} . SAAR^{1.17} . SOIL^{2.17} * The site area is less than 50ha. Since the loH124 methodology is not calibrated for sites less than 50ha in area, the calculation should be undertaken based on a 50ha site area and proportionately adjusted based on the ratio of the site size to 50ha.																									
		QBAR _{50ha} QBAR/ha QBAR_{site}	l/s l/s/ha l/s	7.59 0.15 0.01																					
		Hydrological Area	fig 4.2	6																					
		<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 30%;">Return Period (years)</th> <th style="width: 30%;">Growth Factor (table 4.3)</th> <th style="width: 40%;">Discharge rate l/s</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.85</td> <td>0.01</td> </tr> <tr> <td>2</td> <td>0.88</td> <td>0.01</td> </tr> <tr> <td>10</td> <td>1.62</td> <td>0.01</td> </tr> <tr> <td>30</td> <td>2.3</td> <td>0.02</td> </tr> <tr> <td>50</td> <td>2.62</td> <td>0.02</td> </tr> <tr> <td>100</td> <td>3.19</td> <td>0.03</td> </tr> </tbody> </table>	Return Period (years)	Growth Factor (table 4.3)	Discharge rate l/s	1	0.85	0.01	2	0.88	0.01	10	1.62	0.01	30	2.3	0.02	50	2.62	0.02	100	3.19	0.03		
Return Period (years)	Growth Factor (table 4.3)	Discharge rate l/s																							
1	0.85	0.01																							
2	0.88	0.01																							
10	1.62	0.01																							
30	2.3	0.02																							
50	2.62	0.02																							
100	3.19	0.03																							

Figures and table references from CIRIA C753 The SUDS Manual © CIRIA 2015

Wallingford Procedure : Existing Peak Runoff		15040	29-35 Station Rd, Reading	
		Calculations By: BT	Checked By: GL	Date: 06-09-16
Site Characteristics				
Site Area	AREA	ha	0.0555	
Drained Catchment Area	AREA	ha	0.0555	
Approximate Longest Drainage Path	L	m	15	
Difference in Ground Levels	ΔH	m	0.15	
Slope	Slope (S)		1: 100	
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	0%	
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	100%	
Area Weighted Rational Method Runoff Coefficient			0.950	
Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)				
60minute, 5 year return period rainfall	M5-60	mm	17	
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40	
Time of Concentration				
Recommended Tc Method:	SCS: Sheet Flow			
Tc Method Choice:	SCS: Sheet Flow			
Sheet Flow				
Surface Description	Concrete (smooth)			
Slope	Shallow			
Roughness Coefficient (Manning's n)	0.017			
Flow Length, L	m	15		
M2-24hr	mm	31.74		
Land Slope	m/m	0.01000		
Tc	hr	0.03		
Time of Concentration	T _c	min	2.1	
Critical Storm Duration (minimum 5min)	T _{crit}	min	5.0	
Critical Storm Rainfall and Runoff				
Z1 _{TC}	0.38 *Wallingford Procedure Figure 3.6			Discharge Rate Q = 2.78CiA
M5-T _{crit}	6.5			
C	0.950			
Return Period (years)	Z2*	Depth (mm)	Intensity (mm/hr)	Discharge Rate l/s
1	0.62	4.0	48.3	7.08
2	0.79	5.1	61.8	9.06
10	1.20	7.8	93.5	13.71
30	1.44	9.4	112.6	16.50
50	1.58	10.3	123.4	18.09
100	1.81	11.8	141.9	20.79
*Wallingford Procedure Table 3.2				

Wallingford Procedure : Developed Peak Runoff			15040	29-35 Station Rd, Reading	
			Calculations By: BT	Checked By: GL	Date: 06-09-16
Site Characteristics					
Site Area	AREA	ha	0.0555		
Drained Catchment Area	AREA	ha	0.0543		
Approximate Longest Drainage Path	L	m	13		
Difference in Ground Levels	ΔH	m	0.1		
Slope	Slope (S)		1: 130		
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	0%		
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	86%		
Green Roof of gradient of up to 15°, and depth of 100-150mm, c=		0.4 *	14%		
Area Weighted Rational Method Runoff Coefficient			0.88		
*in line with Table 10.1 of CIRIA C644					
Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)					
60minute, 5 year return period rainfall	M5-60	mm	17		
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40		
Time of Concentration					
Recommended Tc Method:	SCS: Sheet Flow				
Tc Method Choice:	SCS: Sheet Flow				
Sheet Flow					
Surface Description			Short Grass		
Slope			Shallow		
Roughness Coefficient (Manning's n)			0.035		
Flow Length, L	m		13		
M2-24hr	mm		31.74		
Land Slope	m/m		0.00769		
Tc	hr		0.06		
Time of Concentration	T _c	min	3.6		
Critical Storm Duration (minimum 5min)	T _{crit}	min	5.0		
Critical Storm Rainfall and Runoff					
Z1 _{TC}	0.38 *Wallingford Procedure Figure 3.6				Discharge Rate Q = 2.78CiA
M5-T _{crit}	6.5				
C	0.875				
Return Period (years)	Z2*	Depth (mm)	Intensity (mm/hr)	Discharge Rate l/s	Future Rate l/s
1	0.62	4.0	48.3	6.38	8.30
2	0.79	5.1	61.8	8.16	10.61
10	1.20	7.8	93.5	12.35	16.06
30	1.44	9.4	112.6	14.87	19.33
50	1.58	10.3	123.4	16.30	21.19
100	1.81	11.8	141.9	18.74	24.36
*Wallingford Procedure Table 3.2					

MRM 100 year Event Storage Calculator		15040	29-35 Station Rd, Reading																										
		Calculations By: BT	Checked By: GL Date: 06-09-16																										
Site Parameters																													
Drained Catchment Area	AREA	ha	0.0543																										
Approximate Longest Drainage Path	L	m	13																										
Difference in Ground Levels	ΔH	m	0.1																										
Slope	Slope (S)		1: 130																										
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Green Roof of gradient _____ of up to 15°, _____ and depth of 100-150mm , c=		0.4 *	14%																										
Area Weighted Rational Method Runoff Coefficient			0.88																										
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Time of Concentration	T_c	min	3.6																										
Maximum Storm Runoff Storage Volume (modified rational method)																													
5																													
T_d	20.0	min																											
$Z1_{TD}$	0.70 *Wallingford Procedure Figure 3.6																												
M5- T_d	11.9	mm																											
C	0.88																												
$Z2_{100}$	1.94 *Wallingford Procedure Table 3.2																												
M100- T_d	23.1	mm																											
Intensity	69.3	mm/hr																											
Q_d	9.2	l/s																											
$Q_{d,climate\ change}$	11.9	l/s																											
$Q_{limiting\ discharge}$	5.0	l/s																											
Maximum storage required			m ³ 7.6																										
Storage Requirements <table border="1"> <caption>Storage Requirements Data</caption> <thead> <tr> <th>Storm Duration (mins)</th> <th>Storage Volume (m³)</th> </tr> </thead> <tbody> <tr><td>5</td><td>5.0</td></tr> <tr><td>10</td><td>6.2</td></tr> <tr><td>15</td><td>6.8</td></tr> <tr><td>20</td><td>7.6</td></tr> <tr><td>25</td><td>7.0</td></tr> <tr><td>30</td><td>6.2</td></tr> <tr><td>35</td><td>5.5</td></tr> <tr><td>40</td><td>4.8</td></tr> <tr><td>45</td><td>4.2</td></tr> <tr><td>50</td><td>3.8</td></tr> <tr><td>55</td><td>3.4</td></tr> <tr><td>60</td><td>3.0</td></tr> </tbody> </table>				Storm Duration (mins)	Storage Volume (m³)	5	5.0	10	6.2	15	6.8	20	7.6	25	7.0	30	6.2	35	5.5	40	4.8	45	4.2	50	3.8	55	3.4	60	3.0
Storm Duration (mins)	Storage Volume (m³)																												
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45	4.2																												
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55	3.4																												
60	3.0																												

MRM 30 year Event Storage Calculator		15040	29-35 Station Rd, Reading																									
		Calculations By: BT	Checked By: GL	Date: 06-09-16																								
Site Parameters																												
Drained Catchment Area	AREA	ha	0.0543																									
Approximate Longest Drainage Path	L	m	13																									
Difference in Ground Levels	ΔH	m	0.1																									
Slope	Slope (S)		1: 130																									
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Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	86%																									
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Area Weighted Rational Method Runoff Coefficient			0.88																									
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T_d	20.0	min																										
$Z1_{TD}$	0.70 *Wallingford Procedure Figure 3.6																											
M5- T_d	11.9	mm																										
C	0.88																											
$Z2_{30}$	1.50 *Wallingford Procedure Table 3.2																											
M30- T_d	17.9	mm																										
Intensity	53.7	mm/hr																										
Q_d	7.1	l/s																										
$Q_{d,climate\ change}$	9.2	l/s																										
$Q_{limiting\ discharge}$	5.0	l/s																										
Maximum storage required			m^3	4.6																								
Storage Requirements <table border="1"> <caption>Data points for Storage Requirements graph</caption> <thead> <tr> <th>Storm Duration (mins)</th> <th>Storage Volume (m^3)</th> </tr> </thead> <tbody> <tr><td>5</td><td>3.5</td></tr> <tr><td>10</td><td>4.2</td></tr> <tr><td>15</td><td>4.4</td></tr> <tr><td>20</td><td>4.6</td></tr> <tr><td>25</td><td>3.8</td></tr> <tr><td>30</td><td>2.8</td></tr> <tr><td>35</td><td>1.8</td></tr> <tr><td>40</td><td>0.8</td></tr> <tr><td>45</td><td>0.2</td></tr> <tr><td>50</td><td>0.0</td></tr> <tr><td>60</td><td>0.0</td></tr> </tbody> </table>					Storm Duration (mins)	Storage Volume (m^3)	5	3.5	10	4.2	15	4.4	20	4.6	25	3.8	30	2.8	35	1.8	40	0.8	45	0.2	50	0.0	60	0.0
Storm Duration (mins)	Storage Volume (m^3)																											
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MRM 1 year Event Storage Calculator		15040	29-35 Station Rd, Reading																																																	
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M5- T_d	6.5	mm																																																		
C	0.88																																																			
$Z2_1$	0.62 *Wallingford Procedure Table 3.2																																																			
M1- T_d	4.0	mm																																																		
Intensity	48.2	mm/hr																																																		
Q_d	6.4	l/s																																																		
$Q_{d,climate\ change}$	8.3	l/s																																																		
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SUDS Manual Volume Calculation (Existing)		15040	29-35 Station Rd, Reading																			
		Calculations By: BT	Checked By: GL	Date: 06-09-16																		
Site Characteristics																						
Site Area	AREA	ha	0.0555																			
Permeable Surfaces (Existing Case)																						
Proportion discharging to sewer network or local watercourses	β		0%																			
*zero if all runoff collected from unpaved surfaces is retained on site or discharged to ground																						
Impermeable Surfaces (Existing Case)																						
Proportion discharging to sewer network or local watercourses	α		100%																			
*zero if all runoff from paved surfaces remains on site or is collected and discharged to ground																						
Soil Index (from FSR or Wallingford Procedure WRAP maps)*	SOIL		0.1																			
*SOIL is the SPR for the soil type, and for larger sites is a weighted sum of the individual soil classes for the site, where: $SOIL = \frac{0.1A_{SOIL1} + 0.3A_{SOIL2} + 0.37A_{SOIL3} + 0.47A_{SOIL4} + 0.53A_{SOIL5}}{AREA}$ For smaller sites, use the SPR for the local soil type, as follows: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="text-align: left; padding: 5px;">SOIL TYPE</th> <th style="text-align: center; padding: 5px;">1</th> <th style="text-align: center; padding: 5px;">2</th> <th style="text-align: center; padding: 5px;">3</th> <th style="text-align: center; padding: 5px;">4</th> <th style="text-align: center; padding: 5px;">5</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">AREA</td> <td style="text-align: center; padding: 5px;">0.0555</td> <td style="text-align: center; padding: 5px;">0</td> <td style="text-align: center; padding: 5px;">0</td> <td style="text-align: center; padding: 5px;">0</td> <td style="text-align: center; padding: 5px;">0</td> </tr> <tr> <td style="padding: 5px;">SPR</td> <td style="text-align: center; padding: 5px;">0.1</td> <td style="text-align: center; padding: 5px;">0.3</td> <td style="text-align: center; padding: 5px;">0.37</td> <td style="text-align: center; padding: 5px;">0.47</td> <td style="text-align: center; padding: 5px;">0.53</td> </tr> </tbody> </table> SOIL: 0.1					SOIL TYPE	1	2	3	4	5	AREA	0.0555	0	0	0	0	SPR	0.1	0.3	0.37	0.47	0.53
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AREA	0.0555	0	0	0	0																	
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Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)																						
60minute, 5 year return period rainfall	M5-60	mm	17																			
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40																			
Volume Calculation for the 100 year return period 6hr storm																						
Z _{16hr}	1.55 *Wallingford Procedure Figure 3.6																					
M5-6hr	26.4																					
Z _{100yr}	2.00 *Wallingford Procedure Table 3.2																					
M100-6hr	52.9																					
Additional volume (m³) of existing site runoff over Greenfield runoff: $Vol = "M100-6hr".AREA.10[PIMP/100 (0.8\alpha) + (1 - PIMP/100)SOIL . \beta - SOIL]$																						
* EQ24.10 CIRIA C753 The SUDS Manual © CIRIA 2015																						
Additional Volume of Runoff (above Greenfield state):			m³	20.5																		

SUDS Manual Volume Calculation (Proposed)		15040	29-35 Station Rd, Reading																					
		Calculations By: BT	Checked By: GL	Date: 06-09-16																				
Site Characteristics																								
Site Area	AREA	ha	0.0555																					
Permeable Surfaces (Proposed Case)			2%																					
Proportion discharging to sewer network or local watercourses	β		0%																					
*zero if all runoff collected from unpaved surfaces is retained on site or discharged to ground																								
Impermeable Surfaces (Proposed Case)	PIMP		98%																					
Proportion discharging to sewer network or local watercourses	α		100%																					
*zero if all runoff from paved surfaces remains on site or is collected and discharged to ground																								
Soil Index (from FSR or Wallingford Procedure WRAP maps)*	SOIL		0.1																					
*SOIL is the SPR for the soil type, and for larger sites is a weighted sum of the individual soil classes for the site, where: $SOIL = \frac{0.1A_{SOIL1} + 0.3A_{SOIL2} + 0.37A_{SOIL3} + 0.47A_{SOIL4} + 0.53A_{SOIL5}}{AREA}$ For smaller sites, use the SPR for the local soil type, as follows: <table border="1"> <thead> <tr> <th>SOIL TYPE</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th></th> </tr> </thead> <tbody> <tr> <td>AREA</td> <td>0.0555</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td rowspan="2">SOIL: 0.1</td> </tr> <tr> <td>SPR</td> <td>0.1</td> <td>0.3</td> <td>0.37</td> <td>0.47</td> <td>0.53</td> </tr> </tbody> </table>					SOIL TYPE	1	2	3	4	5		AREA	0.0555	0	0	0	0	SOIL: 0.1	SPR	0.1	0.3	0.37	0.47	0.53
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Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40																					
Volume Calculation for the 100 year return period 6hr storm																								
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M5-6hr	26.4																							
Z _{2100yr}	2.00	*Wallingford Procedure Table 3.2																						
M100-6hr	52.9																							
With Climate Change	68.7	30%																						
Additional volume (m ³) of development runoff over Greenfield runoff:																								
$Vol = M100-6hr.AREA.10 \left[\frac{PIMP}{100} (0.8\alpha) + \left(1 - \frac{PIMP}{100} \right) SOIL . \beta - SOIL \right]$																								
* EQ24.10 CIRIA C753 The SUDS Manual © CIRIA 2015																								
Additional Rainfall Volume (above Greenfield state) for the developed site:			m³	26.0																				

SUDS Manual Volume Calculation (Developed)		15040	29-35 Station Rd, Reading																				
		Calculations By: BT	Checked By: GL	Date: 06-09-16																			
Site Characteristics																							
Catchment Area	AREA	ha	0.0555																				
Permeable Surfaces (Proposed Case)	PGF		2%																				
Areas discharging to soakaway or prevented from leaving site via mitigation	β	ha	0																				
			100%																				
Impermeable Surfaces (Proposed Case)	PIMP		85%																				
Areas discharging to soakaway or prevented from leaving site via mitigation	α	ha	0																				
			100%																				
Green Roof Area (Proposed Case)	PGR	Depth of Green Roof	13%																				
Annual coefficient of discharge*	ψ_a	>10-15 cm	0.45																				
<i>*Inline with Table 3 of the FLL Planning, Execution and Upkeep of Green-roof sites, 2002</i>																							
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<i>* Modified from EQ24.10 CIRIA C753 The SUDS Manual © CIRIA 2015</i>																							
Additional Volume of Runoff (above Greenfield state) leaving the site:		m ³	24.3																				
Rainwater harvesting or other re-use scheme committed volumes:		m ³	0																				
Additional Volume of Runoff (above Greenfield state) leaving the site:		m³	24.3																				

APPENDIX C – THAMES WATER PRE- DEVELOPMENT ENQUIRY



Mr Paul Griggs

Peter Brett Associates
Caversham Bridge House
Waterman Place
Reading
Berkshire
RG1 8DN



DS6009290



developer.services@thameswater.co.uk



08000 093 921

Mon – Fri 8am-5pm



thameswater.co.uk/developerservices

12 January 2016

Dear **Mr Griggs**,

SITE LOCATION: 29-35 Station Road, Reading, Berkshire. Development of 110 Dwellings and 360m² of retail.

I write in relation to the above site regarding the proposed development here.

Please note: your initial fee of £398+ VAT covers the expense of our asset planners reviewing your proposed discharges in relation to the capacity in our existing network. They also carry out flood risk assessments.

From the information you have provided, I can confirm that the existing foul sewer network does have sufficient capacity to accommodate the proposed foul water discharge from the proposed commercial development.

Please note that discharging surface water to the public sewer network should only be considered after all other methods of disposal have been investigated and proven to be not viable. In accordance with the Building Act 2000 Clause H3.3, positive connection to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. The disposal hierarchy being: 1st Soakaways; 2nd Watercourses; 3rd Sewers. Please ensure that storm flows are attenuated or regulated into the receiving public network through on or off site storage.

Only when it can be proven that soakage into the ground or a connection into the adjacent watercourse is not possible would we consider a restricted discharge into the public surface water sewer network. A reduction of at least 50% on existing flows from the same site area would be sought for a range of storm conditions..

Please note that no discharge of surface water runoff will be permitted into a foul sewer.

The preferred point of connection of foul water would be into a 300mm foul sewer to the west of the development site.

All connection requests are subject to a full Section 106 (Water Industry Act 1991) application before the Company can confirm approval to the connection itself. Please also note that capacity in the public sewerage system cannot be reserved.

Please note that the views expressed by Thames Water in this letter are in response to this pre development enquiry at this time and do not represent our final views on any future planning applications made in relation to this site.

Yours sincerely,

Sarah Swallow
Developer Services Engineer
Thames Water