



3 VIVEASH CLOSE

SQUIRRELS TRADING ESTATE, HAYES, LONDON, UB3 4RY

SURFACE WATER DRAINAGE ASSESSMENT

FOR

GENERAL FOOD TRADING CO LTD



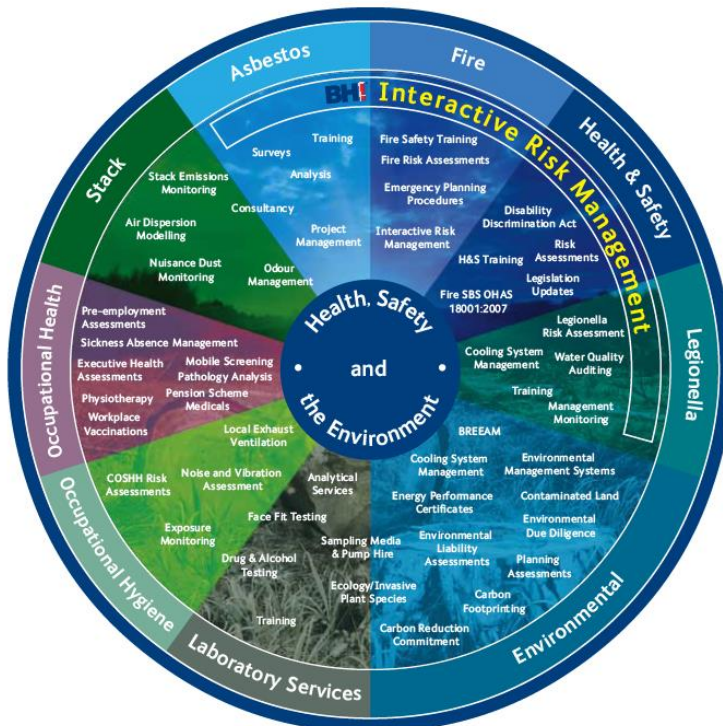
January 2018

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RPS Health, Safety & Environment
35 New Bridge Street
London
EC4V 6BW

Tel: 020 7280 3240
Email: rpslon@rpsgroup.com

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	Name:	Signature:
Report Author:	James Dunn	
Technical Reviewer:	Alison Cadge	
Technical Review: (January Updates)	Anna Velkov	
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RPS HEALTH, SAFETY & ENVIRONMENT

General Notes

1. The following notes should be read in conjunction with the report:
2. This report contains only that available factual data for the site, which was obtained from the sources, described in the text. These data were related to the site on the basis of the location information made available to RPS by the client.
3. The assessment of the site is based on information supplied by the client. Relevant information was also obtained from other sources.
4. The report reflects both the information provided to RPS in documents made available for review and the results of observations and consultations by RPS staff.
5. Where data have been supplied by the client or other sources, including that from previous site audits or investigations, it has been assumed that the information is correct but no warranty is given to that effect. While reasonable care and skill has been applied in review of this data no responsibility can be accepted by RPS for inaccuracies in the data supplied.
6. This report is prepared and written in the context of the proposals stated in the introduction to this report and its contents should not be used out of context. Furthermore new information, changed practices and changes in legislation may necessitate revised interpretation of the report after its original submission.
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1 INTRODUCTION

- 1.1 RPS was commissioned to undertake a Surface Water Drainage Assessment of 3 *Viveash Close, Squirrel Trading Estate, Hayes, London, UB3 4RY* in relation to the proposed redevelopment of the site into a part eight, part ten storey building comprising commercial space and residential units.
- 1.2 The aim of this Assessment is to consider the feasibility of a range of Sustainable Drainage Systems (SuDS) techniques for incorporation within the development scheme, to calculate the attenuation volume required to achieve the required reduction in runoff rates and to produce a conceptual SuDS strategy illustrating how the attenuation could be provided. The report has been produced in accordance with the guidance detailed in the National Planning Policy Framework (NPPF) and its associated Planning Practice Guidance (PPG). Reference has also been made to the CIRIA SUDS manual (C753) and the London Borough of Hillingdon Strategic Flood Risk Assessment (SFRA).
- 1.3 The site is not located within an Internal Drainage Board (IDB) District.
- 1.4 This report is not intended to provide formal details of the final drainage design for the development. However, it provides information regarding the capabilities of the conceptual surface water drainage strategy to meet the requirements of the NPPF.
- 1.5 The desk study was undertaken by reference to information provided / published by the following bodies:
- EA
 - British Geological Survey (BGS)
 - Ordnance Survey (OS)
 - Thames Water
- 1.6 A site visit was conducted by RPS as part of the Phase I report on 16th January 2017.

2 PLANNING POLICY CONTEXT

National Planning Policy

- 2.1 In a written statement to Parliament on 18th December 2014, the Secretary of State for Communities and Local Government strengthened existing planning policy on sustainable drainage, making it clear that sustainable drainage systems should be provided in new developments, unless demonstrated to be inappropriate. The statement requires that:

'in considering planning applications, local planning authorities should consult the relevant lead local flood authority on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development. The sustainable drainage system should be designed to ensure that the maintenance and operation requirements are economically proportionate'.

- 2.2 These changes took effect from 6 April 2015. This policy applies to all developments of 10 homes or more and to major commercial development.
- 2.3 Defra published their 'Non-statutory technical standards for sustainable drainage systems', in support of the above policy changes, in March 2015.

Regional Planning Policy

- 2.4 The development site is within the London Borough of Hillingdon which is covered by The London Plan, as amended March 2015. The London Plan contains various policies pertaining to drainage, the relevant aspects of which are reproduced below.

Policy 5.11 Green roofs and development site environs

- 2.5 This policy promotes the use of green roofs and walls where feasible, to deliver objectives including sustainable urban drainage amongst other wider environmental and sustainability benefits.

Policy 5.13 Sustainable drainage

- 2.6 This policy states *'development should utilise sustainable urban drainage systems (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:*

- *store rainwater for later use;*

- *use infiltration techniques, such as porous surfaces in non-clay areas;*
- *attenuate rainwater in ponds or open water features for gradual release;*
- *attenuate rainwater by storing in tanks or sealed water features for gradual release;*
- *discharge rainwater direct to a watercourse;*
- *discharge rainwater to a surface water sewer/drain; and*
- *discharge rainwater to the combined sewer.*

Drainage should be designed and implemented in ways that deliver other policy objectives of the Plan, including water use efficiency and quality, biodiversity, amenity and recreation.'

- 2.7 The London Plan is supported by the Supplementary Planning Guidance: Sustainable Design and Construction, April 2014. In relation to Surface Water Flooding and Sustainable Drainage, the guidance states that developers should design Sustainable Drainage Systems (SuDS) that incorporate attenuation for surface water runoff. The minimum expectation is to achieve 50% attenuation of the undeveloped site's surface water run off at peak times. The Mayor's priority is to achieve greenfield runoff rates. Development on greenfield sites must maintain a greenfield runoff rate. Development on previously developed sites should have a runoff rate no greater than three times the calculated greenfield runoff rate.

Local Planning Policy

- 2.8 The London Borough of Hillingdon Local Plan contains the following Policies relating to flood risk and drainage:

- 2.9 *Policy EM1: Climate Change Adaptation and Mitigation*

[..] The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:

10. Locating and designing development to minimise the probability and impacts of flooding.

11. Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.

[...] 13. Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks .

- 2.10 *Policy EM6: Flood Risk Management*

The Council will require new development to be directed away from Flood Zones 2 and 3 in accordance with the principles of the National Planning Policy Framework (NPPF). The

subsequent Hillingdon Local Plan: Part 2 -Site Specific Allocations Local Development Document will be subjected to the Sequential Test in accordance with the NPPF.

Sites will only be allocated within Flood Zones 2 or 3 where there are overriding issues that outweigh flood risk. In these instances, policy criteria will be set requiring future applicants of these sites to demonstrate that flood risk can be suitably mitigated.

The Council will require all development across the borough to use sustainable urban drainage systems (SUDS) unless demonstrated that it is not viable. The Council will encourage SUDS to be linked to water efficiency methods. The Council may require developer contributions to guarantee the long term maintenance and performance of SUDS is to an appropriate standard.

2.11 Policy EM7: Biodiversity and Geological Conservation

'Hillingdon's biodiversity and geological conservation will be preserved and enhanced with particular attention given to:

[...] 6. The provision of green roofs and living walls which contribute to biodiversity and help tackle climate change.

7. The use of sustainable drainage systems that promote ecological connectivity and natural habitats. [...]

2.12 The London Borough of Hillingdon SFRA identifies and maps flood risk from all sources at a borough-wide scale as well as providing guidance on producing site specific FRAs. The SFRA contains the following relevant requirements:

- Sustainable Drainage Systems must be included in new developments where possible as a way to manage surface water.
- The London Plan Policy 4A.14 states that developers should aim to achieve greenfield run off from their site through incorporating rainwater harvesting and sustainable drainage. Boroughs should encourage the retention of soft landscaping in front gardens and other means of reducing, or at least not increasing, the amount of hardstanding associated with existing homes.
- Runoff rates should be restricted to greenfield runoff rates in areas known to have a history of sewer flooding.

3 CONSULTATION

Thames Water

- 3.1 The public sewer network within the vicinity of the site is operated by Thames Water. A pre-development enquiry has been made to Thames Water and the response is currently awaited.
- 3.2 The conceptual surface water attenuation scheme presented in this report (see Section 8) is intended to demonstrate that a feasible surface water attenuation solution can be achieved on the site to meet the requirements of the NPPF. The detailed drainage design for the proposed development will be finalised in consultation with Thames Water at detailed design stage.

Lead Local Flood Authority

- 3.3 The LLFA is the London Borough of Hillingdon. Although Hillingdon Borough Council were unable to comment on the SuDS requirements for the site unless queries were as part of formal pre-application advice, RPS are aware that Hillingdon Borough Council require 'greenfield' rates to be targeted for new development and that a 40% allowance should be applied to drainage calculations to account for the effects of climate change. A lowest practical minimum discharge rate of 2 Litres/second is considered acceptable to ensure a self-cleansing system.

Environment Agency

- 3.4 The site is located in Flood Zone 1 and therefore the EA have not been consulted in preparation of this report.

Internal Drainage Board

- 3.5 The site is not located within an IDB District.

4 SITE DESCRIPTION

Site Description

- 4.1 The site is located at National Grid Reference TQ 09840 79305. It is irregular in shape, occupying an area of approximately 0.23 hectares. A site location plan is provided in Figure 1.
- 4.2 The site is currently occupied by industrial units and associated hardstanding areas.
- 4.3 Vehicular access to the site is currently from Viveash Close. Pedestrians can access the industrial units on site through an entrance on the western elevation of the building.
- 4.4 The site is currently occupied by 70% building footprint, 15% hardstanding area and 15% overgrown vegetation.

Topography

- 4.5 A topographic survey carried out in January 2017 indicates that the site slopes gently from around 31.97m AOD in the north to 31.63m AOD in the south. The topographic survey is located in Appendix A.

5 ENVIRONMENTAL SETTING

Designated Areas

- 5.1 There are no designated sensitive areas (e.g. Special Area of Conservation (SAC), Special Protection Area (SPA) or Site of Special Scientific Interest (SSSI)) within close proximity to the site.

Hydrological Setting

- 5.2 Reference to OS Mapping indicates that the nearest surface water feature is the Grand Union Canal which is located 120m to the north of the site.
- 5.3 The nearest main river is the River Crane located 610m to the east of the site.
- 5.4 The EA flood map (available online) indicates that the site is located within Flood Zone 1, whereby the annual probability of flooding from fluvial / tidal sources is classified as less than 1 in 1000. The EA Flood Map is provided in Figure 2.

Hydrogeological Setting

- 5.5 Reference to the BGS online mapping (1:50,000 scale) indicates that the site is underlain by the Lynch Hill Gravel Member, comprising sand and gravel. This is underlain by the London Clay Formation.
- 5.6 A BGS borehole located 90m to the south east of the site encountered groundwater at a depth of 8.59m below ground level (bgl).
- 5.7 The soils are described as 'freely draining slightly acid loamy soils' by the National Soils Research Institute.
- 5.8 According to the EA's online Groundwater Vulnerability Mapping, the Lynch Hill Gravel Member at the surface is classified as a Principal Aquifer. These formations provide a high level of water storage and may support water supply and/or river base flow on a strategic scale. The underlying London Clay Formation is classified as an Unproductive Stratum. These formations have a low permeability and have negligible significance for water supply or river base flow.
- 5.9 Reference to the EA's online groundwater Source Protection Zone maps indicates that the site is not located within a groundwater Source Protection Zone.

6 PROPOSED DEVELOPMENT

- 6.1 The proposed development scheme comprises one building with separate eight storey and ten storey residential blocks, connected at ground and first floor level by a parking area and commercial space. The proposal therefore comprises a 'major development'. Development plans are shown in Appendix B.
- 6.2 Vehicular access to the ground floor parking within the development will be off Viveash Close to the west. Pedestrian access to the western residential block will be from the west of the building. The eastern residential block will be accessible at ground floor level from the northern elevation of the building. The commercial unit at ground floor level will be accessible from the northern and eastern elevations of the building.
- 6.3 The ground floor of the development will consist of residential and commercial parking, cycle racks and cycle stores, refuse rooms, commercial space and lobby area, a residential lobby area, W.Cs, an energy centre, a mail room, stair and elevator cores and hardstanding / landscaped areas surrounding the building.
- 6.4 The first floor of the building will consist of commercial space and stair and elevator cores. The second floor will consist of residential units, seating areas and stair and elevator cores within both blocks. The blocks will be connected by green amenity space on the roof of the first floor. Floors three to seven will consist of residential units and stair and elevator cores in both blocks. Floor eight will consist of residential units and stair and elevator cores in the eastern block whilst the roof of the western block will consist of plant areas, brown roofs and PV zones. Floors eight and nine of Block A will consist of residential units and stair and elevator cores. The roof of Block A will consist of plant areas, brown roofs and PV zones.
- 6.5 Following redevelopment, the site will be occupied approximately 65% by building footprint, 30% by hardstanding and 5% by landscaping.
- 6.6 The proposed residential use at the site is classified as 'more vulnerable' and the proposed commercial use is classified as 'less vulnerable' within the PPG.
- 6.7 At this stage, it is anticipated that surface water runoff will continue to discharge to the surface water sewer beneath Viveash Close, as at present. The acceptable discharge rate to the existing mains sewer will need to be agreed with Thames Water in consultation with the LLFA.
- 6.8 The potential to provide surface water attenuation, including the use of SuDS, has been considered as part of the preliminary design process (see Section 8 – Surface Water Management).

7 EXISTING DRAINAGE

- 7.1 Reference to Thames Water plans of public sewers (shown in Appendix C) indicates that the site is served by foul and surface water sewers beneath Viveash Close. A manhole connected to the surface water sewer on Viveash Close has a cover level of 31.66m AOD and an invert level of 30.7m AOD.

8 SURFACE WATER MANAGEMENT

Introduction

- 8.1 Under the PPG, sustainable drainage systems should be provided for major developments unless demonstrated to be inappropriate. The non-statutory technical standards for sustainable drainage systems (Defra, March 2015) state that for developments which were previously developed, the peak runoff rate from the development 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. Where reasonably practicable, the runoff volume from the development for 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.
- 8.2 The London Borough of Hillingdon Local Plan requires the use of SuDS in major developments. This is supported by the London Plan which promotes the use of SuDS in all developments, and states that greenfield runoff rates should be targeted.
- 8.3 The QBAR greenfield discharge rate for the site has been calculated as 0.4 litres / second using Micro-Drainage modelling. On the other hand the Council has advised that the minimum acceptable self cleansing flow rate is 2l/s. Therefore, on the basis that greenfield runoff rates should be targeted where reasonably practicable and also to ensure a self-cleansing system, a target discharge rate of 2l/s is considered appropriate.
- 8.4 Surface water calculations have been undertaken using Micro-drainage modelling to establish the attenuation requirement in order to achieve 'greenfield' runoff rates. The proposed impermeable area is 2,230m². In order to attenuate runoff from the site during a 1 in 100 year plus 40% climate change event, whilst meeting the required runoff rate of 2 l/s, it has been calculated that 133.2m³ of attenuation would be required. The micro-drainage calculations used to calculate this requirement are provided in Appendix D.

Consideration of Sustainable Drainage Systems

- 8.5 The potential for the use of SuDS has been considered at this stage in accordance with the SuDS Hierarchy:

		<i>Suitability for use at the Site</i>	<i>Proposed?</i>	<i>Comments</i>
SuDS Hierarchy	<i>Swales, Detention Basins and Ponds</i>	Given the limited size of the site, large scale attenuation features such as swales, detention basins and ponds are not considered appropriate.	N	Large scale attenuation features have not been considered further.
	<i>Soakaways</i>	BGS mapping indicates that the site is underlain by the Lynch Hill Gravel Member, which is likely to be of a high permeability. Based on the reported geology, soakaways could provide a feasible method for the disposal of surface water runoff from the site.	N	Building Regulations advise that soakaways should not be used within 5m of buildings and Network Rail specify that soakaways should not be used within 20m of a railway boundary. Given that the site will be occupied mostly by built footprint, it is not feasible to include soakaways as a method of attenuation.
	<i>Rainwater Harvesting</i>	Given the large number of residential units within the development there is potential for harvested rainwater to be utilised.	Y	The attenuation benefits provided through the use of rainwater harvesting would only be realised when the tanks were not full. Limited rainwater harvesting will be included in the proposed development, to be used in the concierge / commercial toilets. The benefits of this will be quantified at detailed design stage.
	<i>Permeable/Porous Paving</i>	There are limited external areas which are not covered by canopy in which permeable paving may be suitable. Additionally, infiltrating permeable paving would not be suitable within close proximity of the building or railway land.	N	Permeable paving is not proposed.

	<i>Suitability for use at the Site</i>	<i>Proposed?</i>	<i>Comments</i>
Green Roofs	The amenity roof areas could provide opportunity for the inclusion of green roofs.	Y	Brown roofs are proposed in the PV / plant roof areas at Levels 8 and 10. Further details will be available following confirmation of the PV areas and therefore these will be accounted for in detailed drainage design. It is also proposed to include additional areas of garden and planters at first and second floor levels, these could provide attenuation benefits through storage and evapotranspiration.
Modular Underground Attenuation Tanks	There is potential for an underground attenuation tank to be included. The use of the ground floor as a car park will allow for easy access to carry out maintenance.	Y	An underground attenuation tank has been proposed to provide the required attenuation for the development.

Table 1 - Suitability of SuDS

Conceptual Surface Water Attenuation Scheme

- 8.6 On the basis of the Micro-drainage calculations above, a total attenuation volume of 133.2m³ will be required to achieve the required reduction in run-off.
- 8.7 It is proposed to provide this attenuation within an underground attenuation tank. The proposed tank will have the potential to provide 135.2m³ of attenuation given an area of 260m² and proposed depth of 0.52m. Discharge from the tank will be restricted by a Hydrobrake to a rate of 2 l/s. It is acknowledged that additional attenuation may be provided by the rainwater harvesting tank and the brown roofs, these will be quantified at detailed design stage. A conceptual drainage plan showing the potential areas for the inclusion of SuDS has been included in Appendix E.
- 8.8 Whilst it is proposed to include rainwater harvesting, given that the proposed development will consist mainly of built footprint, the potential for a significant reduction in runoff volumes is limited, for example through the use of soakaways or other infiltration techniques.
- 8.9 Following the Drainage Hierarchy, the potential for storage and infiltration of runoff has been considered. Storage within open features and infiltration methods are not feasible given the site constraints. However, storage will be provided within the attenuation tank for gradual release. Additional attenuation will be provided through rainwater harvesting and in brown roofs. The

methods will ensure that runoff is managed as close to the source as possible. Runoff will be discharged to the nearby surface water sewer to the west of the site beneath Viveash Close (as at present) which is also in accordance with the Hierarchy. The necessary consents will be obtained from Thames Water with whom the final discharge rate would be agreed.

- 8.10 Consideration will be given at detailed design stage to any pollution prevention measures, if required, to ensure that there is no adverse impact of the development on the receiving watercourse (following discharge to the nearby surface water sewer). It is noted that the majority of the site will be occupied by built footprint, so runoff will either be from the roof or the external areas where no car parking is proposed (i.e. limited potential for pollution).

Summary

- 8.11 Overall, a reduction in runoff rates to the lowest practical minimum rate has been achieved through the use of an underground attenuation tank. Additional attenuation and ecological benefits will be provided through the incorporation of brown roofs and rainwater harvesting. As a result of the proposed measures, there will be a significant reduction in flood risk within the area.

Event Exceedence

- 8.12 Micro-drainage modelling has shown that the proposed tank will provide storage up to and including the 1 in 100 year plus climate change event, with no surcharging of the system expected.
- 8.13 In an event exceeding this magnitude, detailed drainage design will identify mitigation measures to ensure that the resulting above-ground flooding will be confined to temporary shallow flooding on-site and will not affect the buildings or significantly increase flood risk to off-site locations.
- 8.14 Event exceedence planning will be undertaken as part of the final design process. Suitable mitigation measures will be incorporated into the development to ensure water is retained on-site should surcharging of on-site drains occur during extreme rainfall events.

Maintenance of Sustainable Drainage Systems

- 8.15 The detailed design of the surface water attenuation scheme will take account of the construction, operation and maintenance requirements of surface and subsurface components. Access will be allowed for ongoing maintenance of SuDS elements. A Maintenance Plan has been produced and is included within Appendix F.
- 8.16

9 SUMMARY AND CONCLUSIONS

- 9.1 The aim of the Surface Water Drainage Assessment is to consider the feasibility of a range of SuDS techniques for incorporation within the development scheme, to calculate the necessary attenuation volume in order to achieve the required reduction in runoff rates and to produce a conceptual SuDS strategy illustrating how the attenuation could be provided. The report has been produced in accordance with the guidance in the NPPF. Reference has also been made to the CIRIA SUDS manual (C753) and the SFRA.
- 9.2 In order to meet the requirements of the Non-Statutory Technical Standards (i.e. a reduction to greenfield runoff rates), a range of SuDS techniques has been considered for incorporation into the scheme. Drainage calculations have established the attenuation requirement in order to retain runoff generated by the 1 in 100 year plus climate change event on site, whilst reducing runoff rates to a 'greenfield' rate of 2 l/s. This report has demonstrated that this requirement can be met by the installation of an underground storage tank. A further reduction in runoff rates (and volumes) will be provided by the inclusion of brown roofs and rainwater harvesting.
- 9.3 Overall, it has been demonstrated that the proposed surface water strategy would achieve a positive reduction in flood risk, meeting London Plan and local policy requirements.

FIGURES

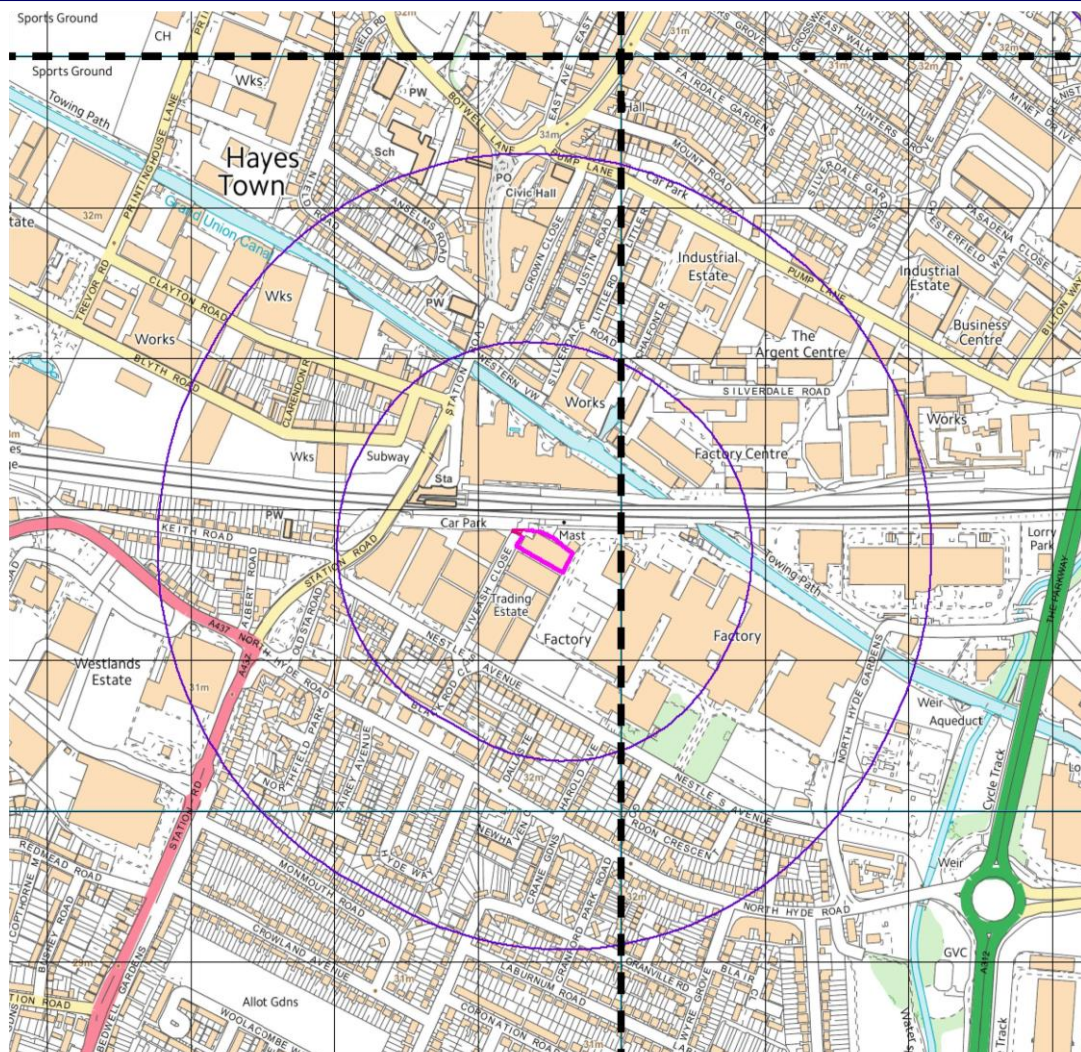


Figure 1: Site Location Plan

Map Date: Current

Scale: Not to scale

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RPS
35 New Bridge Street
London
EC4V 6BW

☎ 020-7280-3240
🌐 www.rpsgroup.com

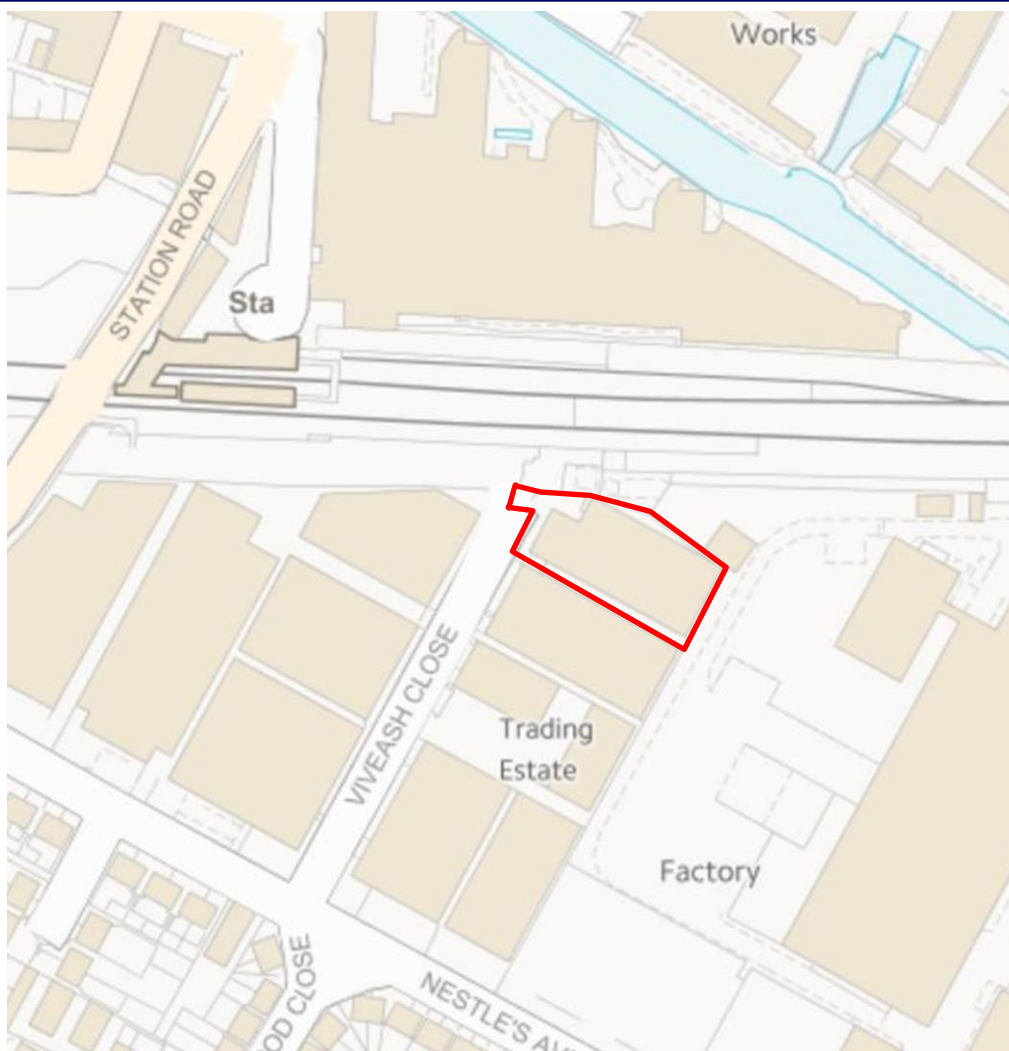


Figure 2: Environment Agency Flood Map

Map Date: Current

Scale: Not to scale

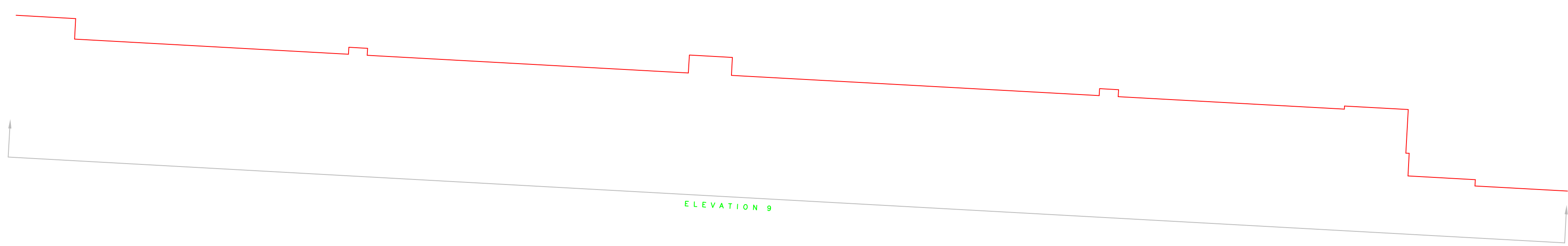
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35 New Bridge Street
London
EC4V 6BW

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APPENDIX A

Topographic Survey



LAND AND BUILDING SURVEYS, UNDERGROUND
SERVICES LOCATION, CCTV DRAINAGE SURVEYS.
Established 1975. Member of The Survey Association.

OPEN SPACE, UPPER INTERFIELDS, LEIGH SINTON ROAD, MALVERN, WORCESTERSHIRE, WR14 1UT
TEL 01886 833173 email: worcester@laser-surveys.com

142-144 HILLVIEW AVENUE, HORNCHURCH, ESSEX, RM11 2DL
TEL 01708 438408 FAX 01708 438405 email: london@laser-surveys.com
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[illegible]

B Floor to Beam Height in cms
C Floor to Ceiling Height in cms
Cr. Floor to Crown Height in cms
D Floor to Door Head Height in cms
FC Floor to False Ceiling Height in cms
FF False Floor Level
H Floor to Head Height in cms
S Floor to Sill Height in cms
Spr. Floor to Springer Height in cms

- * Drainage pipe sizes (where shown) have been gauged from the surface for safety reasons and should be regarded as approximate only.
- * Tree species (where shown) should be treated with caution and expert identification is advised.
- * Although this is a digital survey the accuracy and amount of detail shown is only commensurate with the graphical scales of mapping as specified. Care should be exercised when working to larger scales.
- * Visible features in the vicinity of the boundaries as shown above, may not represent the extent of the surveyed area.
- * Whilst every effort has been made to achieve accuracy on this plan, CRUSE, clearance dimensions, levels and invert levels should be checked prior to design and construction.
- * Kerb levels have been taken in the bottom of the channel.
- * Areas of dense undergrowth cannot be surveyed in detail; these areas will be shown in outline only and marked as 'dense undergrowth' on the plan.

A diagram of a 2x2 grid. The top-right cell is shaded with diagonal lines and contains a red number 1. The other three cells are white.

3 VIVEASH CLOSE
HAYES
LONDON
UB3 4RY

TOPOGRAPHICAL SURVEY
UNDERGROUND SERVICE TRACE
GPR SURVEY

SURVEYED FOR GENERAL FOOD TRADING CO. LTD
3 WYEASH CLOSE
HAYES
MIDDLESEX
UB3 4RY

SURVEYOR **A.E./K.B./S.**
DATE **JUN 2017**

NO	DATE	REVISION		
N	DRAWING NO	L 7882/1	3D	REV
	SCALE	1	:	200 @ A0
	SEE ALSO DWG NOS	L 7882/2	-	5
	SHEET	1	of	2
	REF NO	L 7882		

DATUM ORIGIN

GRID ORIGIN IS BASED UPON SURVEY STATION 2, FIXED TO THE ORIGINANCE SURVEY NATIONAL GRID BY LEICA SMARTNET GPS NETWORK. A SCALE FACTOR OF 1 APPLIES TO THIS DRAWING.

MEASUREMENTS RELATES TO THE GROUND WITHIN GPS WILL BE THE SAME AS THOSE MEASURED ON THIS DRAWING.

LEVELS ARE DERIVED TO :-

- ORIGINANCE SURVEY GPS ACTIVE NETWORK AND TRANSFORMED USING DATUM HEIGHTS 1 & ORIGIN MODEL.

LOCATION USED IS DERIVED AS :-

- SURVEY STATION 2
- HELI-SURVEY NAAL IN FOOTPATH OF NESTLE'S AVENUE.

AS SHOWN ON THE GRADIENT MAP.

VALUE GIVEN AS 31.30m (INDENYU.DAT)

NG REF 5029764.356 E 1792010.697 N

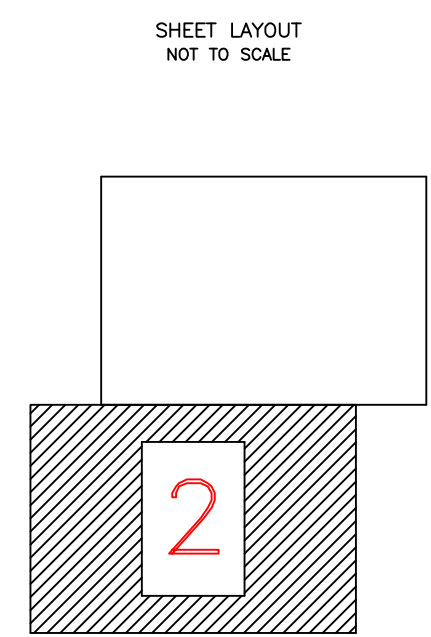
SURVEY CONTROL STATIONS SHOWN



[illegible]

B	Floor to Beam Height in cms
C	Floor to Ceiling Height in cms
Cr.	Floor to Crown Height in cms
D	Floor to Door Head Height in cms
FC	Floor to False Ceiling Height in cms
FF	False Floor Level
H	Floor to Head Height in cms
S	Floor to Sill Height in cms
Spr.	Floor to Springer Height in cms

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- * Tree species (where shown) should be treated with caution and expert identification is advised.
- * Although this is a digital survey the accuracy and amount of detail shown is only commensurate with the graphical scale of mapping as specified. Care should be exercised when using larger scales.
- * Visible features in the vicinity of the boundaries as shown above, may not represent the extent of legally conveyed ownership.
- * What ever effort has been made to achieve accuracy on this plan, ORCA/CML, clients, Dimensional Levels and Street Levels should be checked prior to design and construction.
- * Kerb levels have been taken in the bottom of the drains.
- * Areas of dense undergrowth have been marked on this plan. These areas will be shown in outline only and marked as "dense undergrowth" on the plan.



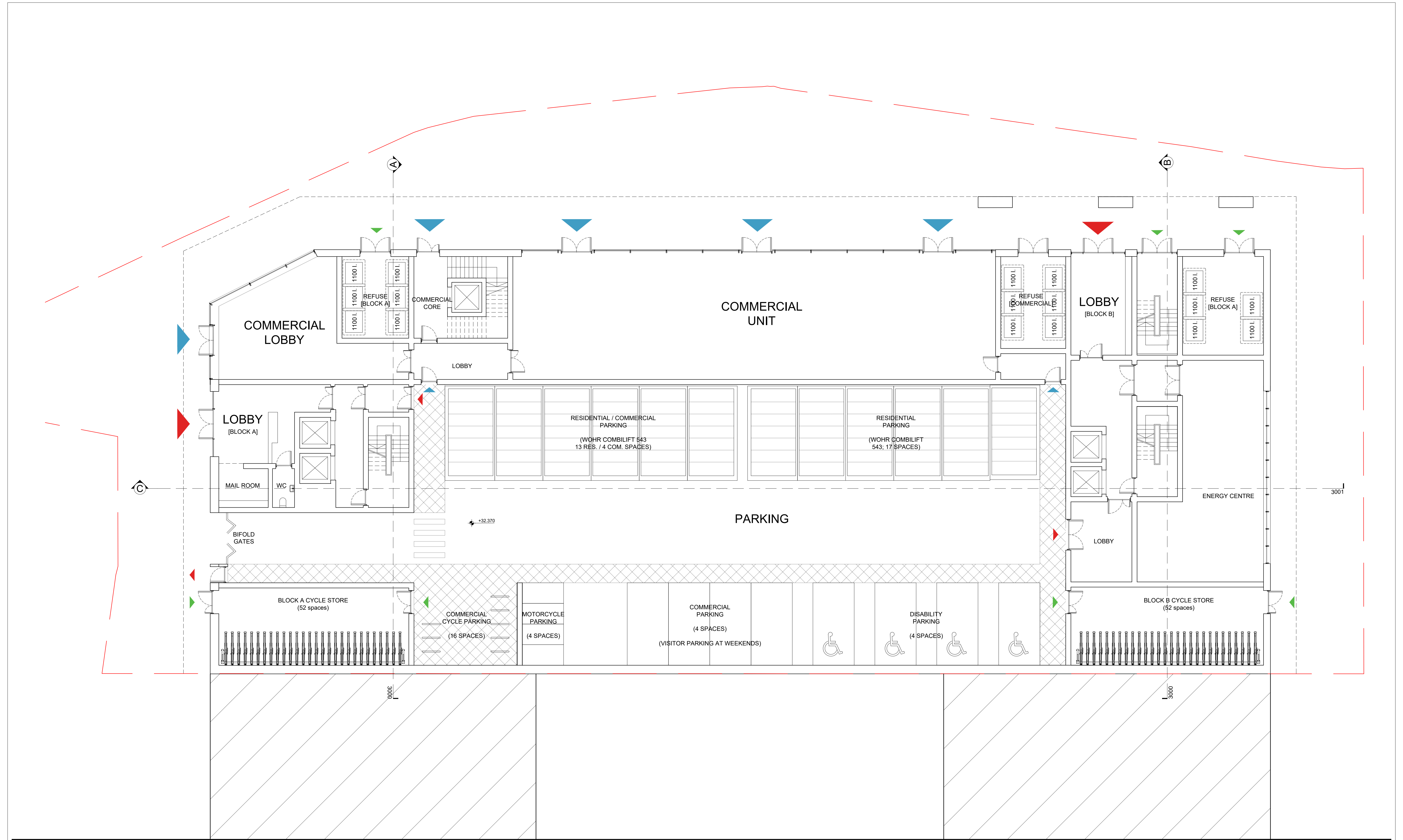
3 VIVEASH CLOSE
HAYES
LONDON
UB3 4RY

TOPOGRAPHICAL SURVEY
UNDERGROUND SERVICE TRACE
GPR SURVEY

SURVEYED FOR		GENERAL FORD TRADING CO. LTD 3 WISDOM CLOSE WATTS MOXTLEIGH SS2 4TH	
		SURVEYOR A.E./K.B./S.L.	
		DATE JAN 2017	
NO.	DATE	REVISION	
DRAWING NO		L 7882/2 3D	REV
SCALE		1 : 200 @ A0	
SEE ALSO DWG NOS		L 7882/1 - 5	
SHEET		2 of 2	
REF NO		L 7882	

APPENDIX B

Development Plans



notes

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drawing notes

Future context indicative only
Source: Greater London Authority's SA5 Wider Masterplan Study- Updated Draft June 2016

0 1m 2m 3m 4m 5m 10m
1:100

Key:

- Residential Block access
- Commercial access
- Service and refuse / cycle store access

REV | BY | CHKD | DATE | AMENDMENT DETAILS

project
3 Viveash Close, Hayes

client
General Food Trading Inc.

FraserBrownMacKennaArchitects
15-18 Featherstone St. London EC1Y 8SL www.fbmacarchitects.com
T:020 7251 0543

drawing title
**GA Plan
Proposed Ground Floor Plan**

PLANNING

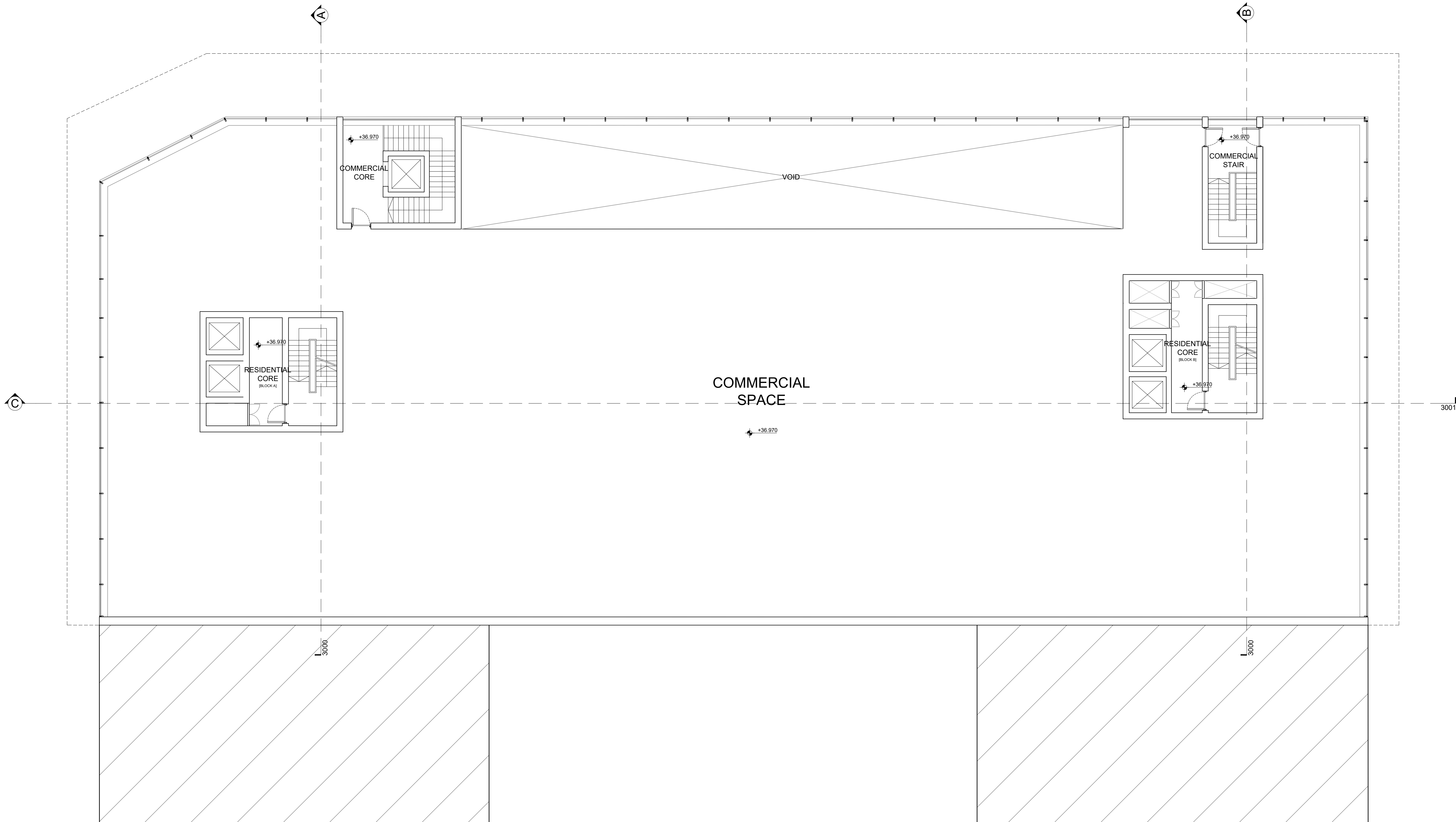
scale
1:100@A1

drawing by
BM

checked by
JM

date
08/12/2017

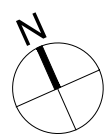
DRAWING NUMBER
897 | P | 1010



notes
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drawing notes
Future context indicative only
Source: Greater London Authority's SA5 Wider Masterplan Study- Updated Draft June 2016

Key:



REV | BY | CHKD | DATE | AMENDMENT DETAILS

REV | BY | CHKD | DATE | AMENDMENT DETAILS

project
3 Viveash Close, Hayes

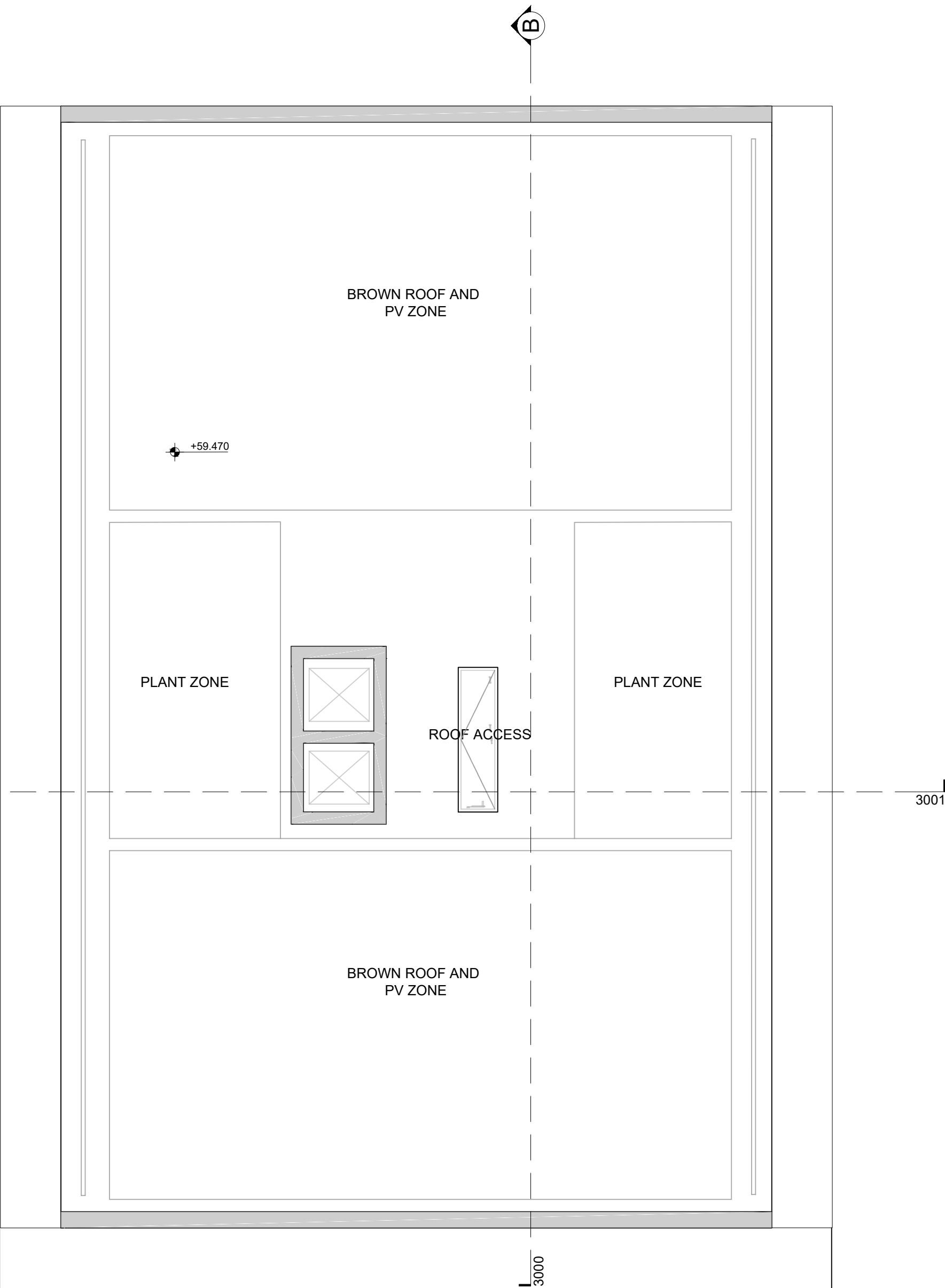
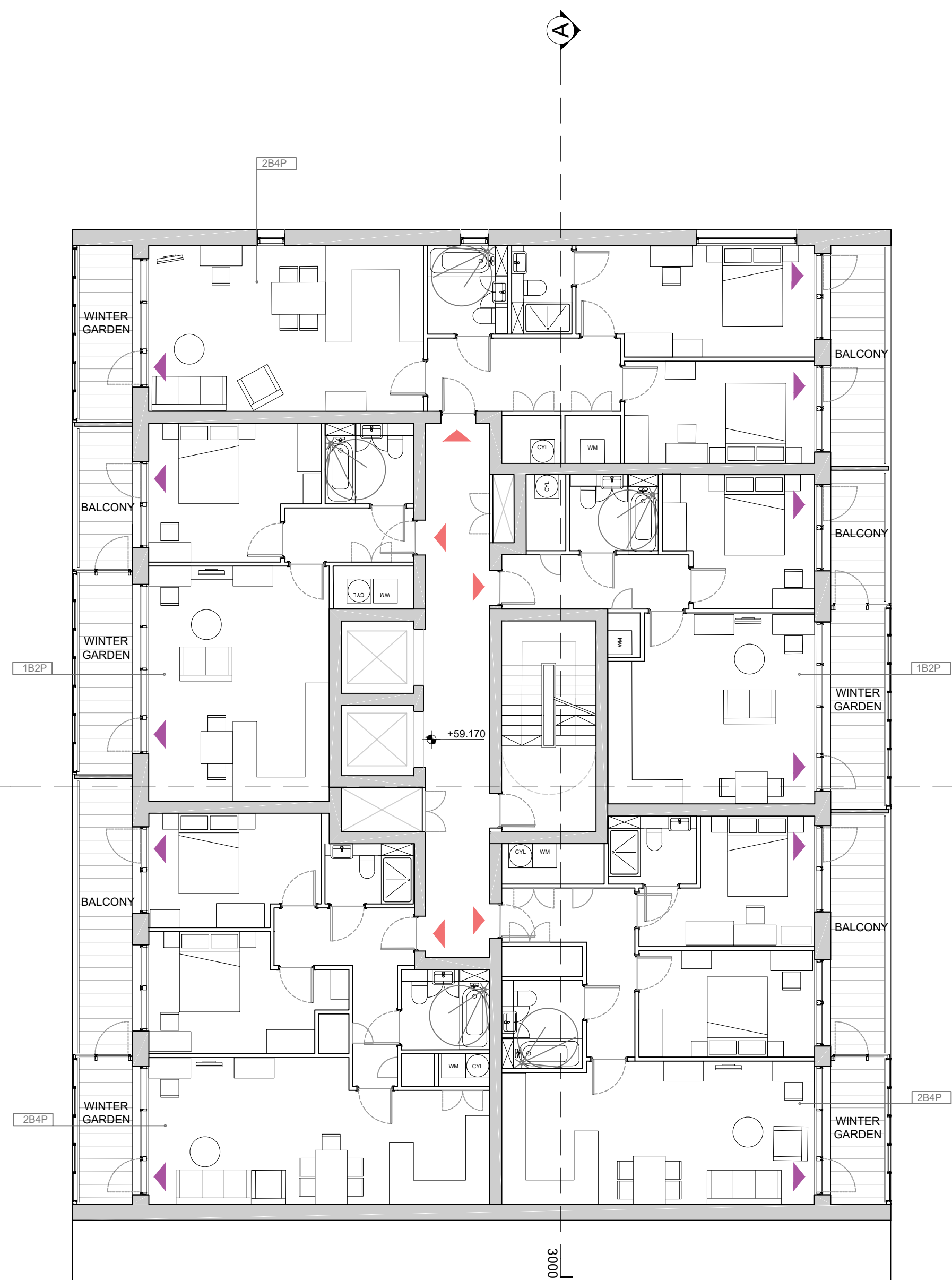
client
General Food Trading Inc.



15-18 Featherstone St. London EC1Y 8SL www.fbmaarchitects.com
T:020 7251 0543

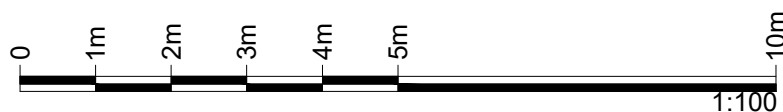
drawing title
GA Plan
Proposed First Floor Plan

scale
1:100@A1
drawing
checked by
date
08/12/2017
project
status
revision
DRAWING NUMBER
897 | P | 1011

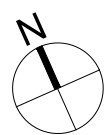


notes
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drawing notes
Future context indicative only
Source: Greater London Authority's SA5 Wider Masterplan Study- Updated Draft June 2016



Key:
Terrace and balcony access
Unit access



REV | BY | CHKD | DATE | AMENDMENT DETAILS

REV | BY | CHKD | DATE | AMENDMENT DETAILS

project
3 Viveash Close, Hayes

client
General Food Trading Inc.

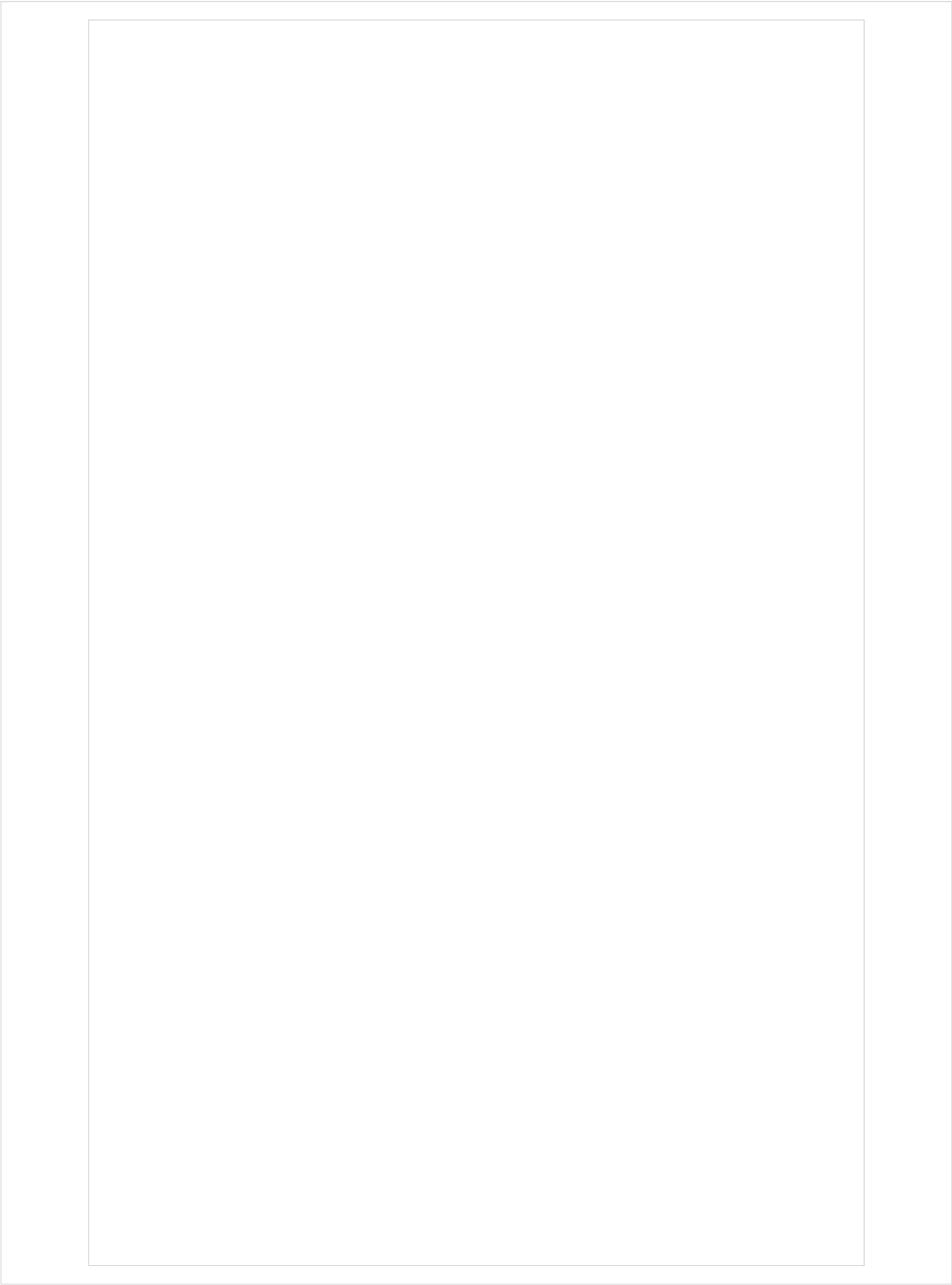
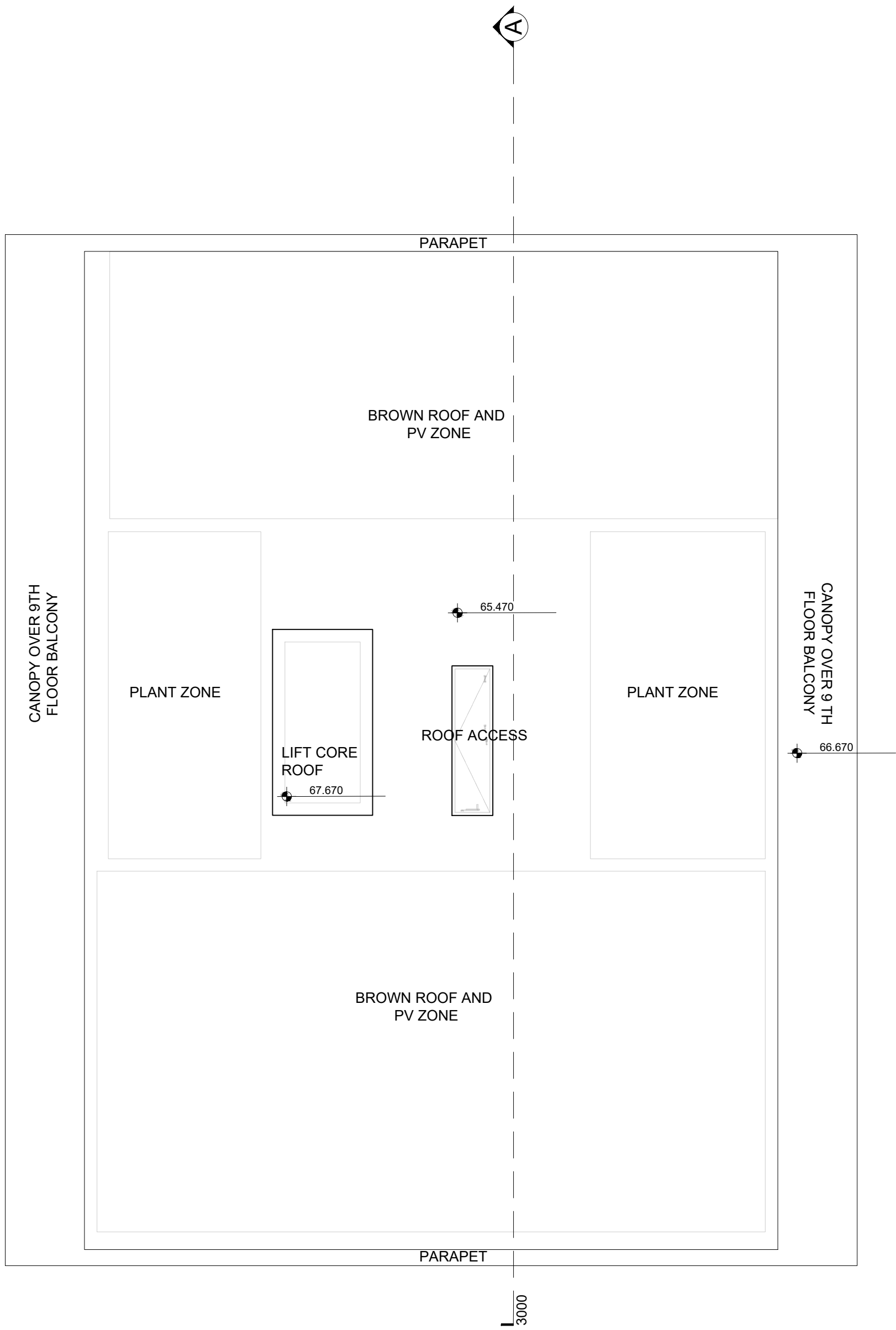


FraserBrownMacKennaArchitects
15-18 Featherstone St. London EC1Y 8SL www.fbmarchitects.com
T:020 7251 0543

drawing title
**GA Plan
Proposed Eighth Floor Plan**

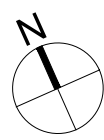
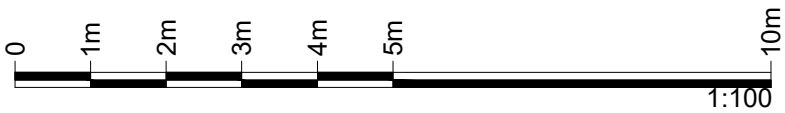
PLANNING

scale 1:100 @ A1	drawn by KOR	checked by JM	date 08/12/2017
DRAWING NUMBER 897	project P	status 1018	revision



notes
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drawing notes
Future context indicative only
Source: Greater London Authority's SA5 Wider Masterplan Study- Updated Draft June 2016



REV | BY | CHKD | DATE | AMENDMENT DETAILS

REV | BY | CHKD | DATE | AMENDMENT DETAILS



project
3 Viveash Close, Hayes

client
General Food Trading Inc.

15-18 Featherstone St. London EC1Y 8SL www.fbmaarchitects.com
T:020 7251 0543

drawing title
**GA Plans
Proposed Roof Plan**

scale
1:100@A1
drawing number
897
project
P
status
1020
drawing title
**GA Plans
Proposed Roof Plan**
drawing by
NOR
checked by
JM
date
08/12/2017
revision

APPENDIX C

Thames Water Sewer Plans

Asset Location Search



RPS Group
35New Bridge Street
LONDON
EC4V 6BW

Search address supplied General Food Trading
3
Viveash Close
Hayes
UB3 4RY

Your reference HLEF48079

Our reference ALS/ALS Standard/2016_3471339

Search date 9 December 2016

Notification of Price Changes...

From **1 September 2016** Thames Water Property Searches will be increasing the prices of its Asset Location Searches. This will be the first price rise in three years and is in line with the RPI at 1.84%. The increase follows significant capital investment in improving our systems and infrastructure.

Enquiries received with a higher payment prior to 1 September 2016 will be non-refundable. For further details on the price increase please visit our website at

www.thameswater-propertysearches.co.uk



Asset Location Search



Search address supplied: General Food Trading, 3, Viveash Close, Hayes, UB3 4RY

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.

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

Affinity Water Ltd
Tamblin Way
Hatfield

Asset Location Search



AL10 9EZ
Tel: 0845 7823333

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

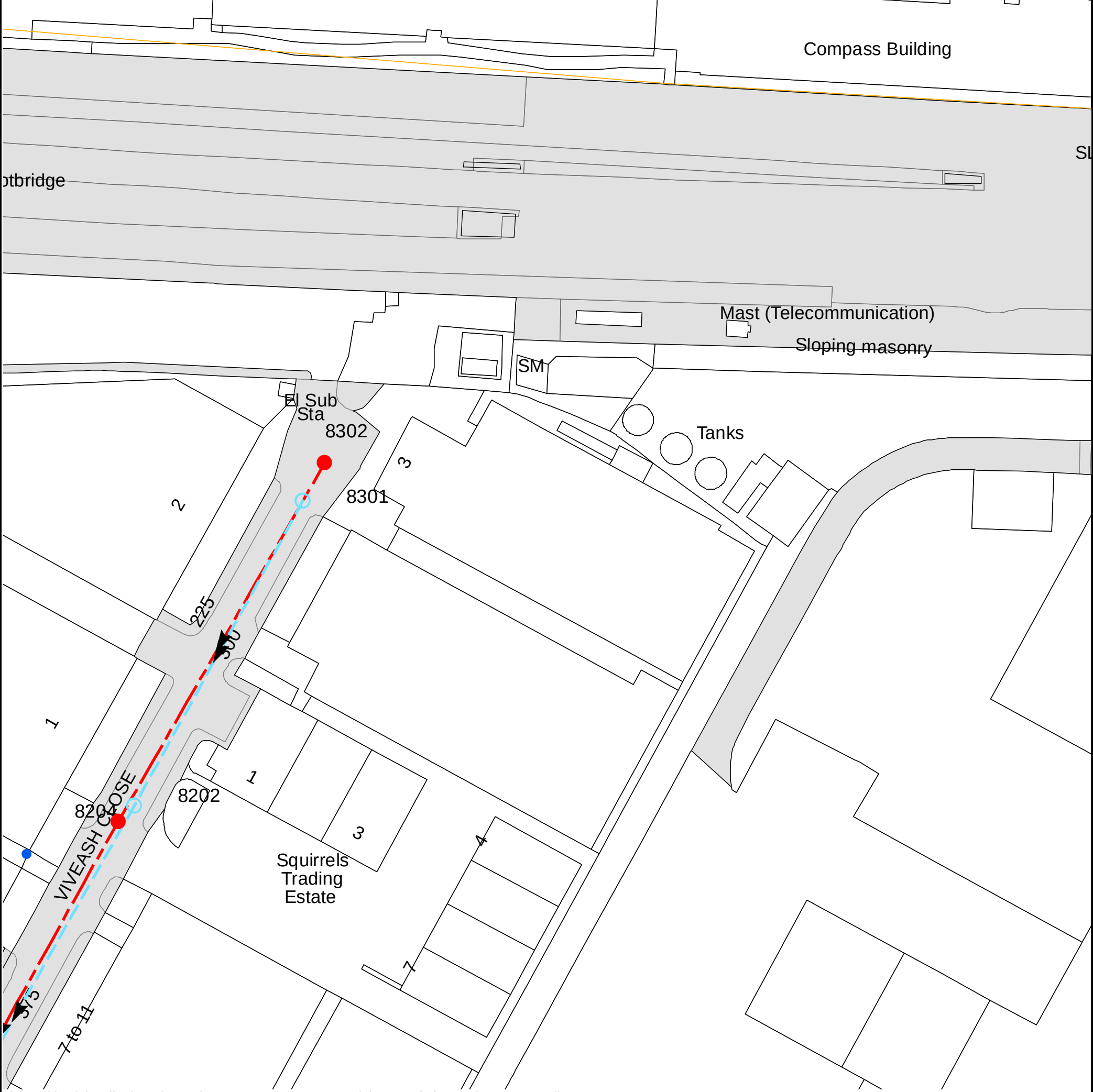
Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

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 width of the displayed area is 200 m and the centre of the map is located at OS coordinates 509892,179342
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.

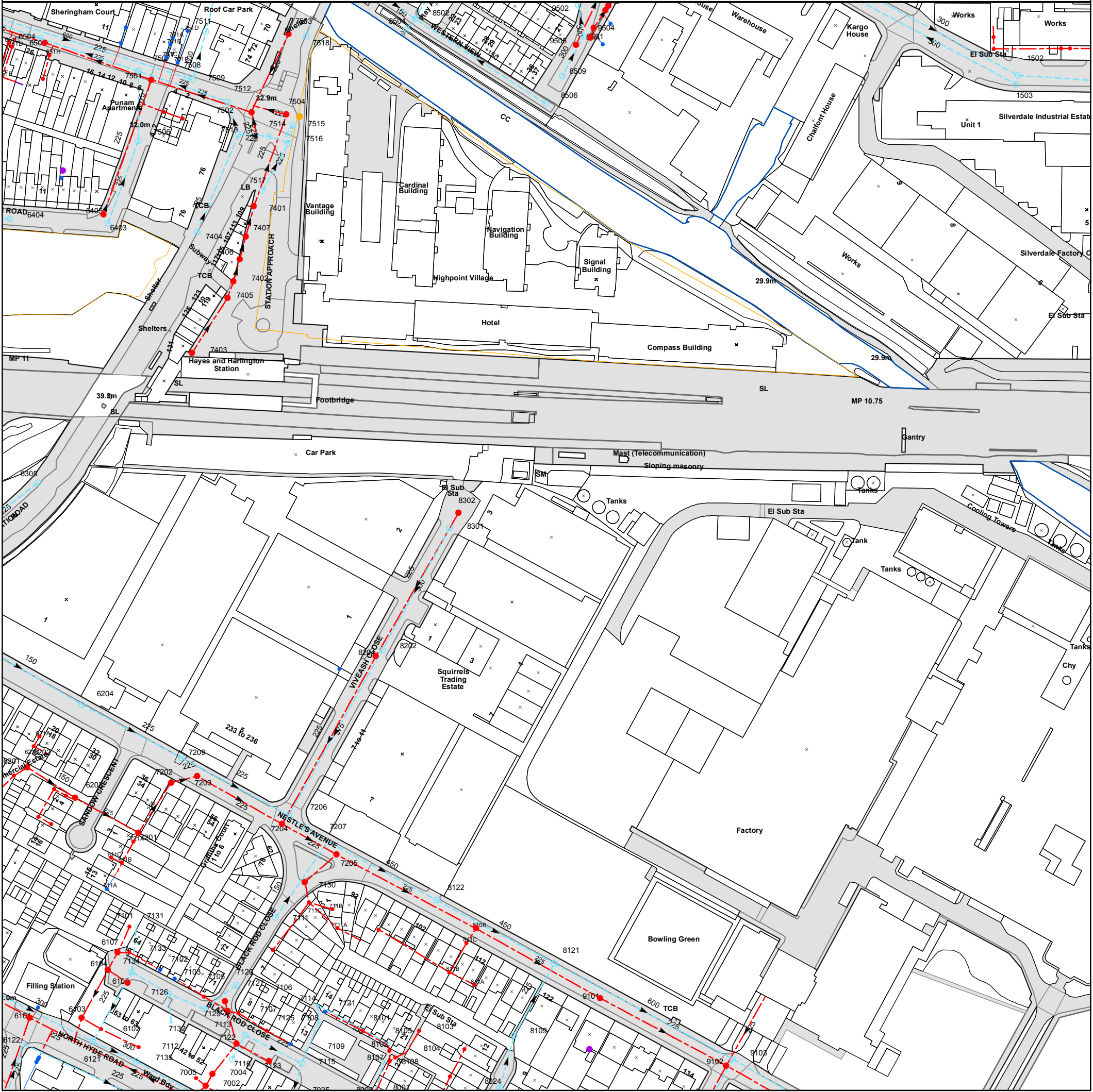
Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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
721B	n/a	n/a
8204	31.49	30.1
8202	31.49	30.51
8301	31.66	30.7
8302	31.69	30.39
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 Stationary
Office License Number 10019345

ALS/ALS Standard/2016_3471339



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 before any works are undertaken. Crown copyright Reserved

Scale: 1:1789
Width: 500m
Printed By: GKANAGAR
Print Date: 09/12/2016
Map Centre: 509891,179342
Grid Reference: TQ0979SE

Comments:

ALS/ALS Standard/2016_3471339

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
811D		
8105	31.03	30.56
8108	30.94	29.62
8103	30.96	29.81
811B		
81LA		
811A		
8024	31.9	30.9
8121	30.9	29.6
9101	30.91	28.74
7106	31.24	29.61
7122	31	28.8
7107	31.17	29.69
7125	31.12	29.95
7109	31.09	30.14
7114	31.08	30.35
7121	31.05	30.34
651L		
7502	32.83	30.82
8506	34.04	32.65
7501	32.24	30.29
651N		
8509		
751E		
651H		
751B		
651M		
6504	31.77	30.34
751A		
7518	33.02	31.77
7511	31.36	29.11
7102	31.68	30.71
7133	31.65	30.35
711A		
7101	31.73	29.98
711B		
611A		
611B		
7205	31.25	29.64
7201	31.44	30.34
621E		
621F		
6203	31.64	30.62
621I		
7203	31.47	30.15
621A		
721B		
8202	31.49	30.51
8302	31.69	30.39
7403		
7402		
7407		
6403	31.73	30.93
7401		
651J		
7516	33.45	31.75
7514	33.27	31.62
7515	33.38	31.88
7002	31.55	31.1
7104	31.47	27.72
61XK		
7112		
6102	31.9	30.63
6103	32.32	28.77
61LF		
7126	31.43	30.6
7103	31.59	30.62
6104	31.61	29.34
6122	32.13	30.33
62LB	31.82	31.17
621B		
651D		
8504	30.77	28.73
95JB		
951B		
9502		
05MA		
05MC		
9102	30.8	28.25
1502		

REFERENCE	COVER LEVEL	INVERT LEVEL
8107	30.98	30.46
8102	31.02	29.75
8104	30.96	29.64
8122		
01LD		
811C		
8106	31.06	29.08
8109	31.97	30.78
911A		
7127	31.19	29.85
7116	31.52	30.69
7120	31.16	30.78
7113	31.19	30.34
7123	31.07	30.32
7115	30.98	30.27
7108	31.03	30.27
8101	31.02	30
7504	33.14	31.32
751G		
7512	32.51	30.79
7509	32.23	29.11
7508	32.23	29.38
7507	32.14	30.51
751C		
9505		
95JA		
6501	31.53	29.98
951A		
9501		
7503	32.86	31.26
751D		
6107	31.57	29.68
711D		
7131	31.73	30.68
7111	31.13	30.13
711C		
7130	31.21	29.92
611C		
721A		
7207	31.06	30.01
7204	31.34	29.78
7206	31.27	30.09
621J		
7202	31.49	30.19
7209		
6204	31.95	30.88
8204	31.49	30.1
8301	31.66	30.7
6305	36.65	34.99
7405		
7406		
7404	34.74	33.42
6405	31.61	30.63
7517	33.25	31.75
651K		
7506	32.08	30.78
7513	33.03	31.21
751F		
7005	30.95	30.09
7135	32.24	30.39
61XH		
6121	32.19	30.45
7132	31.75	31
7129	31.28	30.73
7105	31.52	30.21
6105	31.55	30.45
7134	31.61	30.56
61XG		
6101	31.95	28.16
6202	31.82	31.02
6404	31.68	30.48
651G		
9504		
8502	33.25	29.64
9503	31.83	31.42
05MB		
1503		
05MD		
9103	30.77	29.18



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.

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

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APPENDIX D

Micro-Drainage WinDes Modelling Assessment

RPS Group Limited		Page 1
2420 The Quadrant Aztec West Almondsbury Bristol BS32 4AQ		
Date 06/03/2017 10:21 File	Designed by HSEDMCRAAdmin Checked by	
Micro Drainage		Source Control 2016.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 1 Soil 0.300 Area (ha) 0.234 Urban 0.000 SAAR (mm) 600 Region Number Region 6 Results 1/s QBAR Rural 0.4 QBAR Urban 0.4 Q1 year 0.3 Q1 year 0.3 Q30 years 0.8 Q100 years 1.1		
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RPS Group Limited					Page 1																																																																																																																																					
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Date 22.12.2017 File 1 in 100 year + 40% LS....		Designed by PG Checked by RR			
Micro Drainage		Source Control 2016.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	31.241	0.401	2.0	104.4	O K
120 min Winter	31.302	0.462	2.0	120.2	O K
180 min Winter	31.330	0.490	2.0	127.3	O K
240 min Winter	31.343	0.503	2.0	130.7	O K
360 min Winter	31.352	0.512	2.0	133.2	O K
480 min Winter	31.350	0.510	2.0	132.6	O K
600 min Winter	31.340	0.500	2.0	130.1	O K
720 min Winter	31.326	0.486	2.0	126.5	O K
960 min Winter	31.299	0.459	2.0	119.4	O K
1440 min Winter	31.245	0.405	2.0	105.3	O K
2160 min Winter	31.165	0.325	2.0	84.6	O K
2880 min Winter	31.097	0.257	2.0	66.7	O K
4320 min Winter	30.999	0.159	1.9	41.3	O K
5760 min Winter	30.945	0.105	1.8	27.4	O K
7200 min Winter	30.923	0.083	1.6	21.7	O K
8640 min Winter	30.912	0.072	1.4	18.7	O K
10080 min Winter	30.904	0.064	1.2	16.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	58.456	0.0	108.9	68	
120 min Winter	34.735	0.0	129.5	126	
180 min Winter	25.289	0.0	141.4	184	
240 min Winter	20.080	0.0	149.7	242	
360 min Winter	14.476	0.0	161.9	356	
480 min Winter	11.475	0.0	171.1	468	
600 min Winter	9.576	0.0	178.4	576	
720 min Winter	8.257	0.0	184.6	674	
960 min Winter	6.531	0.0	194.5	750	
1440 min Winter	4.687	0.0	209.0	1044	
2160 min Winter	3.359	0.0	226.8	1460	
2880 min Winter	2.649	0.0	238.5	1848	
4320 min Winter	1.894	0.0	255.2	2552	
5760 min Winter	1.491	0.0	269.0	3176	
7200 min Winter	1.239	0.0	279.2	3816	
8640 min Winter	1.064	0.0	287.5	4504	
10080 min Winter	0.935	0.0	294.5	5200	
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2420 The Quadrant Aztec West Almondsbury Bristol BS32 4AQ	Viveash Close Conceptual SW Drainage Attenuation Requirement	
Date 22.12.2017 File 1 in 100 year + 40% LS....	Designed by PG Checked by RR	
Micro Drainage		Source Control 2016.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.435	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.224

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To: (ha)	From: To: (ha)	From: To: (ha)			
0 4 0.075	4 8 0.075	8 12 0.075			

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2420 The Quadrant Aztec West Almondsbury Bristol BS32 4AQ	Viveash Close Conceptual SW Drainage Attenuation Requirement	
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Model Details

Storage is Online Cover Level (m) 31.660

Tank or Pond Structure

Invert Level (m) 30.840

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	260.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	260.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	260.0	1.800	0.0	3.200	0.0	4.600	0.0
0.520	260.0	2.000	0.0	3.400	0.0	4.800	0.0
0.521	0.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	0.0	2.400	0.0	3.800	0.0		
1.200	0.0	2.600	0.0	4.000	0.0		

Hydro-Brake Optimum® Outflow Control

Unit Reference MD-SHE-0070-2000-0820-2000

Design Head (m) 0.820

Design Flow (l/s) 2.0

Flush-Flo™ Calculated

Objective Minimise upstream storage

Application Surface

Sump Available Yes

Diameter (mm) 70

Invert Level (m) 30.840

Minimum Outlet Pipe Diameter (mm) 100

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.820	2.0
Flush-Flo™	0.248	2.0
Kick-Flo®	0.519	1.6
Mean Flow over Head Range	-	1.8

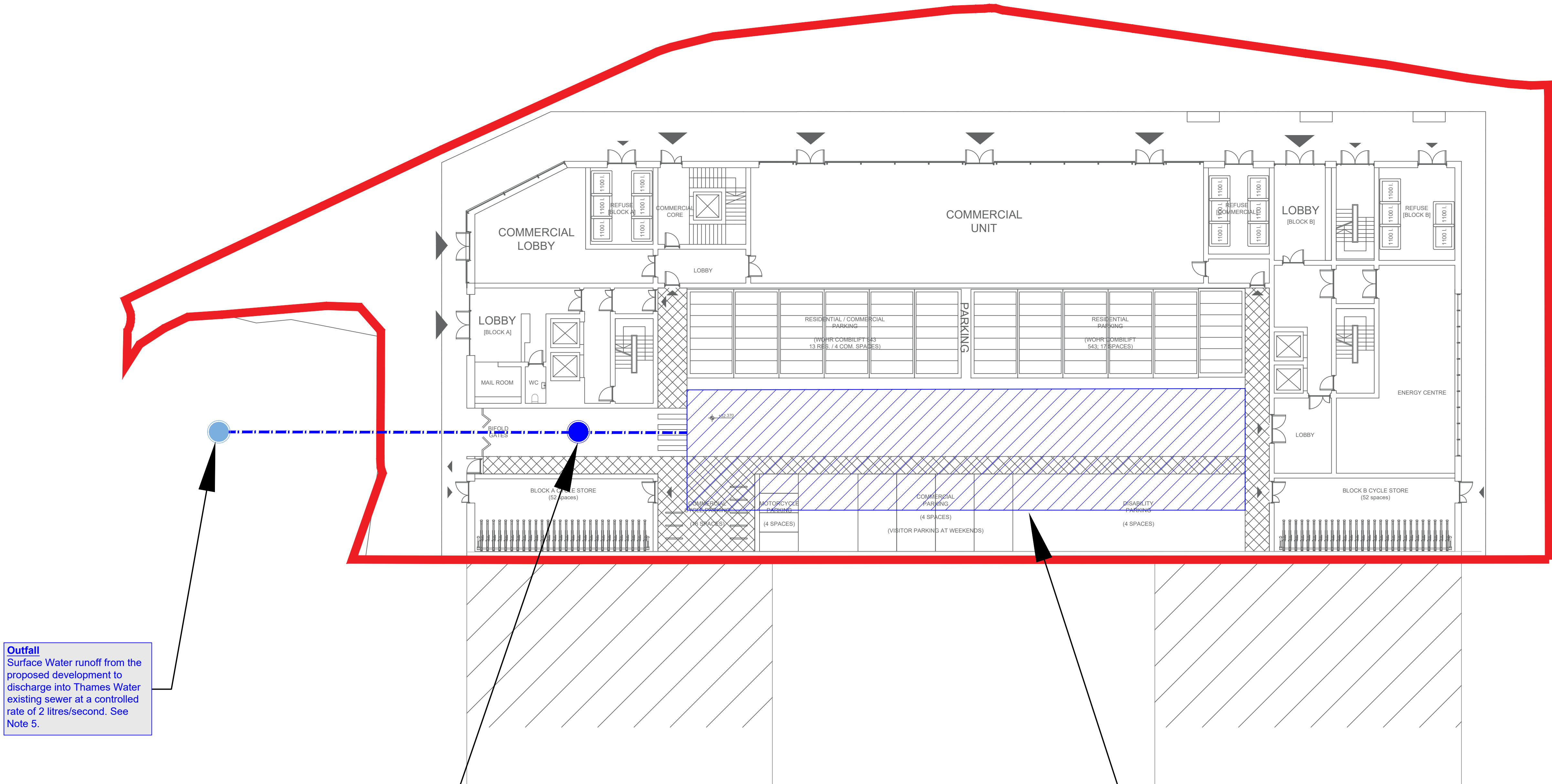
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	1.200	2.4	3.000	3.6	7.000	5.4
0.200	2.0	1.400	2.6	3.500	3.9	7.500	5.6
0.300	2.0	1.600	2.7	4.000	4.1	8.000	5.7
0.400	1.9	1.800	2.9	4.500	4.4	8.500	5.9
0.500	1.7	2.000	3.0	5.000	4.6	9.000	6.1
0.600	1.7	2.200	3.1	5.500	4.8	9.500	6.2
0.800	2.0	2.400	3.3	6.000	5.0		
1.000	2.2	2.600	3.4	6.500	5.2		

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APPENDIX E

Conceptual Surface Water Attenuation Plan



Outfall
Surface Water runoff from the proposed development to discharge into Thames Water existing sewer at a controlled rate of 2 litres/second. See Note 5.

Proposed Flow Control Chamber
Surface water runoff from the proposed development to be discharge at a controlled rate of 2litres/second.

Attenuation Tank
260 m² x 0.52 m deep
Hydro International StormCell Crates or similar. A minimum attenuation of 135.2 m³ to be provided.

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This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.

If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

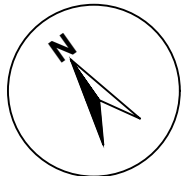
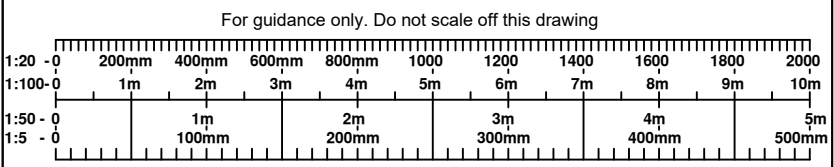
Notes

1. Drawing is based on the layout 897_Building Plan 00.dwg obtained from Fraser Brown MacKenna Architects.
2. Surface Water Drainage features shown are conceptual only and subject to final site levels and detailed designs. Indicated features may require changes dependent on unforeseen changes to the design.
3. All drainage features to be in accordance with Building Regulations Approved Document H.
4. Surface Water System designed to convey and store runoff generated by rainfall event of up to 1 in 100 year + 40% Climate Change.
5. Surface Water runoff generated on site will be discharged into Thames Water surface water sewer, west of the site boundary. The runoff rate will be limited to 2 l/s by using a Hydro Brake® or similar flow control device.

Legend

- Application Site Boundary
- Proposed Attenuation System
- Proposed Surface Water Sewer
- Proposed Manhole Chamber
- Existing Surface Water Manhole Chamber

B	ATTENUATION TANK RELOCATED	09.01.2018	ES	MB
A	CONCEPTUAL	21.12.2017	PG	RR
Rev	Description	Date	Initial	Checked



Unit 12, Waters Edge Business Park,
Salford, M5 3EZ.
T: 0161 834 3737 E: rpsmtr@rpsgroup.com F: 0161 877 3959

Client General Food Trading Co. Limited

Project 3 Viveash Close
Hayes
UB3 4RY

Title Conceptual Drainage Layout
Plan

Status Drawn By PM/Checked by
PRELIMINARY PG RR

Job Ref Scale @ A3 Date Created
RCEF 48109 NTS 21.12.2017

Drawing Number Rev
01 B

APPENDIX F

SuDS Maintenance Plan

SuDS Maintenance Plan

This Maintenance Plan has been produced in order to ensure that the SuDS incorporated at the site remain functional for the lifetime of the development. This will ensure a continued reduction in local flood risk through the attenuation of surface water run-off on-site. It is proposed to provide an underground attenuation tank capable of storing 135.2m³ at the site. This has been shown to reduce surface water run-off rates to the minimum practical discharge rate of 2 l/s. This plan demonstrates that the maintenance and operation requirements of the SuDS are economically proportionate to the development. It is also proposed to provide brown roofs and rainwater harvesting.

Type of SuDS	Illustration	Maintenance required	Regularity	Indicative cost
Underground attenuation tank	 Underground plastic geocellular / modular systems can be used to create a below ground storage structure. Due to the modular nature of the systems, they can be tailored to suit the specific requirements of any site. Water can be attenuated on site, before discharging at a controlled rate to a watercourse or other drainage system.	Cleaning inlets / outlets, manholes, associated pipework and silt traps	Annual, or as required	c.£200 - £500
Green / brown roofs	 Green / brown roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover / landscaping. The roof is likely to consist of an impermeable layer, or substrate or growing medium and a drainage layer.	Litter and debris removal	Monthly	£30 / month
		Weed removal	6 monthly	£60 / roof
		Inspection of bare patches and replacement of plants	6 monthly	£150 / roof
		Indicative annual maintenance cost - £2,500 per year for first 2 years for covered roof with sedum mat, £600 per year after. - £1,250 per year for first 2 years for covered roof with biodiverse roof, £150 per year after		



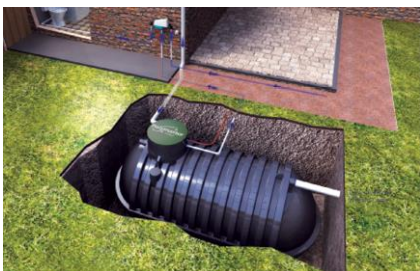
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ISO 9001 FS 22940



ISO 14001 EMS 70624

Type of SuDS	Illustration	Maintenance required	Regularity	Indicative cost
Rainwater Harvesting Tank	 Rainwater harvesting tanks are used for the collection of runoff from buildings. This water can then be pumped out, treated if required, and reused for domestic purposes.	Inspection and cleaning of collection systems, pipes, filters, throttles and vales, pumps.	Annual, or as required	c.£200 - £500
		Replacement of pump	Every 5-7 years, or as required	c. £500
		Repair erosion damage	When required	c. £500 - £750
		Replace filters	Every 1-2 years, or as required	c. £200 - £500

This document was compiled with reference to the Ciria Susdrain website, the CIRIA SuDS Manual (2015) and to 'Cost estimation for SUDS - summary of evidence' (Environment Agency, March 2015) and references therein.