# Stag Brewery, Mortlake

## Drainage Strategy

For Reselton Properties

July 2020

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| **Client Name:** | Reselton Properties Limited |
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## Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2008, BS EN ISO 14001: 2004 and BS OHSAS 18001:2007)

| Issue | Date | Prepared by | Checked by | Approved by |
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**Comments**

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# Executive Summary

This Drainage Strategy has been prepared by Waterman Infrastructure & Environment ('Waterman IE') as a revised submission document to the Drainage Strategy (ref WIE10667-101-R-9-5-1-DS) submitted under Applications A, B and C (refs. 18/0547/FUL, 18/0548/FUL and 18/0549/FUL) ('the Applications'), in respect of the former Stag Brewery Site in Mortlake ('the Site') within the London Borough of Richmond Upon Thames ('LBRuT'). The Applications are for the comprehensive redevelopment of the Site. This document has been prepared on behalf of Reselton Properties Limited ('the Applicant'). A summary of the Applications is set out below:

- Application A – hybrid planning application for comprehensive mixed use redevelopment of the former Stag Brewery site consisting of:
  i. Land to the east of Ship Lane applied for in detail (referred to as 'Development Area 1' throughout); and
  ii. Land to the west of Ship Lane (excluding the school) applied for in outline (referred to as 'Development Area 2' throughout).
- Application B – detailed planning application for the school (on land to the west of Ship Lane).
- Application C – detailed planning application for highways and landscape works at Chalkers Corner.

This document replaces the Drainage Strategy submitted in February 2018, including the May 2019 Drainage Strategy Addendum to LBRuT. The May 2019 Drainage Strategy Addendum was submitted to incorporate changes to the drainage strategy as a result of discussions with the Greater London Authority and the LBRuT and small amendments to the scheme. This was submitted as part of the May 2019 Amendments. Further minor amendments are now proposed (to be submitted as part of the May 2020 Amendments). Compared to the original scheme, these comprise an increase in residential unit provision, an increase in affordable housing provision, an increase in height of some buildings, changes to some building layouts, reduction in size of the western basement, a sub-basement under Building 01, and other amendments including internal layouts and quantum and mix of uses across the Site.

The amended proposals comprise up to 1,250 residential units, flexible uses, office space, a school, a hotel, cinema, as well as associated car and cycle parking, private and public amenity space, and play space.

This amended Drainage Strategy has been produced to reflect amendments to the previously submitted scheme. The drainage strategy covers the Stag Brewery component of the Site (Applications A and B) (refer to Figure 1). Drainage associated with highways works at Chalkers Corner would be discharged to the sewer as existing unattenuated, and would continue to be managed by the highways authority. It is therefore considered to be appropriate and robust to focus the Drainage Strategy on the Stag Brewery Site herein.

Surface water runoff from the northeast of the Application A site would discharge by gravity to the River Thames (adjacent to the northern boundary of the Site) via three outfalls. As the River Thames

is tidal in this location, direct discharge to the river would be unrestricted. The area to discharge into the River Thames has been maximised using shallow geo-cellular conveyance channels, in order to relieve the Thames Water network of flows. Surface water runoff from the remainder of the Site would discharge via gravity to the Thames Water sewer network in the surrounding highways, maximising the attenuation volume within each drainage catchment to restrict surface water flows as much as possible.

Based on an area of 5.89ha currently draining into the Thames Water network, the existing discharge rate was calculated to be 841 l/s. The incorporation of permeable paving, rain gardens, and underground attenuation tanks achieves a reduction of surface water flows to 249 l/s, equal to a 70% reduction compared to the existing rate. This approach has been agreed with the Greater London Authority.

Appropriate treatment would be incorporated into the drainage system to ensure that the quality of water discharged is acceptable. This would be achieved through the incorporation of green roofs, permeable paving aggregate sub-base, rain gardens, and rainwater harvesting. A biomat filtration system within the attenuation tanks and downstream defenders or similar hard engineered solution would also be incorporated if deemed necessary at detailed design to ensure discharge is appropriately treated.

Foul flows from the Site (Application A and B) would discharge by gravity the Thames Water sewer network. The existing and proposed foul discharge rates have been calculated using the water consumption method at 14.4l/s and 28.5 l/s respectively.

The on-Site drainage networks and Sustainable Drainage Systems would be privately managed and maintained for the lifetime of the Development (Applications A and B), ensuring they remain fit for purpose and function appropriately. The management company / operator would be appointed post-planning. The school drainage system (Application B) would be delivered and maintained separately from the Application A and C sites.

This report confirms that surface water runoff from the Site (Applications A and B) can be managed sustainably to ensure that flood risk is not increased elsewhere. It is considered that the information provided within this report satisfies the requirements of the National Planning Policy Framework (NPPF), the London Plan, and the London Borough of Richmond upon Thames Local Plan.

# 1. Introduction

1.1. This Drainage Strategy has been prepared by Waterman Infrastructure & Environment ('Waterman IE') as a revised submission document to the Drainage Strategy (ref WIE10667-101-R-9-5-1-DS) submitted under Applications A, B and C (refs. 18/0547/FUL, 18/0548/FUL and 18/0549/FUL) ('the Applications'), in respect of the former Stag Brewery Site in Mortlake ('the Site') within the London Borough of Richmond Upon Thames ('LBRuT'). The Applications are for the comprehensive redevelopment of the Site. This document has been prepared on behalf of Reselton Properties Limited ('the Applicant'). A summary of the Applications is set out below:

- Application A – hybrid planning application for comprehensive mixed use redevelopment of the former Stag Brewery site consisting of:
  i. Land to the east of Ship Lane applied for in detail (referred to as 'Development Area 1' throughout); and
  ii. Land to the west of Ship Lane (excluding the school) applied for in outline (referred to as 'Development Areas 2' throughout).
- Application B – detailed planning application for the school (on land to the west of Ship Lane).
- Application C – detailed planning application for highways and landscape works at Chalkers Corner.

1.2. The Applications were submitted in February 2018 to LBRuT. The Applications are related and were proposed to be linked via a Section 106 Agreement. In May 2019, a package of substitutions was submitted to LBRuT for consideration, which sought to address comment raised by consultees during determination. On 29 January 2020, the Applications were heard at LBRuT's Planning Committee with a recommendation for approval. This scheme is thereafter referred to as "the Original Scheme".

1.3. The Committee resolved to grant Applications A and B, and refuse Application C. The granting of Applications A and B was subject to the following:

a) Conditions and informative as set out in the officer's report, published addendum and agreed verbally at the meeting;
b) Amendments to the Heads of Terms and completion of a Section 106 Legal Agreement which was delegated to the Assistant Director to conclude;
c) No adverse direction from the Greater London Authority ('GLA'); and
d) No call in by the Secretary of State for Housing, Communities and Local Government.

1.4. The Applications have been referred to the GLA and the Mayor has given a direction that he will take over the determination of the Applications and act as local planning authority in relation to all three applications.

1.5. The Applicant has engaged with the GLA in respect to the proposed amendments to the scheme, referred to throughout this document as the 'Revised Scheme'. As a result of these discussions, a number of changes have been made to the scheme proposals which are summarised as follows:

a) Increase in residential unit provision from up to 813 units (this includes the up to 150 flexible assisted living and / or residential units) to up to 1,250 units;

b) Increase in affordable housing provision from up to 17% to up to 30%;

c) Increase in height for some buildings, of up to three storeys compared to the Original Scheme;

d) Change to the layout of Buildings 18 and 19, conversion of Block 20 from a terrace row of housing to two four storey buildings;

e) Reduction in the size of the western basement, resulting in an overall reduction in car parking spaces of 186 spaces, and introduction of an additional basement storey beneath Building 1 (the cinema);

f) Other amendments to the masterplan including amendments to internal layouts, re-location and change to the quantum and mix of uses across the Site, including the removal of the nursing home and assisted living in Development Area 2;

g) Landscaping amendments, including canopy removal of four trees on the north west corner of the Site; and

h) Associated highways works may be carried out on adopted highways land.

1.6. The submission documents have tested an affordable housing provision of up to 30%. However, it should be noted that the final affordable housing level is subject to further viability testing and discussions with the GLA.

1.7. Minor amendments have also been made to the road and pedestrian layouts for the school (Application B). No other amendments are proposed to Application B. No amendments are proposed to the physical works proposed under Application C, although alternative options within the highway boundaries for mitigating the highway impact of the amended proposals have been assessed within the relevant substitution documents for Applications A and B and are the subject of ongoing discussions with the GLA and TfL.

1.8. A more detailed summary is included within the Planning Statement Addendum and Design and Access Statement Addendum submitted with the Revised Scheme documents.

1.9. These changes are being brought forward as substitutions to Applications A, B and C (refs. 18/0547/FUL, 18/0548/FUL an 18/0549/FUL), which are related applications (to be linked via a Section 106 Agreement). It is important to note that no changes are proposed to the physical works proposed under Application C – the only change to this application is that the supporting documents (which include all documents submitted under Applications A and B) have been updated in the context of the proposed changes to the scheme as sought under Applications A and B. Application C was resolved to be refused by LBRuT at Committee on 29 January 2020. As a result, whilst the works proposed in Application C are still an available option, the Applicant has progressed alternative approaches for addressing and mitigating the impacts on surrounding highways, and these have been tested within the relevant substitution documents for Applications A and B. All of these options are subject to ongoing discussions and testing with TfL. They are all within the existing highway boundaries and if agreed would not, in themselves, require planning consent. Accordingly, Application C remains 'live' within this substitution package.

1.10. This document replaces the Drainage Strategy submitted in 2018, including the May 2019 Drainage Strategy Addendum. The May 2019 Drainage Strategy Addendum was submitted to incorporate changes to the drainage strategy as a result of discussions with the GLA and the LBRuT and small amendments to the scheme. This was submitted as part of the May 2019 Amendments. Further minor amendments are now proposed, as outlined above.

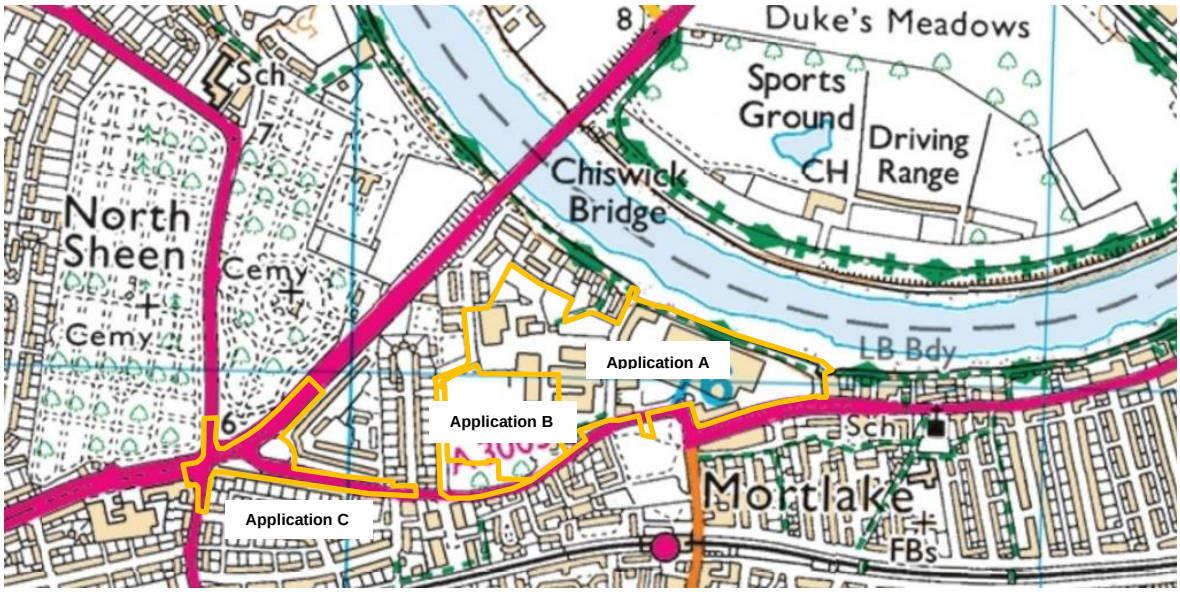
1.11. The LBRuT Committee Report[i] concluded no objects to the previous drainage strategy from the Lead Local Flood Authority, Greater London Authority, or Environment Agency. The changes to the scheme plans presented herein do not alter the principles of the drainage strategy, therefore the conclusions would remain the same.

1.12. This amended Drainage Strategy has been developed for Applications A and B only (hereafter referred to as 'the Site'). A separate Drainage Strategy for Application C was submitted to LBRuT in March 2018 (Ref: WIE10667-101-R.11.2.2). This report is considered to remain valid, with drainage associated with highways and surface water run-off would be discharged to the sewer as per the existing situation to be delivered in conjunction with the local highway authority.

## Site Description

1.13. The Stag Brewery (Application A and B) Site comprises an approximately 9.25 ha parcel of land predominantly occupied by the former Stag Brewery. The former Stag Brewery Site is bounded by Lower Richmond Road to the south, the river Thames and the Thames Bank to the north, Williams Lane to the west and Bulls Alley (off Mortlake High Street) to the east. The Site is bisected by Ship Lane. The Site currently comprises a mixture of large scale industrial brewing structures, large areas of hardstanding and playing fields. The Site is centred on National Grid Reference 520380, 176003, as shown in Figure 1.

Figure 1: Site Location




Key

Development Location

*Source: www.bing.com/maps*

## Development Proposals

1.14. The amended proposals (Appendix A) comprise up to 1,250 residential units, flexible uses (to be used as restaurant/bar/retail/community/boathouse/financial and professional services and/or offices), office space, a school, a hotel, cinema, as well as associated car and cycle parking, private and public amenity space, and play space.

## Scope of the Report

1.15. This report is an update to the previously submitted 2018 Drainage Strategy and May 2019 Drainage Strategy Addendum to reflect the further amendments to the scheme. The report assesses management of foul and surface water runoff from the Site, so as not to have a detrimental effect on the Site or its surroundings, in line with the NPPF and local policy.

# 2. Planning Policy and Guidance

## National Planning Policy Framework

2.1. The National Planning Policy Framework[ii] (NPPF), last revised in February 2019 is the current national policy on flood risk and drainage.

2.2. The NPPF states that when determining planning applications, Local Planning Authorities (LPA) should ensure that flood risk is not increased elsewhere. Major developments should incorporate SuDS unless there is clear evidence that this would be inappropriate. The systems used should:

- Take account of advice from the Lead Local Flood Authority (LLFA);
- Have appropriate proposed minimum operational standards;
- Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- Where possible, provide multifunctional benefits.

### Planning Practice Guidance

2.3. The Planning Practice Guidance (PPG)[iii] provides additional guidance to LPAs to ensure effective implementation of the planning policies set out within the NPPF regarding development in areas at risk of flooding.

2.4. The PPG states that developers and LPAs should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

## Non-statutory Technical Standards for Sustainable Drainage Systems

2.5. The Non-statutory Technical Standards for Sustainable Drainage Systems[iv] was published in March 2015 and is the current guidance for the design, maintenance and operation of SuDS.

2.6. The standards set out that the peak runoff rates should be as close as is reasonably practicable to the greenfield rate, but should never exceed the pre-development runoff rate.

2.7. The standards also set out that the drainage system should be designed so that flooding does not occur on any part of the Site for a 1 in 30 year rainfall event, and that no flooding of a building (including basement) would occur during a 1 in 100 year rainfall event.

2.8. It is also noted within the standards that pumping should only be used when it is not reasonably practicable to discharge by gravity.

## London Plan and London Plan Supplementary Planning Guidance

2.9. The London Plan[v] published in March 2016 sets out the Mayor's policies for development in London.

2.10. The London Plan states that the frequency and consequence of fluvial, surface water and sewer flooding are likely to increase as a result of climate change and identifies SuDS as one of the key ways of ensuring that long-term flood risk is managed. Policy 5.13 promotes the use of SuDS to

reduce the contribution of climate change to flooding and seeks to ensure that surface water runoff is managed as close to its source as possible. Policy 5.11 specifically promotes the inclusion of roof, wall and site planting, where feasible.

2.11. The London Plan Supplementary Planning Guidance[vi] (SPG) entitled 'Sustainable Design and Construction', published in April 2014, provides further information on how to achieve the objectives of the London Plan. Regarding the control of surface water runoff, the SPG states:

- Developers should aim to achieve 100% attenuation of the site's undeveloped surface water runoff rate i.e. achieve greenfield runoff rates; and
- Where greenfield rates cannot be achieved, a minimum of 50% attenuation of the undeveloped sites surface water runoff is expected.

## Draft New London Plan

2.12. A draft new London Plan[vii] was published in November 2017 with the 'Intend to Publish' version in December 2019. Accordingly, although only holding limited weight as it is not yet adopted, it is important to note that in Policy SI13 the most favourable form of surface water management in the drainage hierarchy has been amended to read 'rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)'. The draft policy further states that development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

## Water Industry Act

2.13. Thames Water is the local Sewerage Undertaker and provides sewerage services under the guidance of the Water Industry Act 1991.

2.14. Under Section 106 of the Water Industry Act, the developer currently maintains the automatic right to 'communicate' with the public foul water sewer system.

## London Borough of Richmond Upon Thames Local Plan

2.15. LBRuT's adopted their Local Plan in 2018[viii]. With regards to drainage, Policy LP21 'Flood Risk and Sustainable Drainage' states the following:

*C. The Council will require the use of Sustainable Drainage Systems (SuDS) in all development proposals. Applicants will have to demonstrate that their proposal complies with the following:*

*1. A reduction in surface water discharge to greenfield run-off rates wherever feasible.*

*2. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development.*

2.16. LBRuT published a Planning Guidance Document – Delivering SuDS in Richmond[ix] in 2015, which provides further guidance on the implementation of SuDS.

2.17. It further states that to reduce the risk of surface water and sewer flooding, all development proposals in the borough that could lead to changes to or have impacts on, surface water runoff are required to follow the London Plan 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 to a watercourse
- Attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse
- Discharge rainwater direct to a watercourse
- Discharge rainwater to a surface water drain
- Discharge rainwater to a combined sewer.

# 3. Existing Drainage

3.1. Thames Water sewer records (Appendix B) indicate that several sewers are present in the vicinity of and crossing the Site, as indicated in Table 1.

Table 1: Existing Sewers Associated with the Stag Brewery Component of the Site

| Location | Sewer |
|---|---|
| Crossing through the north-west of the Site. | 225mm diameter Thames Water foul sewer. |
| Within north-west of the Site. | Two Thames Water foul rising mains. |
| Along north-eastern boundary of the Site along Thames towpath. | 686mm diameter combined Thames Water sewer. |
| West of the Site along Williams Lane. | 900mm diameter Thames Water surface water sewer. |
| South of the Site along Lower Richmond Road. | 600mm diameter Thames Water surface water sewer. |
| | 750mm diameter and 225mm diameter Thames Water foul water sewer. |
| Centre of the Site along Ship Lane. | 600mm diameter Thames Water surface water sewer. |
| | 225mm diameter Thames Water foul water sewer. |

3.2. Following review of the existing onsite drainage records for the Site (Appendix C) it is understood that existing drainage scenario is as follows:

- Existing foul flows discharge to the Thames Water sewer network;
- Existing surface water flows from the north-east of the Site discharge into the Thames via an existing outfall; and
- Existing surface water flows from the remainder of the Site discharge to the Thames Water sewer network at various connection points.

3.3. The existing drainage and connections would be confirmed by a CCTV drainage survey post planning.

# 4. Surface Water Drainage

4.1. Since the initial 2018 drainage strategy, the strategy has been developed to reflect the comments from LBRuT and the GLA, and amendments to the scheme proposals. The changes to the strategy comprise:

1. The 3G sports pitch was removed from the surface water drainage catchment on the basis that it would drain freely (requested by the GLA);
2. Permeable paving extents and the rain garden added to the drainage strategy with attenuation volumes quantified to demonstrate a reduction in runoff beyond the 50% mark; and
3. Basement attenuation tanks removed from the west of Ship Lane due to the reduction in basement extent allowing the tanks to be provided closer to the surface. This allows for gravity drainage.

4.2. The amended drainage strategy outlined below (bar the removal of the basement attenuation tanks) has been agreed and accepted by the GLA (Appendix D). The removal of the basement attenuation tanks removes the requirement for pumping and therefore provides a further sustainability benefit.

4.3. As noted previously, the potential highways works at Chalkers Corner is anticipated to comprise entirely highway land, with surface water run-off from the highway drainage discharging into the sewer as existing without attenuation. Drainage design here will be addressed as part of wider highways drainage design under the responsibility of the highway authority. Accordingly, the proposed drainage strategy included herein covers the Stag Brewery Site only. Any existing highways within Application Boundary A would also discharge as existing.

4.4. The proposed surface water drainage system would be designed to convey surface water only, with foul water being discharged separately. The design would be in accordance with BS EN 752 – Drain and Sewer Systems Outside Buildings[x], BS EN 12056 – Gravity Drainage Systems Inside Buildings[xi], and Approved Document H of Building Regulations[xii].

4.5. In line with Building Regulations and the PPG, the following hierarchy of surface water disposal should be adhered to, in decreasing order of preference.

i. Discharge to ground;
ii. Discharge to a surface water body;
iii. Discharge to a surface water sewer; and
iv. Discharge to a combined sewer.

## Discharge to Ground

4.6. According to the Preliminary Environment Risk Assessment by Waterman[xiii] (February 2018), the Site is underlain by clay, with the likelihood of high groundwater due to the Site's proximity to the River Thames. The report also states the possibility of contamination due to the previous industrial uses on Site. Therefore, the use of infiltration techniques is unlikely to be feasible for the majority of the Site.

4.7. As requested by the Greater London Authority (GLA) (Appendix D), it is proposed that the 3G sports pitch proposed in the south west of the Site would drain freely into the ground. This is subject to ground investigations, which would be undertaken during detailed design. If results show that infiltration is not feasible, then a tank or similar attenuation feature would be provided and surface water runoff from the pitch would be directed into the surrounding Thames Water network. The GLA agreed (Appendix D) that this approach satisfies their aspirations.

### Discharge to a Surface Water Body

4.8. The second most sustainable option would be to discharge directly to a surface water body. Due to the proximity to the River Thames, the north-eastern part of the Site would discharge directly into the River.

4.9. An existing residential area lies between the western part of the Site and the River Thames. As such, there is no means to provide a connection directly into the Thames from the western or south-eastern part of the Site.

### Discharge to a Sewer

4.10. Thames Water sewer records (Appendix B) indicate that several surface water sewers are present in the vicinity of the Site, which ultimately connect into the River Thames. The on-Site sewer records (Appendix C) indicate that the majority of the Site currently drains into the Thames Water surface water sewer network.

4.11. Areas of the Site where a direct connection into the River Thames is not feasible would instead connect to the Thames Water sewer network as per the existing situation.

## Sustainable Drainage Systems

4.12. The most sustainable way to drain surface water runoff is through the use of Sustainable Drainage Systems (SuDS), which need to be considered in relation to Site-specific constraints.

4.13. SuDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, SuDS features improve water quality, and provide biodiversity and amenity benefits.

4.14. The potential for SuDS was considered throughout the design process with workshops being held by the design team to discuss the various constraints and opportunites for each of the SuDS devices. In line with the draft London Plan Policy SI13 “Sustainable Drainage”, rainwater harvesting and parmeable paving would be incorporated along with a number of other SuDS features, as outlined in Table 2 below.

Table 2: Sustainable Drainage Techniques

| Device | Description | Constraints/Comments | ✓/✗ |
|---|---|---|---|
| Green / brown roofs (source control). | Provide soft landscaping at roof level which reduces surface water runoff. | Green roofs are proposed throughout the Development (Appendix A). | ✓ |

| Device | Description | Constraints/Comments | ✓/✗ |
|---|---|---|---|
| Infiltration devices & Soakaways (source control). | Store runoff and allow water to percolate into the ground via natural infiltration. | The underlying geology, high groundwater levels, and potential contamination risks preclude the potential for formal infiltration at this stage. | ✗ |
| Pervious surfaces (source control). | Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and / or slowly release to sewers. | The underlying geology, high groundwater levels, and potential contamination risks preclude the potential for formal infiltration. However, lined permeable paving is proposed throughout the Development. | ✓ |
| Rainwater harvesting (source control). | Reduces the annual average rate of runoff from a site by reusing water for non-potable uses e.g. toilet flushing or water butts. | Rainwater harvesting butts are proposed throughout the Development. However, the reduction of surface water runoff cannot be quantified with certainty as this would be dependent on the demand for harvested rainwater. | ✓ |
| Swales (permeable conveyance). | Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting). | The underlying geology, high groundwater level, and potential contamination risks preclude the potential for formal infiltration. The tight urban nature of the Site precludes the inclusion of swales. | ✗ |
| Filter drains & perforated pipes (permeable conveyance). | Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration (ground conditions permitting). | The underlying geology, high groundwater level, and potential contamination risks preclude the potential for formal infiltration. | ✗ |
| Filter Strips (permeable conveyance). | Wide gently sloping areas of grass or dense vegetation that remove pollutants from runoff from adjacent areas. | The underlying geology, high groundwater level, and potential contamination risks preclude the potential for formal infiltration. | ✗ |
| Infiltration basins (end of pipe treatment). | Depressions in the surface designed to store runoff and allow infiltration through the base. | The underlying geology, high groundwater level, and potential contamination risks preclude the potential for formal infiltration. | ✗ |
| Bioretention Systems / Rain Garden (end of pipe treatment). | A shallow landscaped depression which allows runoff to pond temporarily on the surface before filtering through vegetation and underlying soils. | The underlying geology, high groundwater and potential contamination risks preclude the potential for formal infiltration. However, a lined rain garden is proposed along the green link in the eastern part of the Site. | ✓ |

| Device | Description | Constraints/Comments | ✓/✗ |
|---|---|---|---|
| Dry ponds (end of pipe treatment) | Depressions in the surface designed to store runoff without infiltration through the base. | Due to the proposed basement extents, the incorporation of ponds would not be feasible. | ✗ |
| Attenuation underground (end of pipe treatment) | Oversized pipes or geo-cellular tanks designed to store water below ground level. | Due to the tight urban nature of the site, attenuation tanks are required to restrict runoff to the required rates. | ✓ |

### Green Roofs

4.15. Green roofs would provide a bio-diverse habitat in addition to capturing rainwater, naturally slowing the rate of runoff, and providing water quality benefits. The proposed locations for green roofs are shown on the development proposals in Appendix A.

### Rainwater Harvesting

4.16. The inclusion of rainwater harvesting would decrease the demand on potable water, and could be used for irrigation of the proposed landscaping. However, it cannot be guaranteed that there would always be sufficient demand for recycled water to ensure an empty tank is available prior to a high intensity rainfall event, when the storage is most required. Therefore, rainwater harvesting has not been taken into account in the surface water runoff calculations presented later in the drainage strategy.

4.17. Including rainwater harvesting butts is a simple means to increase water efficiency and reduce the amount of surface water runoff. Rainwater harvesting butts are proposed throughout the Development.

### Permeable Paving (Lined)

4.18. Permeable paving would provide water quality benefits as well as attenuating flows within the lined sub-base structure. The inclusion of lined permeable paving is proposed throughout the Development (as shown on the drainage strategy drawing, Appendix E). Rainwater would percolate through the granular sub-base prior to being attenuated in geo-cellular tanks located beneath.

### Rain Gardens

4.19. Rain gardens are planted areas where surface water is directed into, providing primarily water quality benefits as the water percolates through the soil as well as some attenuation. Rain gardens are proposed along the eastern edge of the green link in the eastern part of the Site.

### Underground Attenuation

4.20. Due to the constrained urban nature of the Site, lined geo-cellular attenuation tanks are required to significantly restrict surface water runoff. If deemend necessary during detailed design, these would include pollutant-intercepting biomats, which float on the water and are designed to intercept and

treat any potential residual emulsified oils (residual hydrocarbons) that may be present within the surface water. These provide a sutainable solution as it is self-maintaining and 100% recyclable.

## Proposed Surface Water Drainage Strategy

### Discharge to River Thames

4.21. In line with the drainage hierarchy, it is proposed to discharge surface water runoff from the north-east part of the Site into the adjacent River Thames. Due to the tidal nature of the Thames in this location, LBRuT accept that surface water runoff can discharge to it unrestricted (Appendix F). In the existing situation, the majority of this area drains into the Thames Water network. The proposals therefore reduce contributing area discharging into the public sewer network compared to the existing situation.

4.22. It is important to include the potential for tide locking in the assessment, to ensure that if the outfall into the Thames becomes surcharged (i.e. if the water level in the river rises above the level of the outfall), any rain falling on the Site during this time would not cause flooding within the Development. For the purpose of this assessment the Mean High Water Spring Level (MHWS) of 4.13m AOD has been used (as indicated in the 2017 PLA Tide Table in Appendix G), plus an 1.1m for sea level rise over the next 100 years (in accordance with EA guidance). This gives a tide locking design level to be 5.23m AOD. At this design level, the outfall would be surcharged for 5.4 hours during a tidal surge (Appendix G includes tide locking calculations).

4.23. The north-east of the Site would discharge unrestricted into the River Thames via three outfalls; the existing outfall would be reused if possible subject to CCTV survey and detailed design.

4.24. A proposed single-level basement (including a sub-basement under Building 01) extends across the majority of the eastern part of the Site, restricting potential drainage routes to the River Thames and therefore the size of the catchment that could drain to the River Thames. In order to maximise the size of the catchment that could drain to the River Thames, a shallow channel system made up of permavoid tanks is proposed to convey surface water towards the River (note this is for conveyance, not attenuation).

4.25. The channels would be 150mm deep and 3200mm in width (subject to detailed design) and laid flat above the ground floor slab. At the boundary of the basement the channels would be picked up by traditional below ground drainage and directed to the River Thames.

4.26. To ensure this system would work under storm conditions, a Microdrainage network model has been developed. The worst-case scenario (longest channel with largest incoming catchment area) has been assessed and the potential for tide-locking has been incorporated in the analysis. The results (Appendix G) indicate no flooding for the 1 in 100 year plus 40% climate change storm event.

### Discharge to Thames Water Sewers

4.27. It is proposed to discharge surface water runoff from the remaining areas of the Site (that cannot reach the River Thames directly) to the existing Thames Water network. The London Plan ideally requires developments to restrict surface water runoff to the greenfield rate. However, it states that where it can be justified that this volume cannot be incorporated within the development, 50% of the existing rate can be acceptable.

4.28. The area of the Site which currently drains into the Thames Water network is 5.89ha. This excludes the existing green area in the south-west of the Stag Brewery Site, to the south of the proposed school, as it would remain a green park area as part of the Development. By directing flows from the north-eastern part of the Stag Brewery Site directly to the River Thames, the area that drains into the Thames Water network is reduced to 4.82ha.

4.29. The greenfield runoff rate (Q100) has been calculated to be 9.2 l/s/ha (or 44.1 l/s for the the Site) (Appendix H). The existing runoff rate has been calculated for the 1 in 100 year 60 minute event using the Modified Rational Method. This gives an existing runoff rate off 841 l/s (Appendix H) for the Site.

4.30. The potential to restrict runoff to the greenfield runoff rate has been considered throughout the design process. However, the Site is spatially constrained by the proposed basement extents and level of the existing sewers. To restrict runoff to greenfield rates, the attenuation features would need to be considerably deeper to accommodate a larger volume. As a result, discharge to sewers by gravity would not be possible. Whilst avoiding pumping requirements, the attenuation volume available across the Site has been maximised through the incorporation of permeable paving with aggregate sub-base, rain gardens, and underground attenuation tanks, achieving a 70% reduction in surface water flows compared to the existing rate. A Briefing Note[xiv] was prepared for the benefit of the GLA outlining this approach (which was submitted to support the previous applications, reference 18/0547/FUL and 18/0549/FUL), which the GLA subsequently agreed to (Appendix D). In addition, the proposed 70% betterment compared to the existing rate is above and beyond the 50% flow reduction required by LBRuT (Appendix F).

4.31. The Site has been split into 7 drainage catchments, mimicking the existing situation as much as practicable. The attenuation provision within each catchment has been maximised, achieving a total of 2,667m$^3$ across the Site (Table 3). MicroDrainage Source Control module (Appendix H) was used to calculate the runoff rate this attenuation can achieve, resulting in 249 l/s, which represents a 70% reduction of flows compared to the existing rate. Source Control includes for all storm durations and takes account of a 40% increase in rainfall intensity to account for climate change.

Table 3: Proposed Discharge Rates and Attenuation Provision

| Catchment | Area (ha) | Existing Rate (l/s) | Proposed Rate (l/s) | Attenuation (m$^3$) | Betterment (%) |
|---|---|---|---|---|---|
| East part of the Site – 1 | 0.30 | 42.8 | 20.0 | 143 | 53 |
| East part of the Site – 2 | 0.25 | 35.7 | 17.8 | 117 | 50 |
| East part of the Site – 3 | 0.18 | 25.7 | 12.8 | 84 | 50 |
| West part of the – School | 1.31 | 187.0 | 16.0 | 992 | 91 |
| West part of the Site – 4 | 1.07 | 152.7 | 76.2 | 499 | 50 |

| Catchment | Area (ha) | Existing Rate (l/s) | Proposed Rate (l/s) | Attenuation ($m^3$) | Betterment (%) |
|---|---|---|---|---|---|
| West part of Site – 5 | 0.92 | 131.3 | 49.5 | 465 | 62 |
| West part of the Site – 6 | 0.79 | 112.8 | 56.3 | 369 | 50 |
| Sub-Total | 4.82 | 688 | 249 | 2,667 | 64 |
| **Total*** | **5.89** | **841** | **249** | **2,667** | **70** |

*Includes area of the Site which is proposed to discharge unrestricted into the River Thames

4.32. The proposed geo-cellular tanks are proposed outside of the basement extent and below the extent of the proposed tree pits.

4.33. There is limited space for attenuation features to serve the proposed residential units in the north-west of the Site due to the road and pavements to be offered up for adoption. A proposed surface water sewer within the road would pick up surface water from the residential units and associated hardstanding areas and discharge into the Thames Water surface water sewer to the west. Attenuation would be provided by two offline attenuation tanks; surface water would back up into these tanks from the flow control structure prior to discharge into the public sewer.

4.34. Existing surface water connections into the surrounding public sewer network would be re-used where feasible, which would be determined following a CCTV survey during detailed design. Where new connections are required, these would be made to the public sewer system through a Section 106 Agreement with Thames Water, under the Water Industry Act 1991.

## Water Quality

4.35. Appropriate treatment would be incorporated into the drainage system to ensure that the quality of water discharged is acceptable in line with the CIRIA SuDS Manual[xv]. This would be achieved through the incorporation of green roofs and permeable paving sub-base storage. A biomat filtration system, downstream defender, petrol interceptor and/or other hard engineered solution would also be incorporated if deemed necessary during detailed design to ensure discharge is appropriately treated. The GLA have confirmed (Appendix D) that the proposed SuDS provision is in line with their aspirations.

4.36. The extensive basement proposed as part of the Development includes mainly car parking. It is anticipated that any surface water within the basement would pass through a petrol interceptor prior to being pumped into the foul network; details and requirements are to be confirmed during detailed design.

## Sustainable Drainage Systems Maintenance Plan

4.37. The on-Site drainage networks and SuDS would likely be privately managed and maintained for the lifetime of the Development, ensuring they remain fit for purpose and function appropriately. The management company / operator would be appointed post-planning.

4.38. The PPG sets out the requirement for developers to consider the operation, management and maintenance of all SuDS.

4.39. Post construction the on-Site management company (who would be appointed post-planning) would be responsible for the SuDS included in the scheme. Table 4 outlines what maintenance is anticipated for the proposed / potentially proposed SuDS features.

Table 4: Maintenance Plan for SuDS

| SuDs and Task | Frequency |
|---|---|
| **Green Roofs** | |
| Inspect system to replace dead plants as required and ensure plants are sufficiently watered (during establishment period). | As required. |
| Inspect system to replace dead plants (post establishment period). | Annually (in autumn). |
| Remove nuisance and invasive vegetation, including weeds. | Six monthly or as required. |
| Inspect system to ensure substrate is not eroded and inlet / outlet drains are not blocked. | Annually or as required (after severe storms). |
| **Rainwater Harvesting** | |
| Inspect system for debris / blockages. | Annually or as required. |
| **Permeable Paving** | |
| Brushing and vacuuming. | Once a year. |
| Stabilise and mow contributing adjacent areas. | As required. |
| Removal of weeds or management using glyphosphase applied directly into the weeds. | As required. |
| Remediate any landscaping which, through.vegetation maintenance of soil slip, has been raised to within 50mm of the level of the paving. | As required. |
| Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material. | As required. |
| Rehabilitation of surface and upper substructure by remedial sweeping. | Every 10 to 15 years as required (if infiltration performance is reduced due to significant clogging). |
| Initial inspection. | Monthly for three months after installation. |
| Inspect for evidence of poor operation and / or weed growth – if required, take remedial action. | Three-monthly, 48 hours after large storms in first six months. |
| Inspect silt accumulation rates and establish appropriate brushing frequencies. | Annually. |
| Monitor inspection chambers. | Annually. |

| SuDs and Task | Frequency |
|---|---|
| **Rain Garden** | |
| Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain to determine if maintenance is necessary. | Quarterly. |
| Check operation of the underdrains by inspection of flows after rain. | Annually. |
| Assess plants for disease infection, poor growth, invasive species etc., an replace as necessary. | Quarterly. |
| Inspect inlets and outlets for blockage. | Quarterly. |
| Remove litter and surface debris and weeds. | Quarterly. |
| Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch. | As required. |
| Remove and replace filter medium and vegetation above. | As required by likely to be > 20 years. |
| **Attenuation Tank** | |
| Inspect and identify any areas that are not operation correctly. If required, take remedial action. | Monthly for 3 months, then annually. |
| Remove debris from catchment surface, where it may cause risks to performance. | Monthly. |
| For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter, remove and replace surface infiltration medium as necessary. | Annually. |
| Repair/rehabilitate inlets, outlet, and overflows and vents. | As required. |
| Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed. | Annually. |
| Survey inside of tank for sediment build-up and remove if necessary. | Every 5 years or as required. |

# 5. Foul Drainage

5.1. The proposed foul drainage would be designed in accordance with BS EN 752 – Drain and Sewer Systems Outside Buildings[vii], BS EN 12056 – Gravity Drainage Systems Inside Buildings[viii], and Approved Document H of Building Regulations[ix].

5.2. It is understood that foul flows from the existing Site discharge to the Thames Water foul network in the surrounding highways. It is proposed to mimic this scenario, with new connections into the sewers on Mortlake High Street, Lower Richmond Road, Ship Lane, and Willams Lane according to the proposed building layout. The indicative connection points are shown on the drainage layout (Appendix E).

5.3. The existing and proposed foul discharge rates have been calculated using the water consumption method at 14.4 l/s and 28.5 l/s respectively (Appendix I).

5.4. Thames Water have previously confirmed (Appendix B) that there is capacity for the proposed surface and foul flows, however the scheme has changed since then. The proposed flow rates have decreased for surface water and slightly increased for foul water, thus it is not anticipated that there would be an issue relating to capacity.

5.5. Existing connections would be re-used where feasible. Where new connections are required, these would be made to the public sewer system through an S106 Agreement with Thames Water, under the Water Industry Act 1991.

# 6. Impact on Existing Drainage Infrastructure

6.1. The impact on existing drainage infrastructure is as previously assessed in the 2018 Drainage Strategy and the May 2019 Drainage Strategy Addendum.

6.2. Easements to existing drainage infrastructure crossing the Site need to be allowed for to ensure it is not impacted upon. The Development complies with all necessary easements, and where these are not possible, appropriate diversions are proposed.

6.3. The 225mm diameter Thames Water foul sewer crossing the Site is proposed to be diverted as shown on the drainage plan in Appendix I. The two rising mains only service the existing uses within the Site (now redundant and dis-used), and are proposed to be abandoned as part of the Development (Applications A and B). An easement of 4.0m is allowed for to the combined sewer along the north-eastern boundary of the Site to ensure it is not impacted upon as it conveys off-Site flows.

# 7. Conclusions

7.1. A Drainage Strategy was submitted in support of the initial planning application for the development in 2018. In May 2019, a Drainage Strategy Addendum was submitted to incorporate changes to the drainage strategy as a result of discussions with the GLA and LBRuT and small amendments to the scheme. This was submitted as part of the May 2019 Amendments. Further minor amendments are now proposed (to be submitted as part of the May 2020 Amendments). These comprise an increase in residential unit provision, an increase in affordable housing provision, an increase in height of some buildings, changes to some building layouts, reduction in size of the western basement, and other amendments including internal layouts and quantum and mix of uses across the Site.

7.2. This amended Drainage Strategy report is an update to the previously submitted 2018 Drainage Strategy and May 2019 Drainage Strategy Addendum to reflect the further amendments to the scheme.

7.3. As per the previous submission, the drainage strategy covers the Stag Brewery Site (Applications A and B) (refer to Figure 1). Drainage associated with highways and surface water run-off from the highway drainage associated with Chalkers Corner works (Application C) would be discharged to the sewer unattenuated as existing, with the drainage strategy to be developed in conjunction with the local highway authority at the detailed design stage..

7.4. As per the previous submission, surface water runoff from the northeast of the Application A site would discharge by gravity to the River Thames (adjacent to the northern boundary of the Site) via three outfalls. As the River Thames is tidal in this location, direct discharge to the river would be unrestricted. The area to discharge into the River Thames has been maximised using shallow geo-cellular conveyance channels, in order to relieve the Thames Water network of flows. Surface water runoff from the remainder of the Site would discharge via gravity to the Thames Water sewer network in the surrounding highways, maximising the attenuation volume within each drainage catchment to restrict surface water flows as much as possible.

7.5. Based on an area of 5.89ha currently draining into the Thames Water network, the existing discharge rate was calculated to be 841 l/s. The incorporation of permeable paving, rain gardens, and underground attenuation tanks achieves a reduction of surface water flows to 249 l/s, equal to a 70% reduction compared to the existing rate. This approach has been agreed with the GLA.

7.6. Appropriate treatment would be incorporated into the drainage system to ensure that the quality of water discharged is acceptable. This would be achieved through the incorporation of green roofs, permeable paving aggregate sub-base, rain gardens, and rainwater harvesting. A biomat filtration system within the attenuation tanks and downstream defenders or similar hard engineered solution would also be incorporated if deemed necessary at detailed design to ensure discharge is appropriately treated.

7.7. Foul flows from the Site (Application A and B) would discharge by gravity the Thames Water sewer network. The existing and proposed foul discharge rates have been calculated using the water consumption method at 14.4l/s and 28.5 l/s respectively.

7.8. The on-Site drainage networks and Sustainable Drainage Systems would be privately managed and maintained for the lifetime of the Development (Applications A and B), ensuring they remain fit for purpose and function appropriately. The management company / operator would be appointed post-

planning. The school drainage system (Application B) would be delivered and maintained separately from the Application A and C sites.

7.9. This report confirms that as per the previous submitted reports, surface water runoff from the Site (Applications A and B) can be managed sustainably to ensure that flood risk is not increased elsewhere. It is considered that the information provided within this report satisfies the requirements of the NPPF, the London Plan, and the LBRuT Local Plan.

# 8. References


[i] London Borough of Richmond Upon Thames, January 2020. Planning Committee Public Document Pack.

[ii] Ministry of Housing, Communities and Local Government, February 2019. National Planning Policy Framework.

[iii] Ministry of Housing, Communities and Local Government, 2018. Planning Practice Guidance.

[iv] Department for Environment, Food and Rural Affairs, March 2015. Non-statutory technical standards for sustainable drainage systems.

[v] Greater London Authority, March 2016. The London Plan: Spatial Development Strategy for Greater London consolidated with Alterations since 2011.

[vi] Mayor of London, April 2014. Supplementary Planning Guidance: Sustainable Design and Construction

[vii] London Plan Team, December 2019. Draft London Plan – Intend to Publish Version.

[viii] London Borough of Richmond upon Thames, July 2018: Local Plan As Adopted 3 July 2018.

[ix] London Borough of Richmond Upon Thames, February 2015. Planning Guidance Document – Delivering SuDS in Richmond.

[x] British Standards Institution, April 2008. BS EN 752:2008 – Drain and Sewer Systems Outside Buildings.

[xi] British Standards Institution, September 2000. BS EN 12056-2:2000 – Gravity Drainage Systems Inside Buildings.

[xii] HM Government, 2010. The Building Regulations 2010: H, Drainage and Waste Disposal.

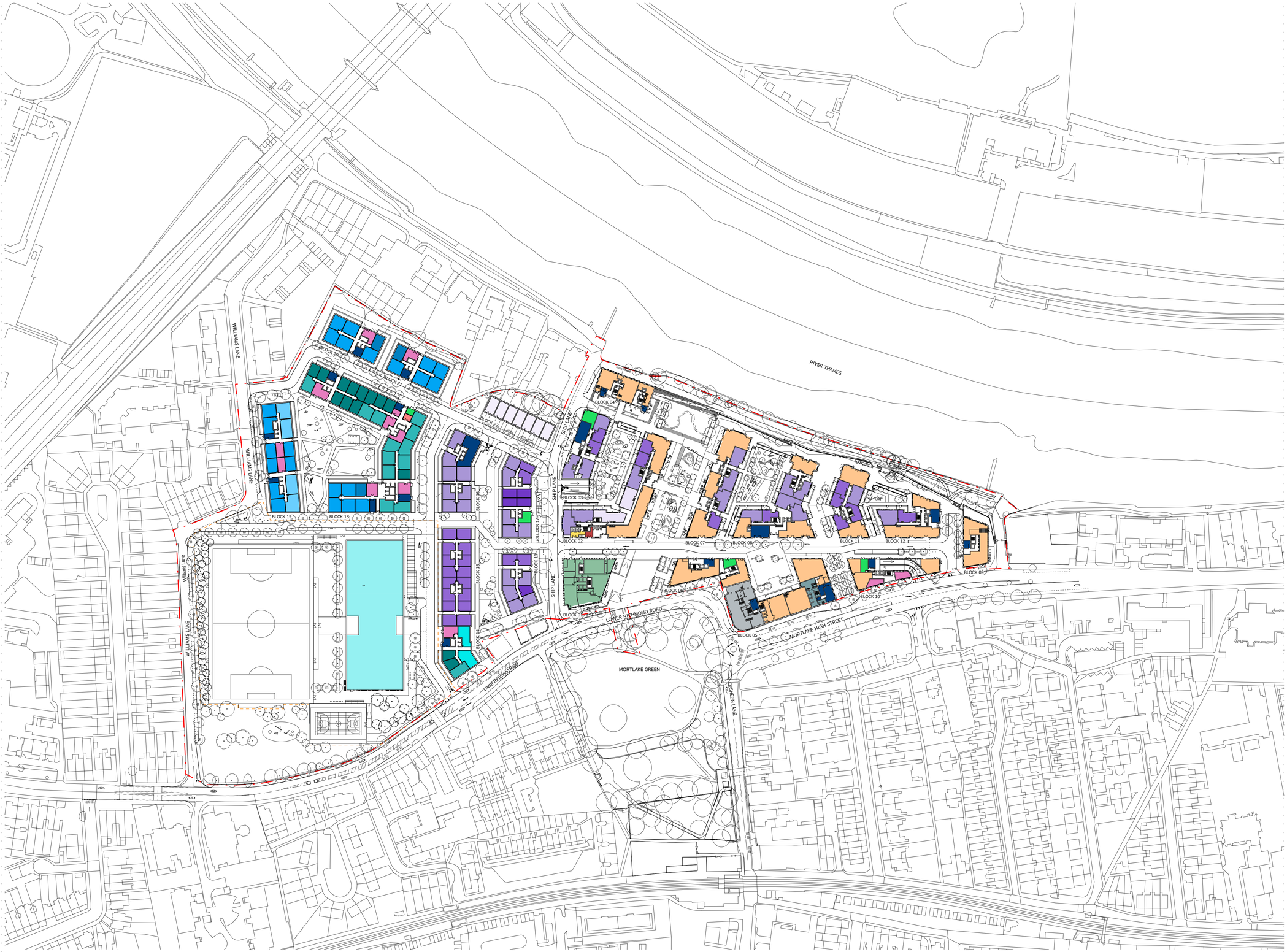
[xiii] Waterman Infrastructure & Environment Ltd, 2018. Preliminary Environmental Risk Assessment.

[xiv] Waterman Infrastructure & Environment, 2019. Surface Water Drainage Update Briefing Note.

[xv] CIRIA C753, 2015. The SuDS Manual.

# APPENDICES

## A. Development Proposals




NOTES:

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NOTE: UNIT MIX AND LAYOUT FOR DEVELOPMENT AREA 2 IS INDICATIVE AT THIS STAGE

- Studio
- 1B2P
- 2B3P
- 2B4P
- 3B4P
- 3B5P
- 4B8P
- 1B2P INT
- 2B3P INT
- 2B4P INT
- 3B5P INT
- 1B2P SR
- 2B3P SR
- 2B4P SR
- 3B5P SR
- BIKE STORE
- CAR PARK ENTRANCE
- CINEMA
- FLEXIBLE USE
- GAS METER ROOM
- HOTEL
- LV SWITCHROOM
- OFFICE
- REFUSE STORE
- SCHOOL
- SUBSTATION

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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Project

Stag Brewery
Richmond

Drawing

PROPOSED MASTERPLAN
GROUND FLOOR LEVEL

| Drawn | Date | Scale |
|---|---|---|
| TC | 18/01/18 | 1 : 1250 @ A1<br>1 : 2500 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_MP_P_00_001 | C |

Existing granite setts cleaned and retained

Proposed location of the Heritage Interpretation Board

Part of existing riverwall retained with new riverwall built adjacent to it

Stag Brewery Gate 2 Relocated

Existing vegetation pruned

Existing granite setts cleaned and retained

Step Access to Towpath

Existing paving cleaned and retained

New river wall and 1m high balustrade

Existing PUDC Draw Dock

Long Stay Cycle Rack Shelter - 20 spaces

Two Tier Cycle Rack Shelter - 60 spaces

Half panel of Watneys Brewery Gate Relocated

Stag Brewery Gate 1 Relocated

Williams Lane

Two Tier Cycle Rack Shelter - 60 spaces

Covered Bin Store and Cycle Stands

Lower Richmond Road

1m High hedge proposed to match existing

Existing Hedge retained

## LEGEND

### GENERAL

- Site Ownership Boundary
- Site Planning Application Boundary
- School Planning Application Boundary
- Existing Surface Level
- Proposed Surface Level
- Top of Wall Level
- Finished Floor Level (Internal)
- Stairs Up

### PAVING

- Paving Type 1 Stone setts for footpath
- Paving Type 2 Stone paving for shared surface
- Paving Type 3 Stone setts for river terrace
- Paving Type 4 Stone paving for courtyards
- Paving Type 5 Stone flag paving for plazas and entrances
- Paving Type 6 Small stone blend paving
- Paving Type 7 Large stone blend paving
- Paving Type 8 Resin bound gravel
- Paving Type 9 Artificial Stone flag paving
- Paving Type 10 Artificial Stone blend paving
- Paving Type 11 Porous Macadam MUGA surfacing
- Paving Type 12 Tri artificial grass
- Paving Type 13 Rubber surfacing for playground
- Paving Type 14 Artificial grass Colour light green

### STRUCTURES

- Fence Type 1 1.1m high fence for school
- Fence Type 2 1.8m high fence for school
- Fence Type 3 1.8m high fence with super rebound fence for school
- Wall Type 1 Concrete retaining wall
- Wall Type 2 Brick retaining wall with balustrade
- Wall Type 3 1.8m Flodal timber brick wall
- New Riverwall Concrete faced with brick cladding and concrete coping with glass balustrade
- Masonry pier Concrete masonry wall pier with brick cladding and concrete coping
- Existing Riverwall Retained Existing riverwall retained to match adjacent new riverwall height
- Gate Type 1 Double door gate for school

### FURNITURE

- Bollard Type 1 Stainless steel bollard
- Seat Type 1 Concrete Bench
- Seat Type 2 Concrete bench with timber top
- Cycle Stand Type 1 Sheffield cycle hoop - galvanised steel
- Two Tier Cycle Shelter 30 space per module
- Handrail Type 1 Stainless Steel Handrail
- Tree Surround Type 1 Resin bound gravel
- Bin Type 1 Stainless steel bin

### FEATURE

- Metal Railway Track For towpath to match existing railway track

### LIGHTING

- Lighting Column 10.5grting designer's details
- Lighting Column 10.5grting designer's details
- Bespoke Lighting Mast Mast mounted lighting with CCTV and camera's. To lighting designer's details
- Bespoke Lighting Mast Side spotlights. To grting designer's details
- Lighting Column 10.5grting designer's details
- Sports Lighting Column 10.5grting designer's details

### PLANTING

- Short Mown Grass Mown path
- Planting Mix Mixed perennial and evergreen planting
- Rain Garden Planting Mixed low shrub planting - 1.2m high
- Low Shrub Planting Mixed low shrub planting - 1.5m high
- Hedge Type 1 1.5m high hedge
- Existing Hedge Hornbeam
- Meadow Planting Mixed meadow planting
- Existing Trees to be Retained Protected during all works
- Proposed Trees

| rev | details | by | date |
|---|---|---|---|
| 00 | For Information | RM | 12.08.2019 |
| 01 | For Information | RM | 13.08.2019 |
| 02 | For Information | RM | 13.09.2019 |
| 03 | For Information | CL | 23.09.2019 |
| 04 | For Information | CL | 26.09.2019 |
| 05 | For Information | CL | 25.10.2019 |
| 06 | For Information | RM | 27.03.2020 |
| 07 | For Information | RM | 02.04.2020 |

| rev | details | by | date |
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## Notes

1.0 Do not scale from drawing, use figured dimensions only
1.1 All dimensions to be checked onsite
1.2 This drawing to be read in conjunction with all other Gillespies drawings and specifications

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Project title
STAG BREWERY

Drawing title
Landscape Site Wide General Arrangement

Drawing number
P10736-00-003-GIL-0101

Drawing Status: FOR INFORMATION
Revision: 07

| Date | Scale | Drawn | Checked |
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| 02.04.2020 | 1:500 @ A0 | RM | CL |



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GILLESPIES
1 St John's Square, London, EC1M 4DH
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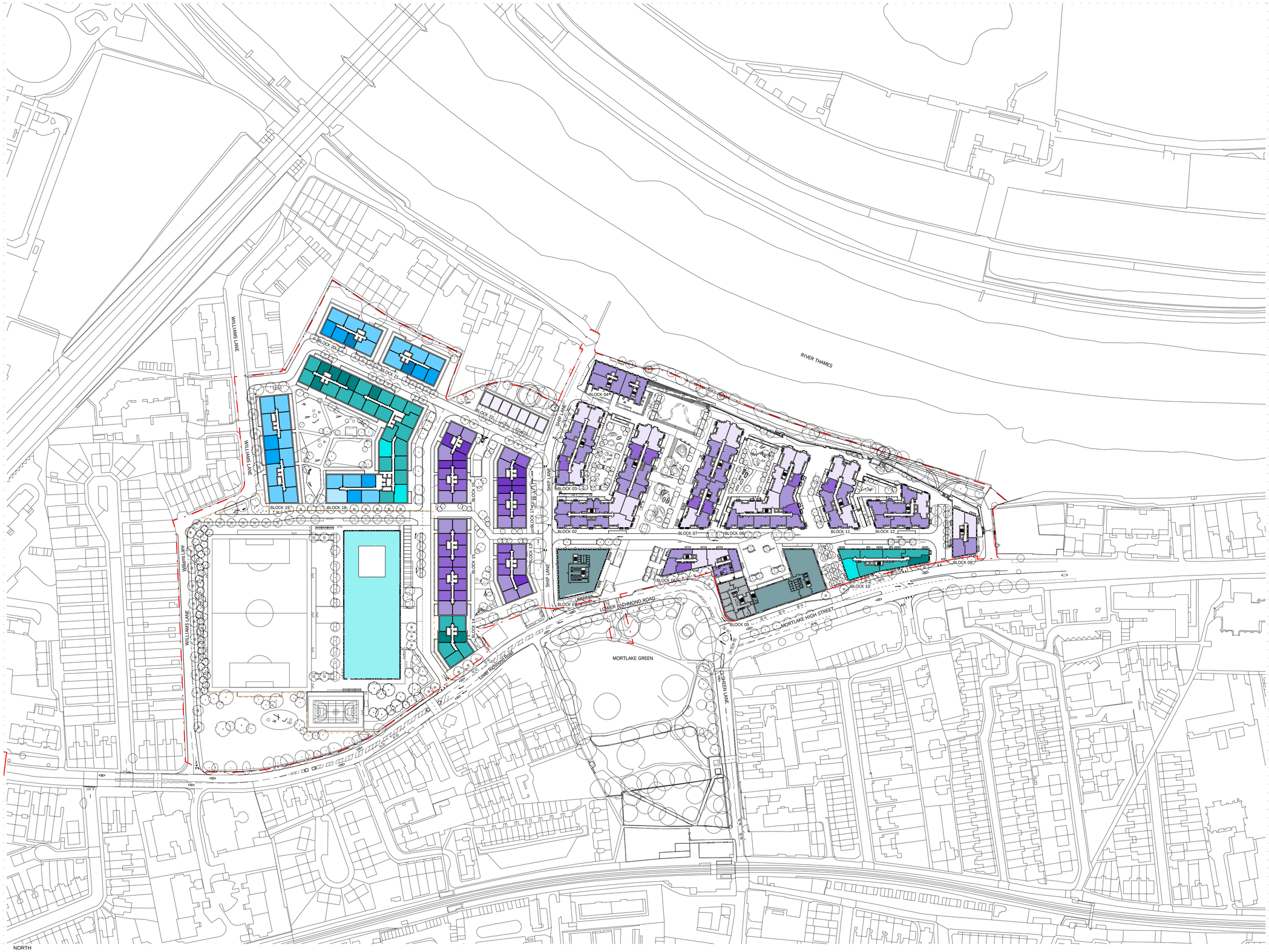


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NOTE: UNIT MIX AND LAYOUT FOR DEVELOPMENT AREA 2 IS INDICATIVE AT THIS STAGE

- Studio
- 1B2P
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- 2B4P
- 3B5P
- 3B6P
- 4B7P
- 4B8P
- 1B2P INT
- 2B3P INT
- 2B4P INT
- 3B5P INT
- 3B6P INT
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- 2B4P SR
- 3B5P SR
- 3B6P SR
- 4B8P SR
- HOTEL
- OFFICE
- SCHOOL

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| GLA SUBMISSION | 06/04/20 | BJ | C |
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PROPOSED MASTERPLAN TYPICAL FLOOR LEVEL

| Drawn | Date | Scale |
|---|---|---|
| TC | 18/01/18 | 1 : 1250 @ A1<br>1 : 2500 @ A3 |

| Job Number | Drawing number | Revision |
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| 18125 | C645_MP_P_TY_001 | C |


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- Studio
- 1B2P
- 2B3P
- 2B4P
- 3B4P
- 3B5P
- 4B8P
- BIKE STORE
- CAR PARK ENTRANCE
- CINEMA
- FLEXIBLE USE
- GAS METER ROOM
- HOTEL
- OFFICE
- REFUSE STORE
- SUBSTATION

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|---|---|---|---|
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PROPOSED DEVELOPMENT AREA 01
GROUND LEVEL PLAN

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|---|---|---|
| KHO | 18/01/18 | 1 : 500 @ A1<br>1 : 1000 @ A3 |

| Job Number | Drawing number | Revision |
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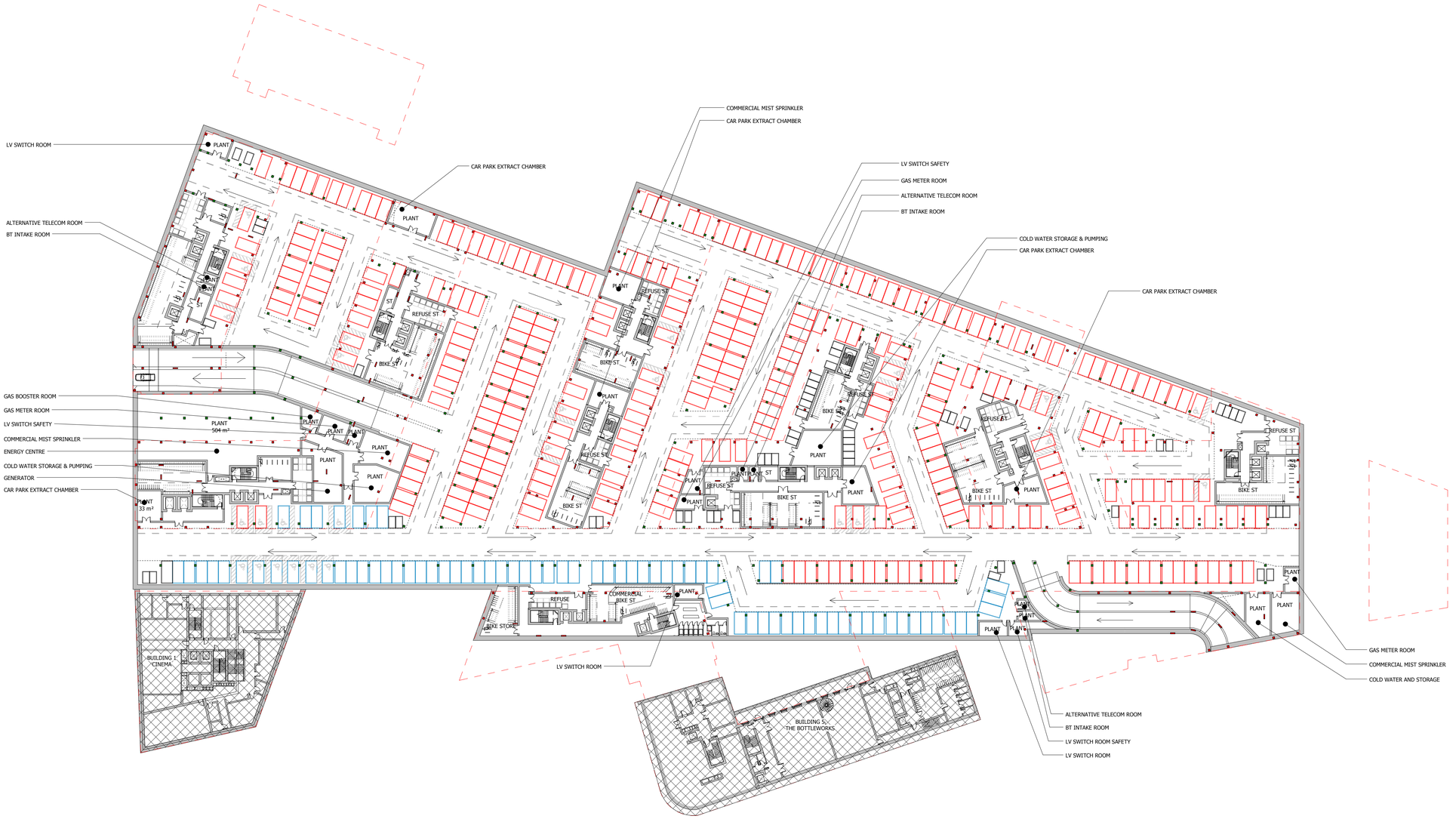


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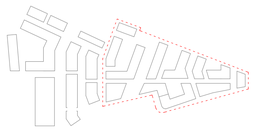
NORTH



KEY

- 330 Residential Spaces
- 78 Commercial Spaces
- 56 Motorbike Spaces
- 1,215 Cycle Spaces

NORTH

0 5 10 25 50 m

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 01/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
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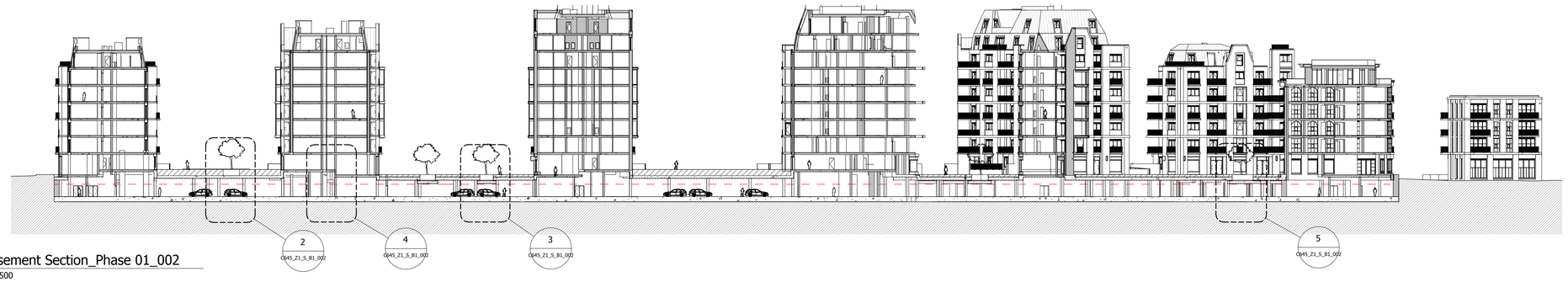
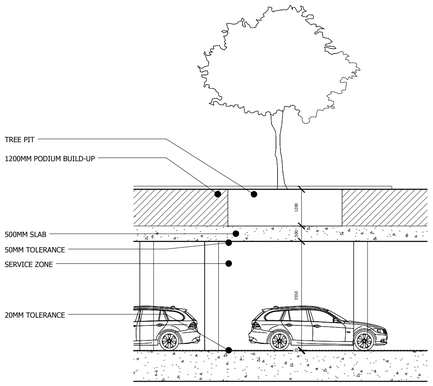
PROPOSED DEVELOPMENT AREA 01
BASEMENT PLAN

| Drawn | Date | Scale |
|---|---|---|
| RKL | 06/09/19 | 1 : 500 @ A1<br>1 : 1000 @ A3 |

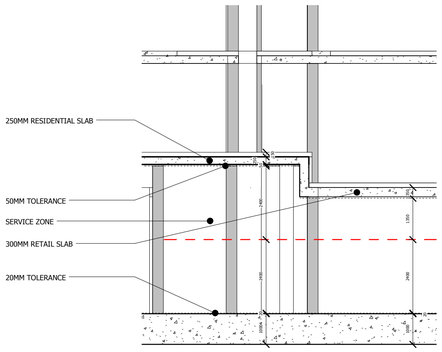
| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_Z1_P_B1_001 | C |



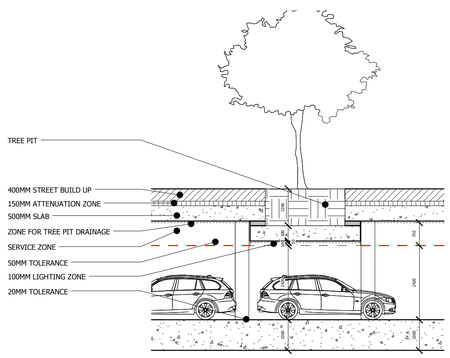

1 Basement Section_Phase 01_002
1 : 500



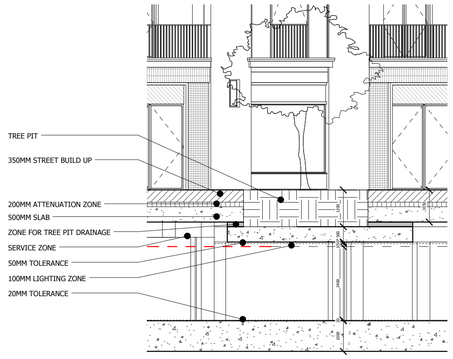

2 Basement Section_Development Area 01_Podium
1 : 100




4 Basement Section_Development Area 01_Slab Step
1 : 100




3 Basement Section_Development Area 01_Boulevard
1 : 100




5 Basement Section_Development Area 01_Main Street
1 : 100

NORTH

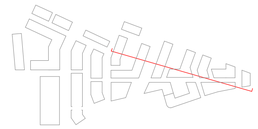
0 5 10 25 50 m

NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH



| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 01/04/20 | BJ | A |
| PLANNING APPLICATION | 29/03/18 | BJ | - |

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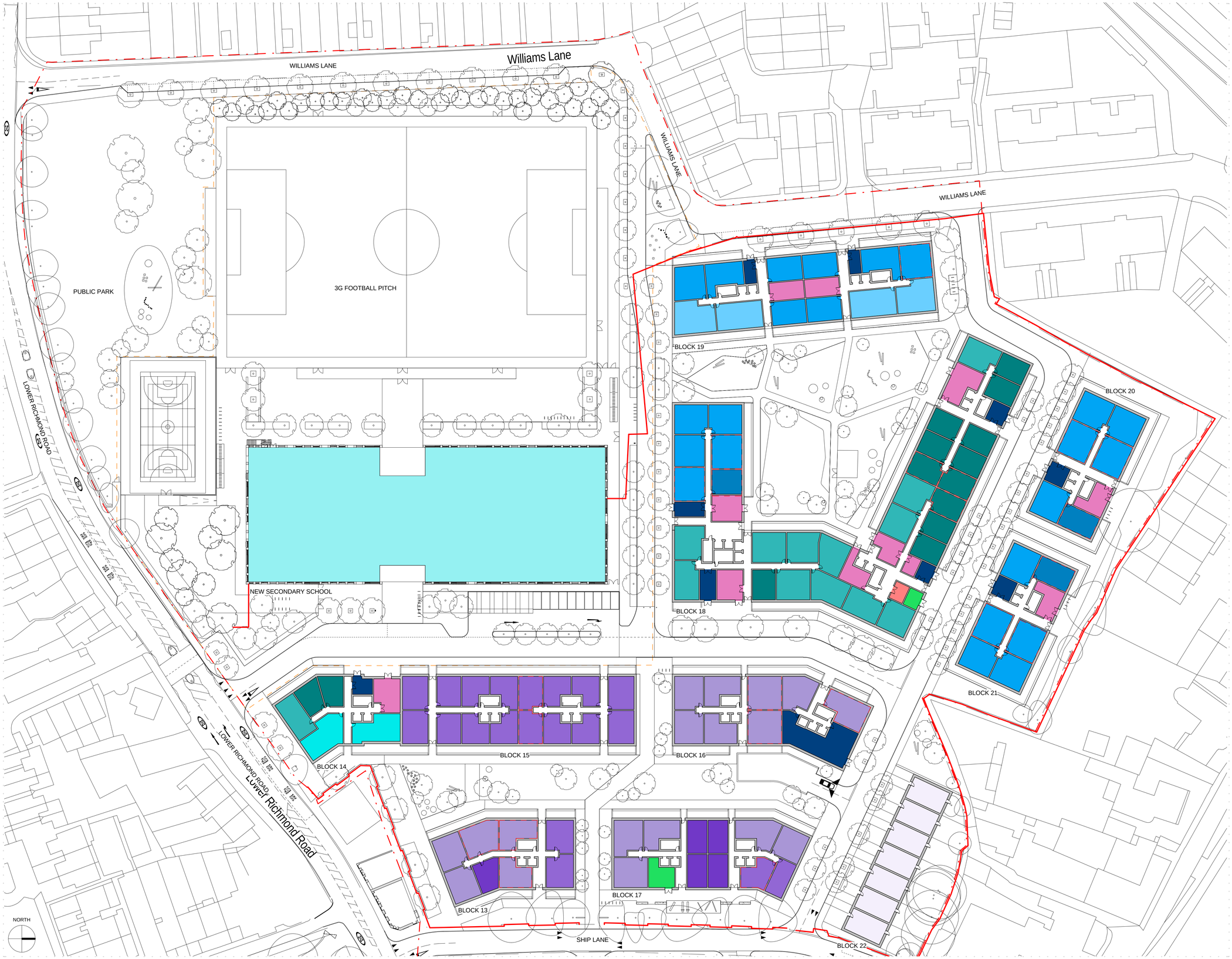
Drawing
PROPOSED DEVELOPMENT AREA 01
BASEMENT SECTION BB

| Drawn | Date | Scale |
|---|---|---|
| KHO | 29/03/18 | As indicated@ A1 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_Z1_S_B1_002 | A |




NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH

NOTE: UNIT MIX AND LAYOUT FOR DEVELOPMENT AREA 2 IS INDICATIVE AT THIS STAGE

NOTE:

WHEELCHAIR ACCESSIBLE UNIT / CONVERTIBLE UNIT

| | |
|---|---|
| Studio | 1B2P SR |
| 1B2P | 2B3P SR |
| 2B3P | 2B4P SR |
| 2B4P | 3B5P SR |
| 4B8P | BIKE STORE |
| 1B2P INT | LV SWITCHROOM |
| 2B3P INT | REFUSE STORE |
| 2B4P INT | SCHOOL |
| 3B5P INT | SUBSTATION |

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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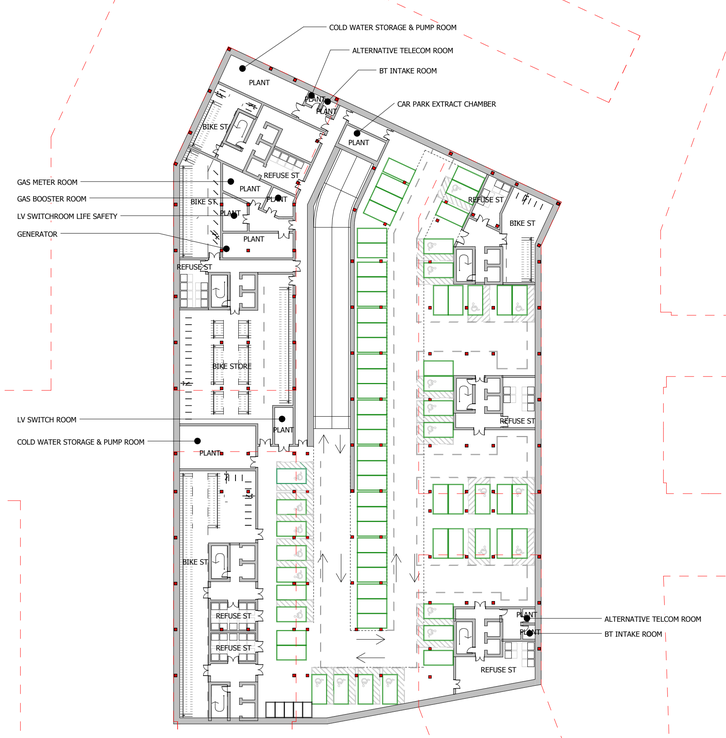
PROPOSED DEVELOPMENT AREA 02
GROUND LEVEL PLAN

| Drawn | Date | Scale |
|---|---|---|
| RKL | 18/01/18 | 1 : 500 @ A1<br>1 : 1000 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_Z2_P_00_001 | C |




NOTES:

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NORTH

KEY

70 Residential Spaces

5 Motorbike Spaces

762 Cycle Spaces

NORTH

0 5 10 25 50 m

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 01/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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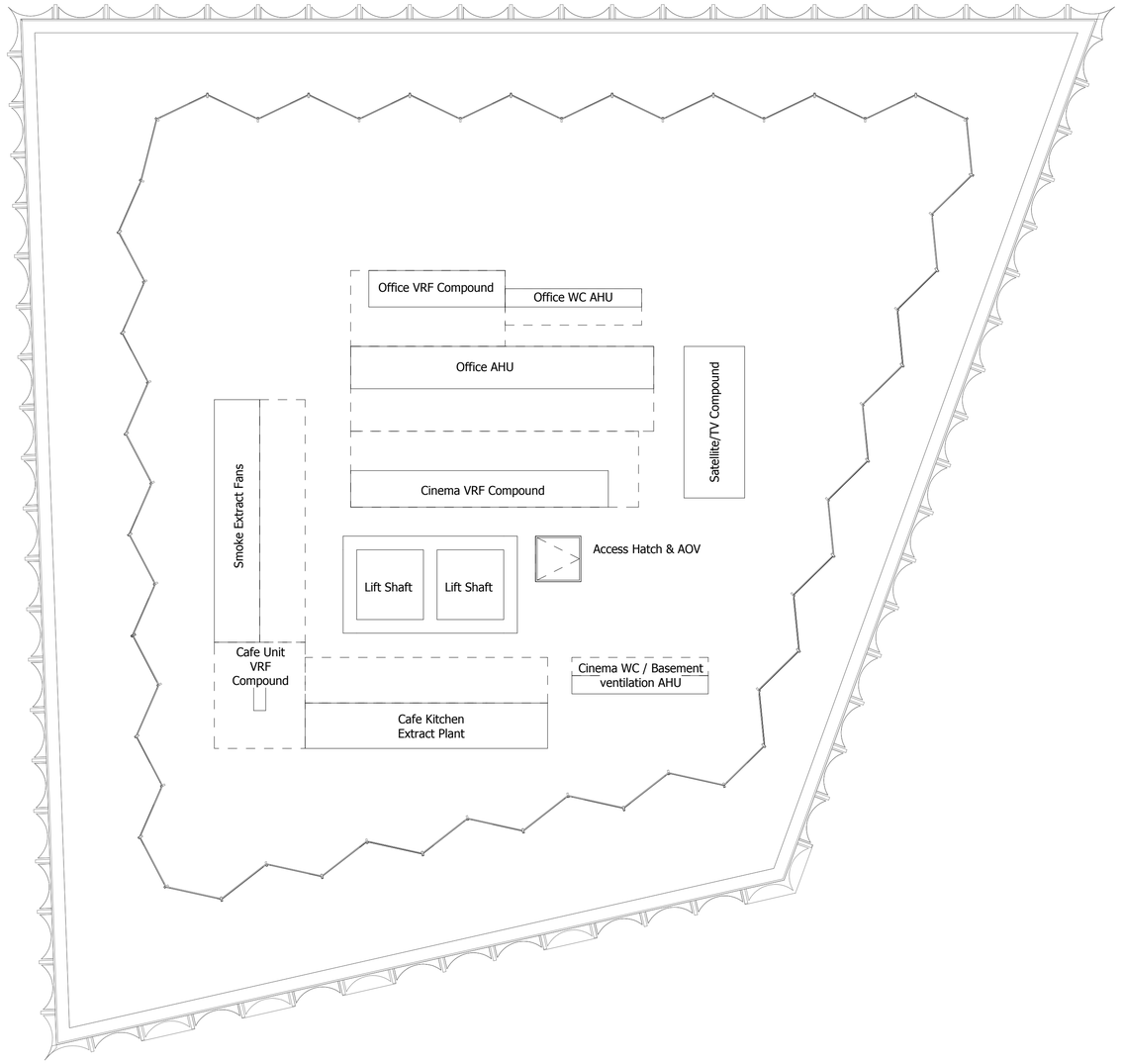
PROPOSED DEVELOPMENT AREA 02
BASEMENT PLAN

| Drawn | Date | Scale |
|---|---|---|
| RKL | 06/09/19 | 1 : 500 @ A1<br>1 : 1000 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_Z2_P_B1_001 | C |




NORTH

0 1 2 5 10 m

NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH

B1

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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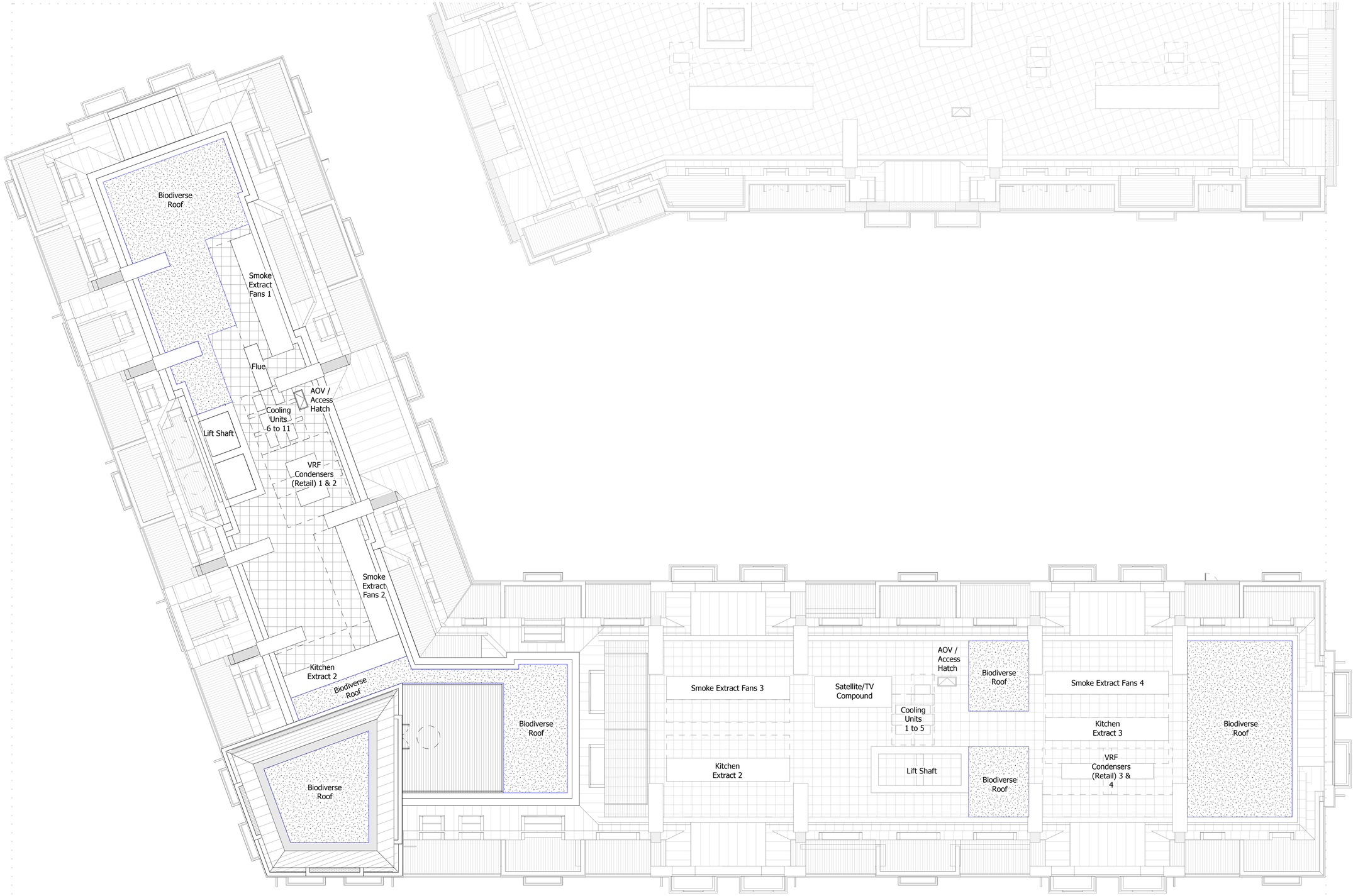
BUILDING 01 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| AJ | 13/09/19 | 1 : 100 @ A1<br>1 : 200 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B01_P_RF_001 | C |




NORTH

0 1.25 2.5 6.25 12.5 m

NOTES:

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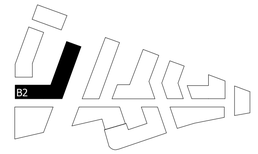
NORTH




Available roof space for brown/green roof and PVs

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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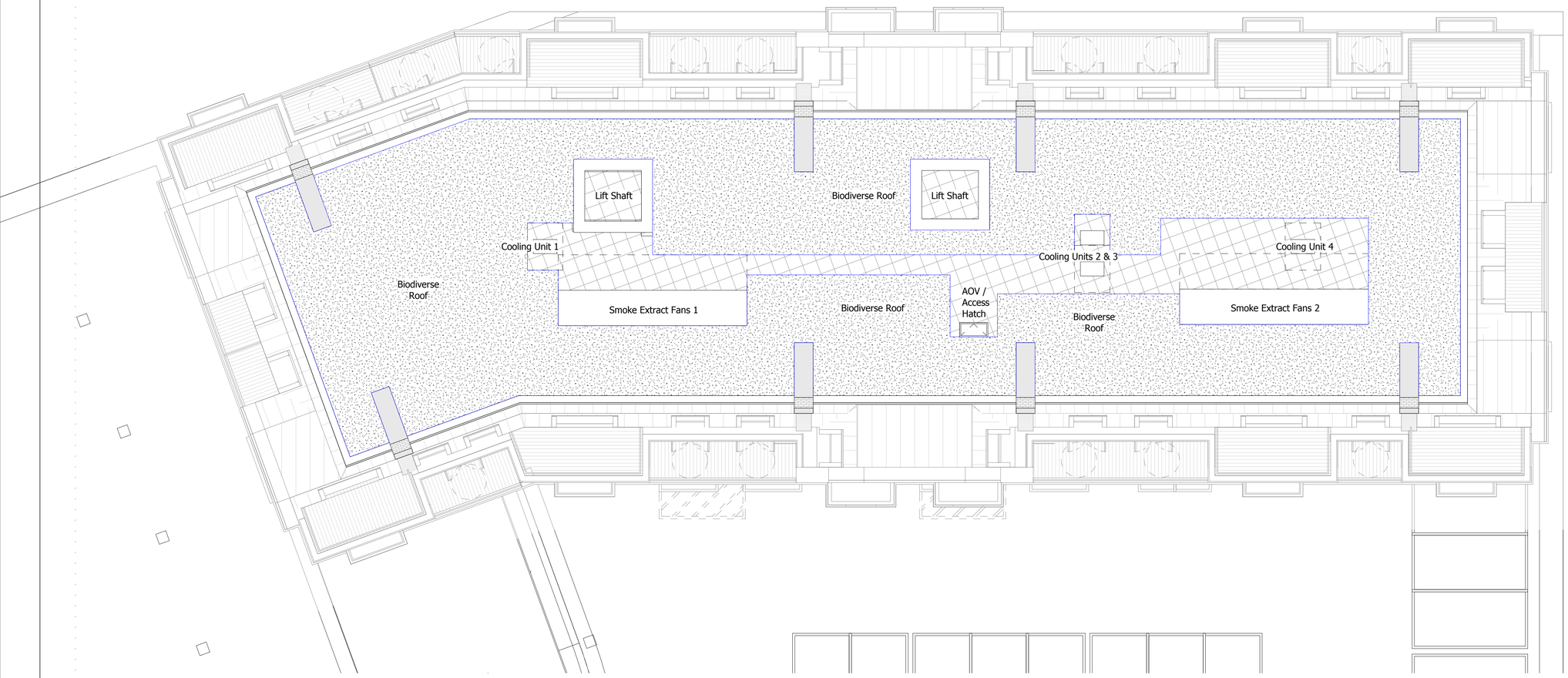
BUILDING 02 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| RKL | 09/04/19 | 1 : 125 @ A1<br>1 : 250 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B02_P_RF_001 | C |

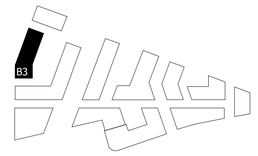



NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH




AVAILABLE ROOF SPACE FOR BROWN/GREEN ROOF AND PVs

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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BUILDING 03 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| AJ | 13/09/19 | 1 : 100 @ A1<br>1 : 200 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B03_P_RF_001 | C |

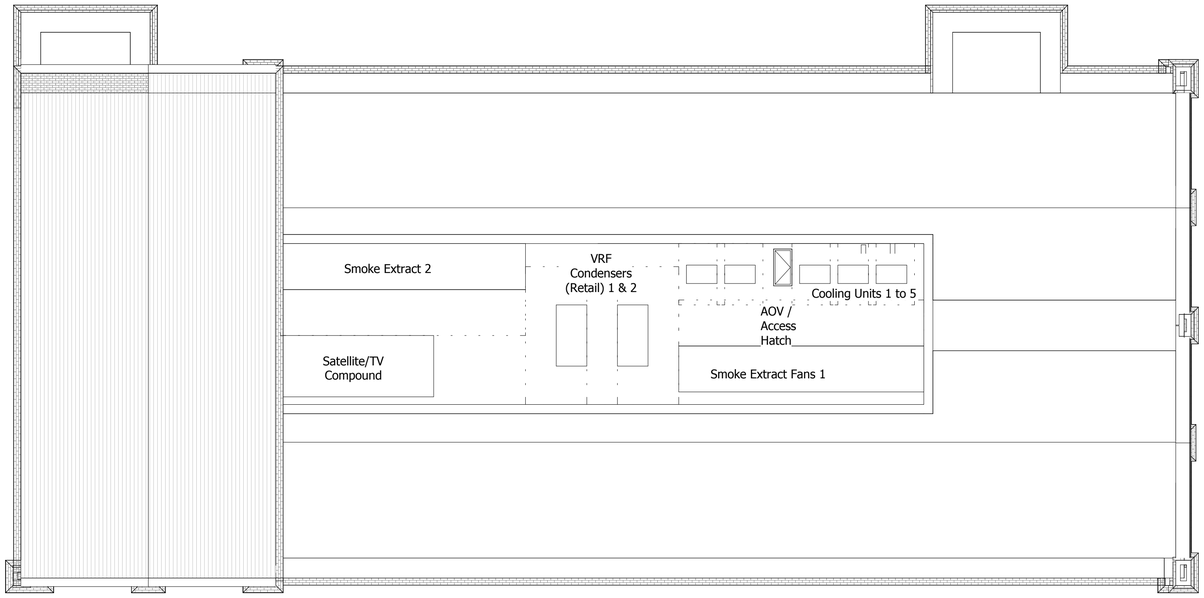
NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH

B4




NORTH

0 1 2 5 10 m

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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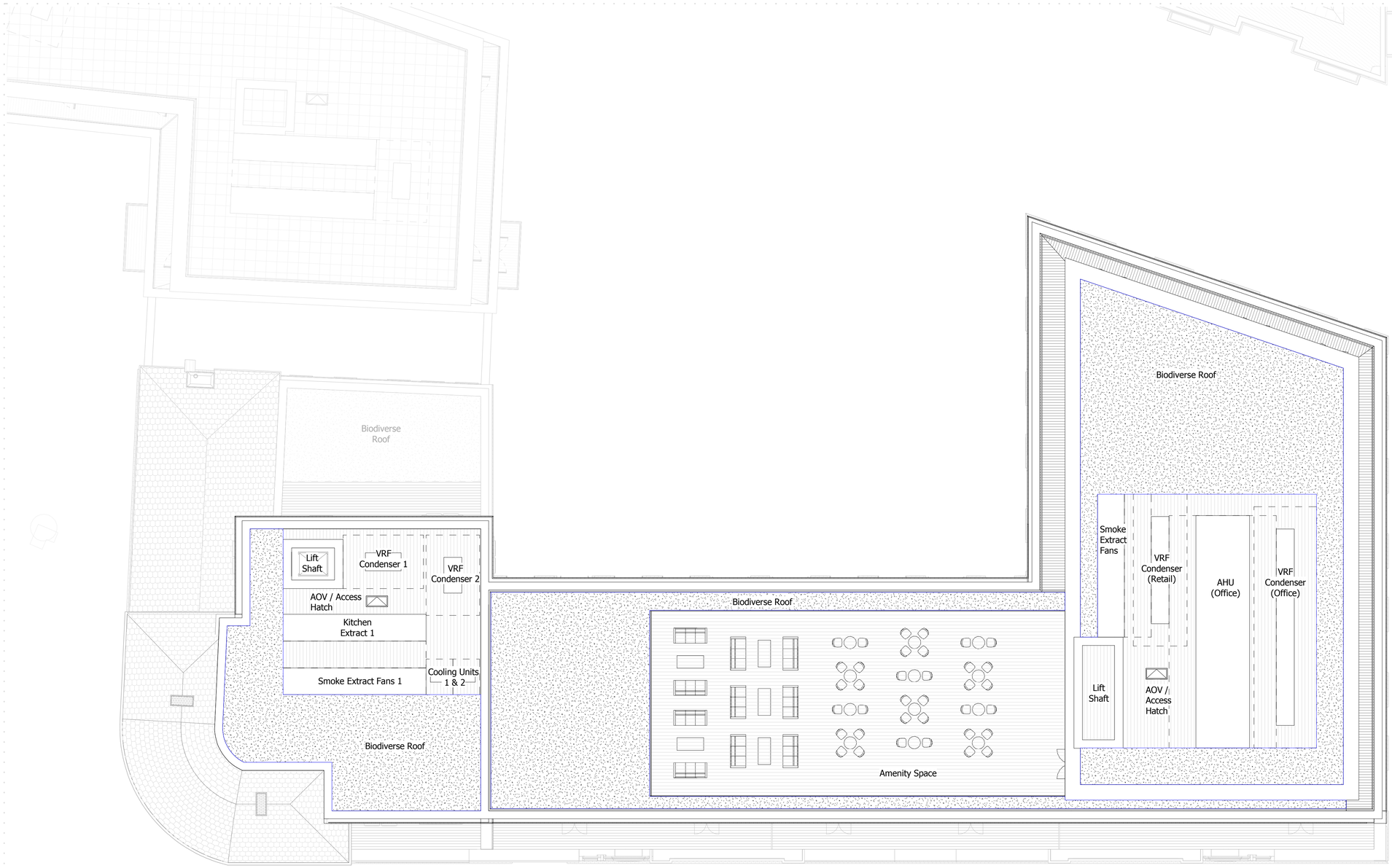
BUILDING 04 - PROPOSED ROOF LEVEL

| Drawn | Date | Scale |
|---|---|---|
| NSh | 09/06/19 | 1 : 100 @ A1<br>1 : 200 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B04_P_RF_001 | C |




NOTES:

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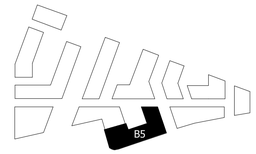
NORTH




Available roof space for brown/green roof and PVs

NORTH

0 1.25 2.5 6.25 12.5 m

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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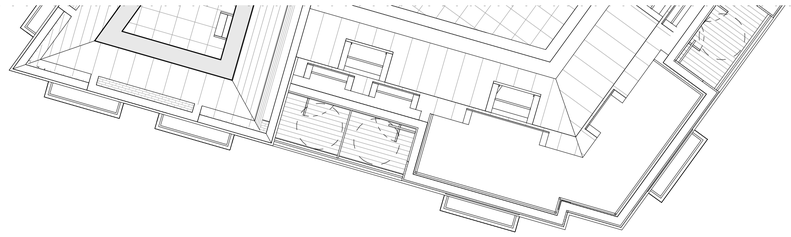
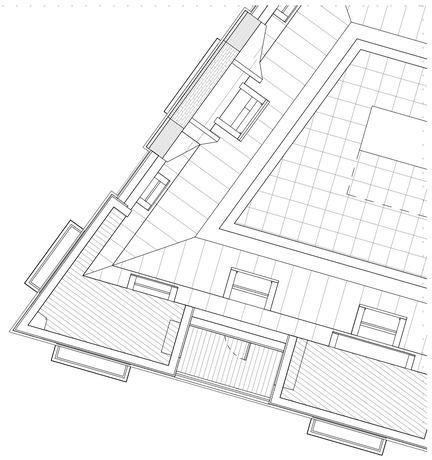
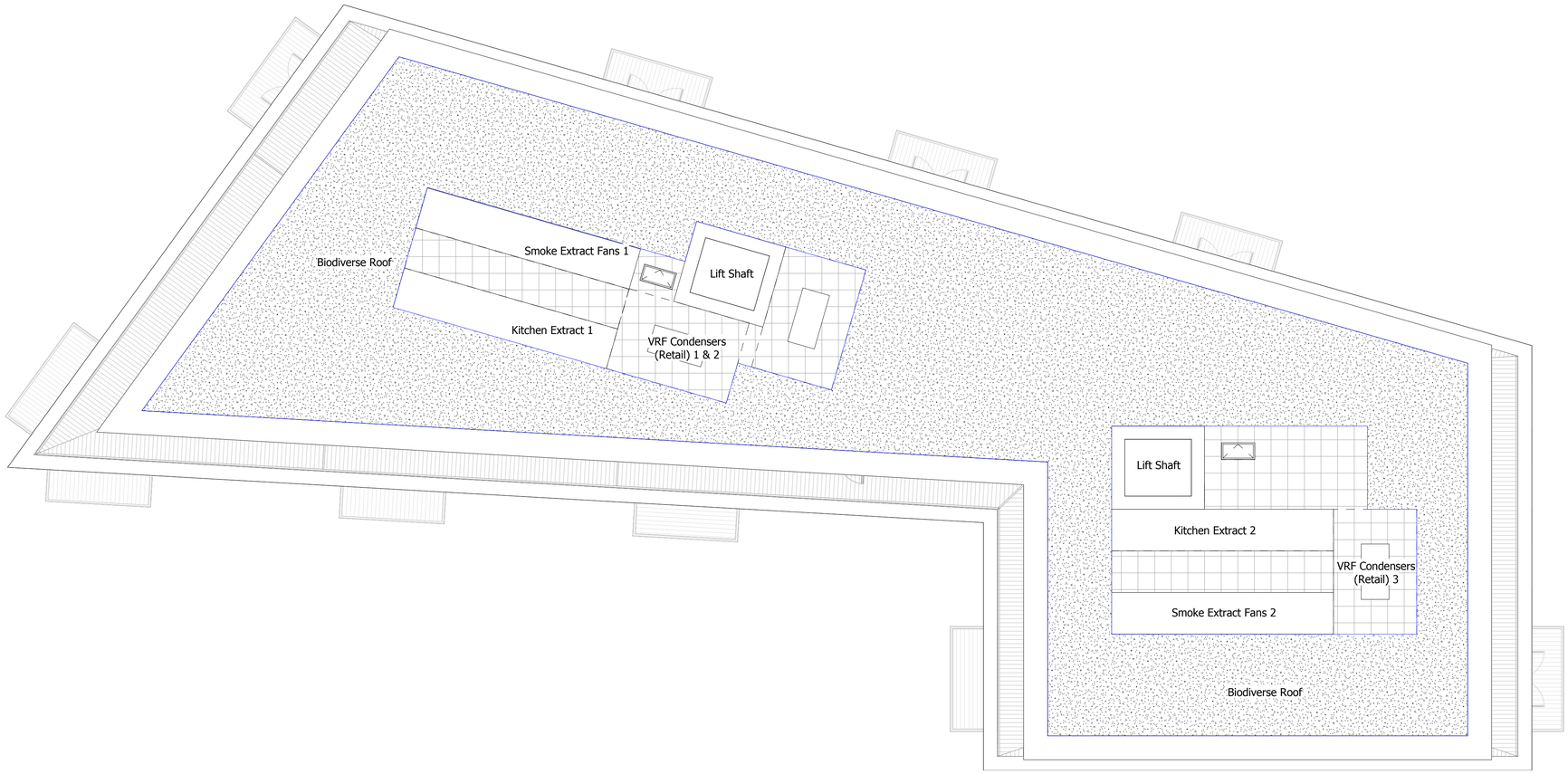
BUILDING 05 - PROPOSED ROOF PLAN

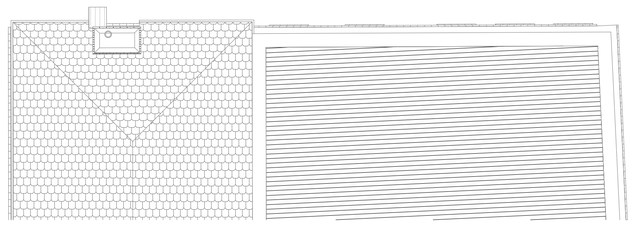
| Drawn | Date | Scale |
|---|---|---|
| NSh | 09/06/19 | 1 : 125 @ A1<br>1 : 250 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B05_P_RF_001 | C |







NORTH

0 1 2 5 10 m

NOTES:

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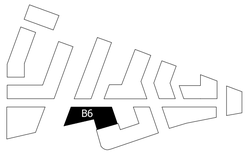
NORTH




Available roof space for brown/green roof and PVs

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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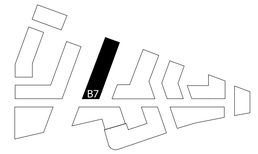
Drawing

BUILDING 06 - PROPOSED ROOF PLAN

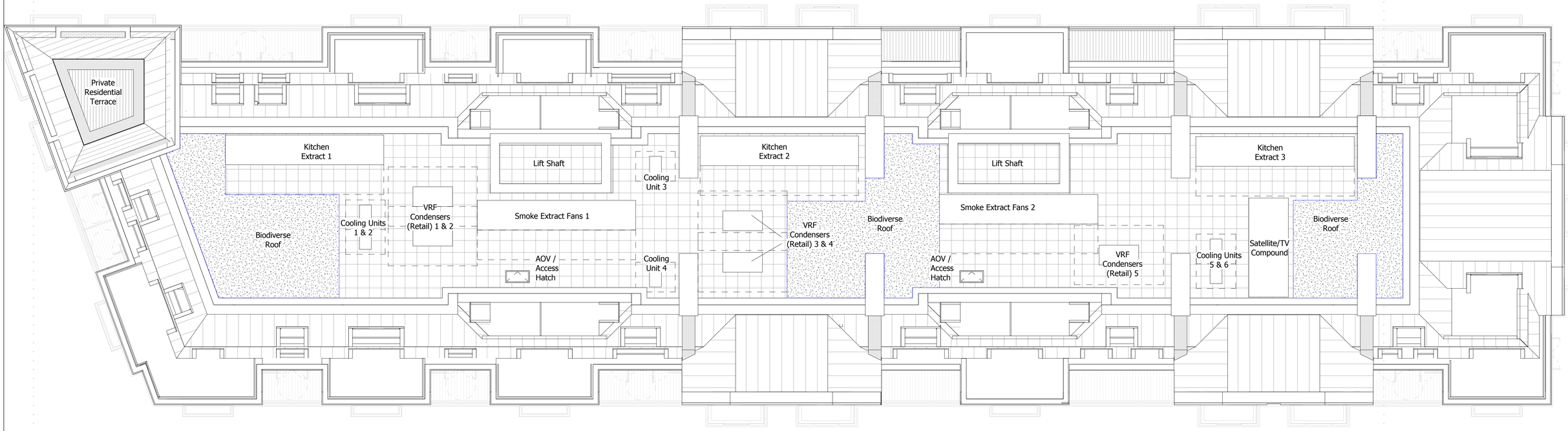
| Drawn | Date | Scale |
|---|---|---|
| NSh | 13/09/09 | 1 : 100 @ A1<br>1 : 200 @ A3 |

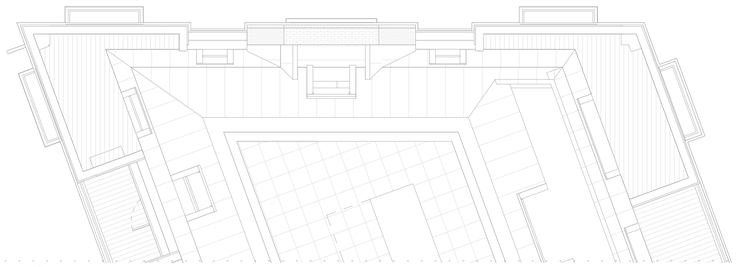
| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B06_P_RF_001 | C |

NORTH




Available roof space for brown/green roof and PVs



NORTH

0 1 2 5 10 m

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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BUILDING 07 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| EmK | 13/09/19 | 1 : 100 @ A1<br>1 : 200 @ A3 |

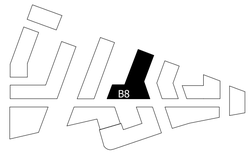
| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B07_P_RF_001 | C |


NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH




Available roof space for brown/green roof and PVs

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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BUILDING 08 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| EmK | 13/09/19 | 1 : 125 @ A1<br>1 : 250 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B08_P_RF_001 | C |

NORTH

0 1.25 2.5 6.25 12.5 m

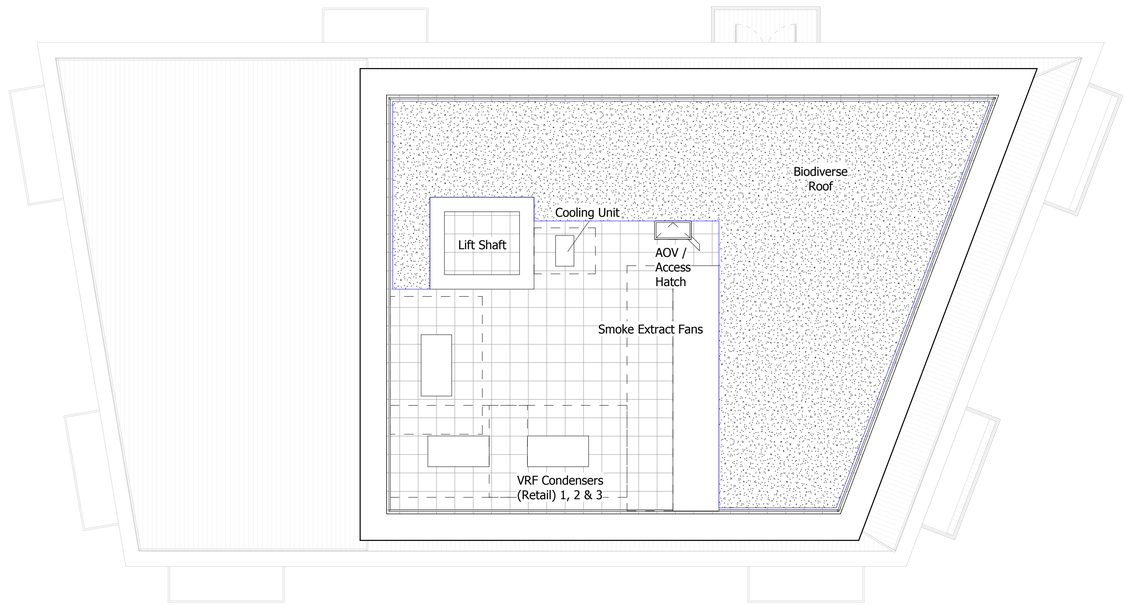
NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH

B9




AVAILABLE ROOF SPACE FOR BROWN/GREEN ROOF AND PVs

NORTH

0 1 2 5 10 m

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | 13/09/19 | KH | - |

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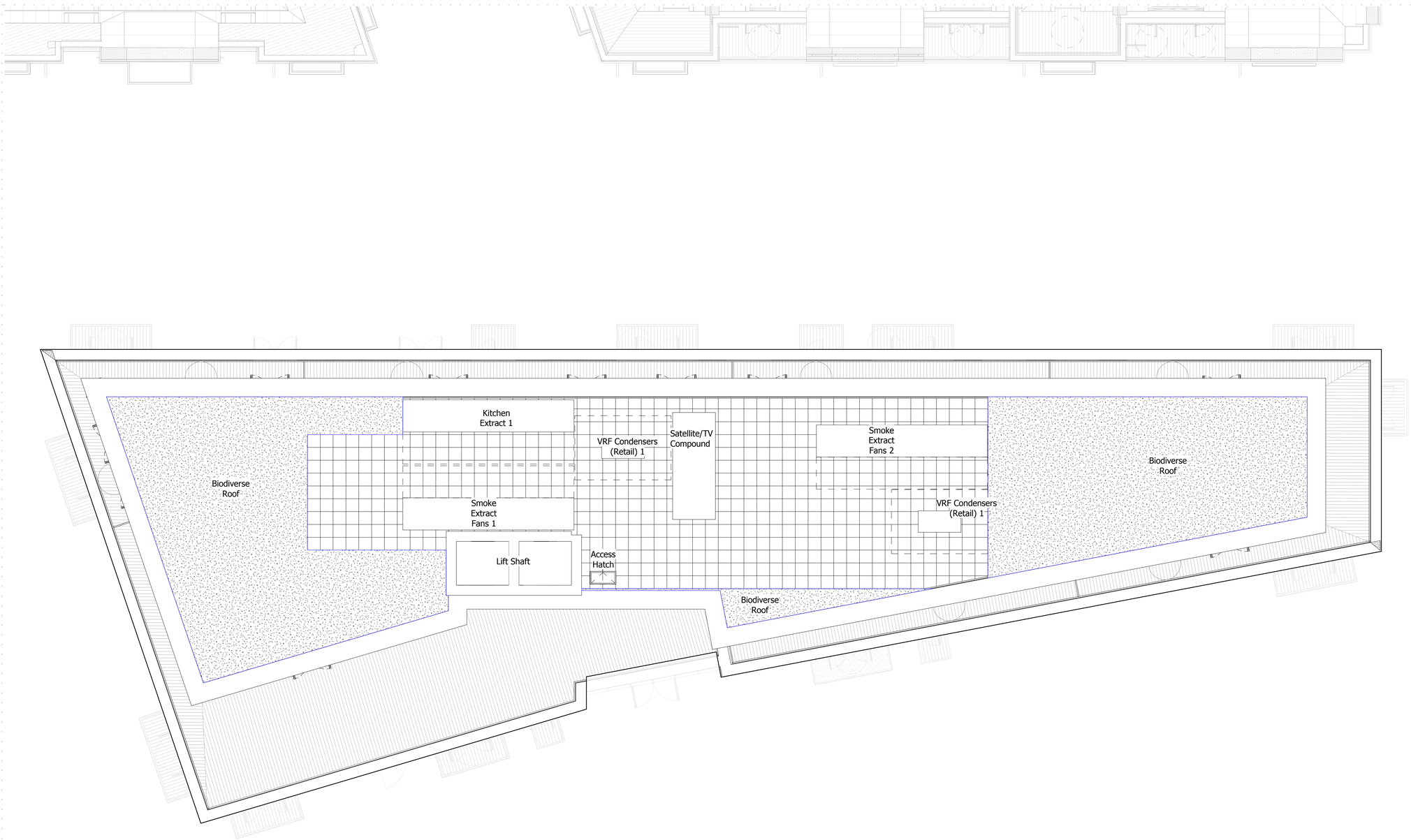
BLUILDING 09 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| EmK | 13/09/19 | 1 : 100 @ A1<br>1 : 200 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B09_P_RF_001 | C |

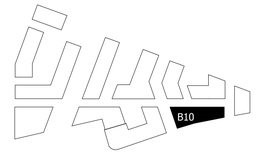



NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH




AVAILABLE ROOF SPACE FOR BROWN/GREEN ROOF AND PVs

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | - | KH | - |

SQUIRE & PARTNERS

The Department Store
248 Ferndale Road London SW9 8FR
T: 020 7278 5555 F: 020 7239 0495

info@squireandpartners.com
www.squireandpartners.com

Project

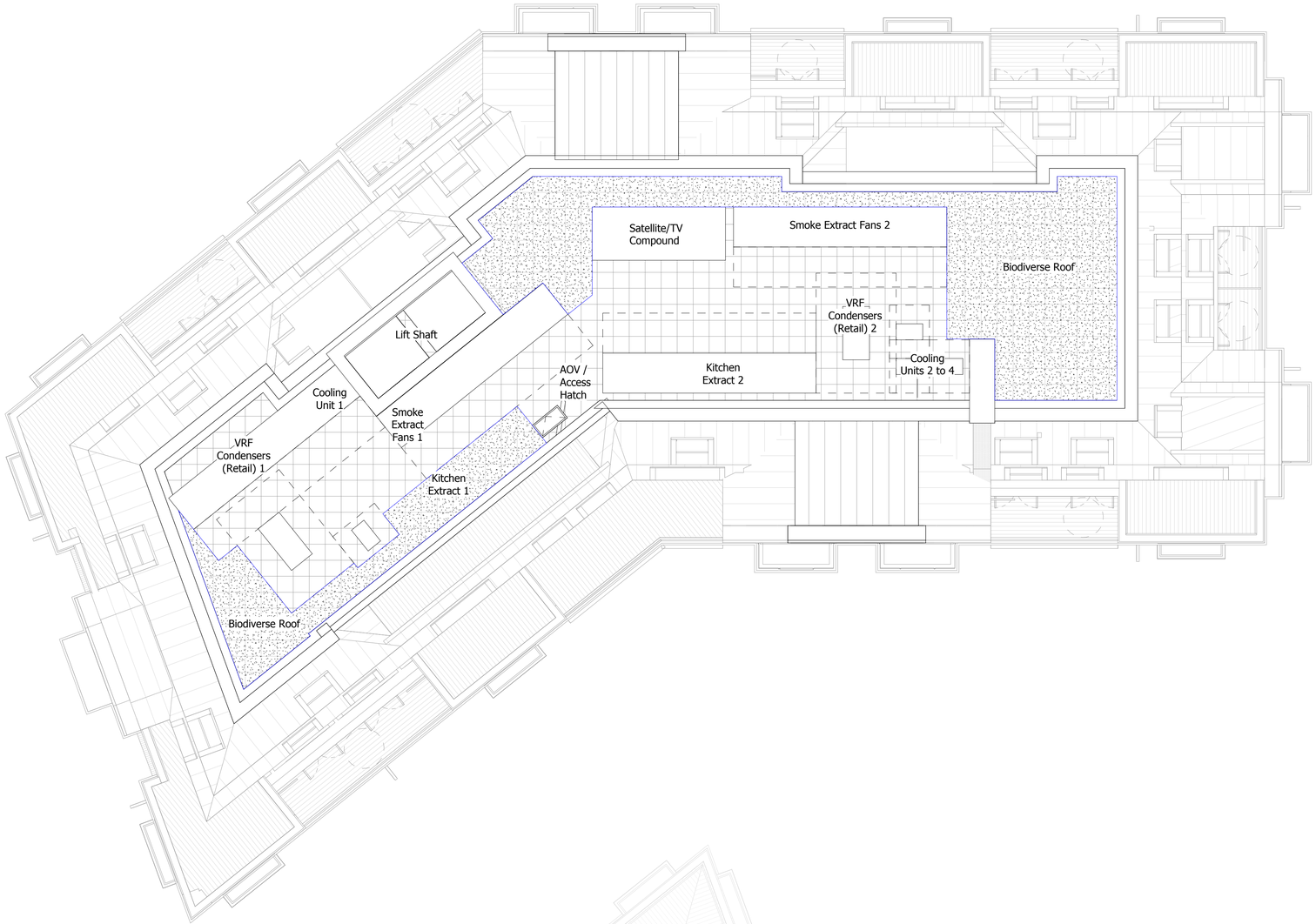
Stag Brewery
Richmond

Drawing

BUILDING 10 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| KHO | 16/01/18 | 1 : 100 @ A1<br>1 : 200 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B10_P_RF_001 | C |




NORTH

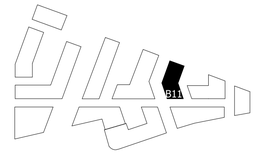
0 1 2 5 10 m

NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH




AVAILABLE ROOF SPACE FOR BROWN/GREEN ROOF AND PVs

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | - | KH | - |

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Project

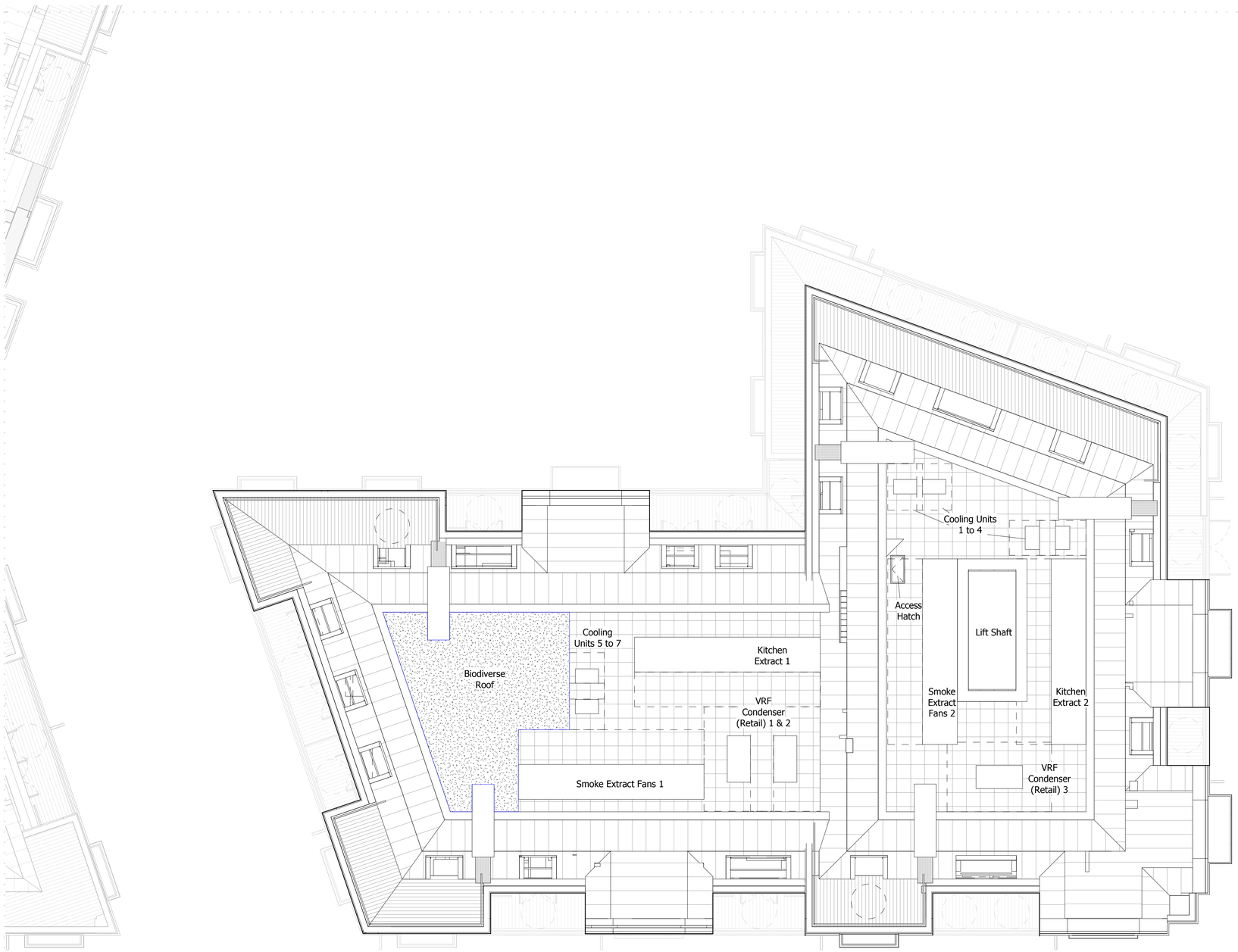
Stag Brewery
Richmond

Drawing

BUILDING 11 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| KHO | 26/10/19 | 1 : 100 @ A1<br>1 : 200 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B11_P_RF_001 | C |

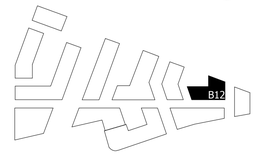



NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.



NORTH




AVAILABLE ROOF SPACE FOR BROWN/GREEN ROOF AND PVs

NORTH

0 1 2 5 10 m

| Revision description | Date | Check | Rev |
|---|---|---|---|
| GLA SUBMISSION | 06/04/20 | BJ | C |
| DRAFT GLA SUBMISSION | 24/01/20 | KH | B |
| FINAL DRAFT PLANNING APPLICATION | 21/10/19 | KH | A |
| LEGAL REVIEW | - | KH | - |

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Project

Stag Brewery
Richmond

Drawing

BUILDING 12 - PROPOSED ROOF PLAN

| Drawn | Date | Scale |
|---|---|---|
| KHO | 13/09/19 | 1 : 100 @ A1<br>1 : 200 @ A3 |

| Job Number | Drawing number | Revision |
|---|---|---|
| 18125 | C645_B12_P_RF_001 | C |

## B. Thames Water Correspondence

# Sewer Flooding
## History Enquiry

Waterman Infrastructure & Environment

**Search address supplied**

Stag Brewing Co Ltd
The Stag Brewery
Mortlake
London
SW14 7ET

**Your reference** WIE10667

**Our reference** SFH/SFH Standard/2016_3238633

**Received date** **22 January 2016**

**Search date** **23 January 2016**

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

# Sewer Flooding

## History Enquiry

**Search address supplied:** Stag Brewing Co Ltd,The Stag Brewery,Mortlake,London,SW14 7ET

**This search is recommended to check for any sewer flooding in a specific address or area**

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

Thames Water Utilities Ltd

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Slough SL1 4WW

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I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

# Sewer Flooding

## History Enquiry

**History of Sewer Flooding**

**Is the requested address or area at risk of flooding due to overloaded public sewers?**

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is “overloaded” when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- “Internal flooding” from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- “At Risk” properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company’s reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

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E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

# Asset Location Search Sewer Map - ALS/ALS Standard/2016_3238630

**TQ2075NW**


The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520250,175750

**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.**

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 |
|---|---|---|
| 4512 | 6.54 | 4.41 |
| 4601 | 6.78 | 4.11 |
| 46MK | n/a | n/a |
| 46NE | n/a | n/a |
| 46NL | n/a | n/a |
| 4605 | 6.03 | 4.3 |
| 4604 | 5.92 | 2.97 |
| 4603 | 6.02 | 4.11 |
| 4602 | 5.92 | 2.18 |
| 46MN | n/a | n/a |
| 46NH | n/a | n/a |
| 46LN | n/a | n/a |
| 461A | n/a | n/a |
| 4508 | 6.77 | 5.28 |
| 4507 | n/a | n/a |
| 4506 | 6.76 | 5.22 |
| 4501 | 6.75 | 4.26 |
| 451B | n/a | n/a |
| 451A | n/a | n/a |
| 4502 | 6.44 | 3.91 |
| 4510 | 6.45 | 3.59 |
| 4511 | 6.34 | 3.37 |
| 4504 | 6.33 | 2.52 |
| 4503 | 6.45 | 2.92 |
| 4513 | 6.36 | 3.22 |
| 4505 | n/a | 2.86 |
| 4802 | 5.35 | .8 |
| 4716 | n/a | n/a |
| 4706 | 6.33 | 4.22 |
| 4717 | n/a | n/a |
| 4707 | n/a | n/a |
| 4801 | 5.22 | 1.38 |
| 4708 | n/a | n/a |
| 4714 | 5.95 | 3.74 |
| 4718 | n/a | n/a |
| 4705 | 5.87 | 2.69 |
| 4713 | 5.79 | 1.65 |
| 4715 | 5.75 | 2.45 |
| 4711 | 6.05 | 2.52 |
| 4712 | n/a | n/a |
| 4703 | 5.84 | 1.98 |
| 4804 | 5.05 | 2.06 |
| 4803 | 4.95 | n/a |
| 4908 | 4.97 | n/a |
| 4905 | 5.03 | 2.59 |
| 4904 | 5.02 | .89 |
| 4903 | 5.08 | .89 |
| 4907 | 4.94 | 2.32 |
| 4902 | 4.86 | 1.96 |
| 4906 | 4.96 | n/a |
| 4901 | 4.93 | 2.36 |
| 35LH | n/a | n/a |
| 35LJ | n/a | n/a |
| 3502 | 6.37 | 5.2 |
| 3501 | 6.57 | 5.49 |
| 4509 | 5.71 | 5.46 |
| 351A | n/a | n/a |
| 361A | n/a | n/a |
| 3611 | 6.7 | 4.84 |
| 3610 | 6.8 | 4.74 |
| 3609 | 6.77 | 4.77 |
| 3604 | 6.76 | 4.09 |
| 46ME | n/a | n/a |
| 3605 | 6.78 | 3.94 |
| 36LL | n/a | n/a |
| 36LM | n/a | n/a |
| 3603 | n/a | n/a |
| 36NC | n/a | n/a |
| 36NL | n/a | n/a |
| 36NK | n/a | n/a |
| 36NH | n/a | n/a |
| 36MM | n/a | n/a |
| 361B | n/a | n/a |
| 3802 | 5.33 | 3.22 |
| 39MJ | n/a | n/a |
| 39NE | n/a | n/a |
| 391A | n/a | n/a |
| 38LK | n/a | n/a |
| 38MK | n/a | n/a |
| 38ML | n/a | n/a |
| 39ND | n/a | n/a |
| 39NK | n/a | n/a |
| 3904 | 5.14 | 2.68 |
| 3907 | 5.99 | 1.99 |
| 39NJ | n/a | n/a |
| 39NC | n/a | n/a |
| 3902 | 4.98 | 3.64 |
| 3903 | 6 | 1.53 |
| 3906 | 5.17 | 2.03 |
| 3908 | n/a | n/a |
| 3905 | 5.19 | 2.25 |

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 3901 | 5.2 | 1.62 |
| 361C | n/a | n/a |
| 3608 | 6.19 | 5.48 |
| 36MJ | n/a | n/a |
| 36MH | n/a | n/a |
| 36NF | n/a | n/a |
| 36ML | n/a | n/a |
| 361D | n/a | n/a |
| 3602 | 5.82 | 3.69 |
| 3701 | 6.15 | 3.48 |
| 3702 | 6.16 | 4.58 |
| 271D | n/a | n/a |
| 371B | n/a | n/a |
| 2701 | 5.59 | 2.87 |
| 371A | n/a | n/a |
| 371D | n/a | n/a |
| 371C | n/a | n/a |
| 1603 | 6.29 | 5.13 |
| 1506 | 6.76 | 5.16 |
| 1503 | 6.75 | 4.86 |
| 26MK | n/a | n/a |
| 26ME | n/a | n/a |
| 26LF | n/a | n/a |
| 26LE | n/a | n/a |
| 26LN | n/a | n/a |
| 26LM | n/a | n/a |
| 26LD | n/a | n/a |
| 26LL | n/a | n/a |
| 2601 | 6.27 | 4.87 |
| 2602 | 6.33 | 5.17 |
| 2510 | 6.72 | 4.76 |
| 2508 | 6.68 | 5.12 |
| 26HD | n/a | n/a |
| 2502 | 6.83 | 5.04 |
| 2503 | 6.67 | 4.98 |
| 261A | n/a | n/a |
| 26FN | n/a | n/a |
| 2604 | n/a | n/a |
| 251B | n/a | n/a |
| 251A | n/a | n/a |
| 35MN | n/a | n/a |
| 3607 | 6.32 | 4.48 |
| 3606 | 6.55 | 4.89 |
| 35NF | n/a | n/a |
| 35MJ | n/a | n/a |
| 3601 | 6.58 | 4.51 |
| 16NK | n/a | n/a |
| 16ME | n/a | n/a |
| 16LM | n/a | n/a |
| 271A | n/a | n/a |
| 271C | n/a | n/a |
| 26MF | n/a | n/a |
| 271B | n/a | n/a |
| 27NM | n/a | n/a |
| 26HM | n/a | n/a |
| 26HL | n/a | n/a |
| 2702 | 6.33 | 5.28 |
| 281A | n/a | n/a |
| 261B | n/a | n/a |
| 2703 | 5.61 | 2.87 |
| 2603 | n/a | n/a |
| 3804 | 4.67 | 4.08 |
| 3801 | n/a | n/a |
| 1809 | 5.06 | 3.86 |
| 1804 | 5.11 | n/a |
| 1805 | 5.12 | 2.35 |
| 1801 | 5.09 | .25 |
| 2808 | 5.07 | 3.63 |
| 381D | n/a | n/a |
| 2807 | 5.2 | 3.42 |
| 381C | n/a | n/a |
| 381B | n/a | n/a |
| 2803 | 5.26 | 2.16 |
| 2802 | 5.28 | .38 |
| 381A | n/a | n/a |
| 38NL | n/a | n/a |
| 38NH | n/a | n/a |
| 38NM | n/a | n/a |
| 38NJ | n/a | n/a |
| 2809 | 5.07 | n/a |
| 2805 | 5.19 | 2.78 |
| 2806 | 5.3 | 3.26 |
| 3803 | 4.87 | 3.65 |
| 38LM | n/a | n/a |
| 2801 | 5.32 | .44 |
| 38MM | n/a | n/a |
| 2804 | 5.33 | 1.95 |
| 38LL | n/a | n/a |
| 16JM | n/a | n/a |
| 26KL | n/a | n/a |
| 06NL | n/a | n/a |
| 26KK | n/a | n/a |
| 16LH | n/a | n/a |

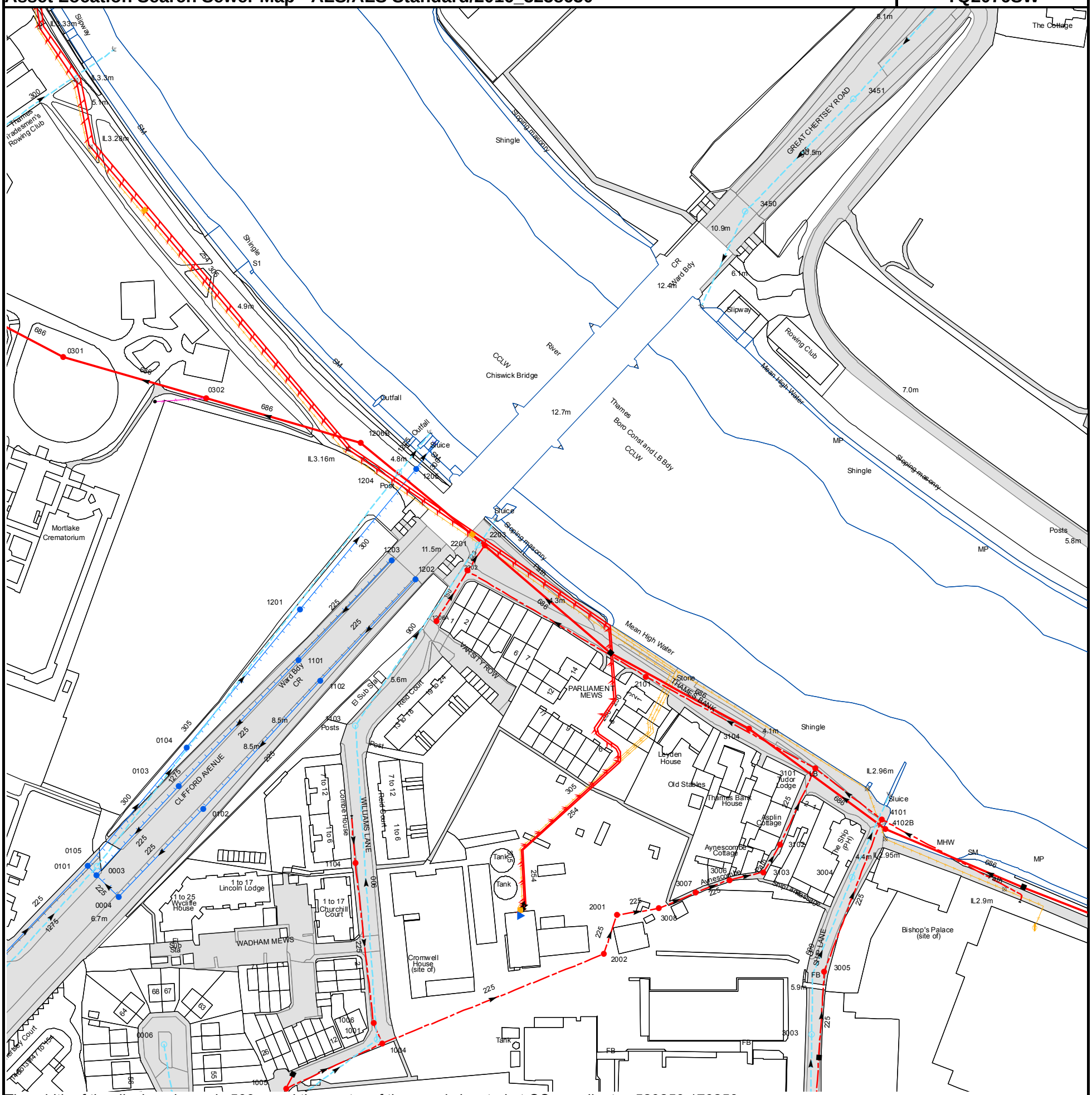
| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 26KJ | n/a | n/a |
| 1604 | 6.26 | 5.46 |
| 16LD | n/a | n/a |
| 1601 | 6.28 | 4.59 |
| 26KD | n/a | n/a |
| 16KM | n/a | n/a |
| 26KC | n/a | n/a |
| 16KJ | n/a | n/a |
| 16MM | n/a | n/a |
| 26JN | n/a | n/a |
| 16KE | n/a | n/a |
| 261C | n/a | n/a |
| 1606 | 6.33 | 5.49 |
| 1602 | 6.34 | 5.24 |
| 26JJ | n/a | n/a |
| 26JH | n/a | n/a |
| 26JF | n/a | n/a |
| 161A | n/a | n/a |
| 16MN | n/a | n/a |
| 16NG | n/a | n/a |
| 26HN | n/a | n/a |
| 16LN | n/a | n/a |
| 0613 | 6.15 | 4.12 |
| 0606 | n/a | n/a |
| 0614 | 6.16 | 3.64 |
| 0506 | n/a | n/a |
| 0610 | 6.19 | 5.11 |
| 0517 | n/a | n/a |
| 0611 | n/a | n/a |
| 0604 | 6.15 | 3.68 |
| 0516 | n/a | n/a |
| 0504 | 6.97 | 4.62 |
| 0609 | 6.14 | 4.77 |
| 0515 | 6.78 | 3.96 |
| 0501 | 6.94 | 4.13 |
| 151A | n/a | n/a |
| 151C | n/a | n/a |
| 151B | n/a | n/a |
| 16JJ | n/a | n/a |
| 1508 | 6.71 | 4.9 |
| 1504 | 6.71 | 5.25 |
| 1502 | 6.89 | 5.09 |
| 16LL | n/a | n/a |
| 1505 | 6.86 | 5.41 |
| 16MF | n/a | n/a |
| 1605 | 6.3 | 5.42 |
| 09ND | n/a | n/a |
| 09NM | n/a | n/a |
| 09NJ | n/a | n/a |
| 09NL | n/a | n/a |
| 091A | n/a | n/a |
| 0903 | n/a | n/a |
| 0904 | 5.55 | 3.51 |
| 0901 | n/a | n/a |
| 0902 | 5.59 | 1.67 |
| 09MN | n/a | n/a |
| 19NE | n/a | n/a |
| 19NL | n/a | n/a |
| 19NM | n/a | n/a |
| 19NF | n/a | n/a |
| 19NH | n/a | n/a |
| 19MK | n/a | n/a |
| 19MJ | n/a | n/a |
| 19MF | n/a | n/a |
| 19MH | n/a | n/a |
| 18ME | n/a | n/a |
| 1901 | n/a | n/a |
| 0807 | 5.16 | 2.54 |
| 07NK | n/a | n/a |
| 0804 | 5.18 | 1.83 |
| 0802 | 5.19 | .09 |
| 0703 | 5.21 | 3.38 |
| 0701 | 5.18 | 2.31 |
| 0702 | n/a | n/a |
| 0605 | 6.1 | 2.99 |
| 0809 | 5.08 | 2.26 |
| 0808 | 5.06 | 2.47 |
| 07ML | n/a | n/a |
| 07NE | n/a | n/a |
| 0805 | 5.1 | 1.16 |
| 0801 | 5.15 | .14 |
| 08NM | n/a | n/a |
| 18NJ | n/a | n/a |
| 18MN | n/a | n/a |
| 18NK | n/a | n/a |
| 18NC | n/a | n/a |
| 18NL | n/a | n/a |
| 18ND | n/a | n/a |
| 18NM | n/a | n/a |
| 1808 | 5.26 | 2.26 |
| 1807 | 5.17 | 2.41 |
| 1806 | 5 | 2.43 |
| 1802 | 5.16 | .2 |

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 1803 | 5.03 | 2.03 |
| 05LD | n/a | n/a |
| 05LE | n/a | n/a |
| 07LK | n/a | n/a |
| 07KN | n/a | n/a |
| 08NE | n/a | n/a |
| 08NC | n/a | n/a |
| 0803 | 5.12 | .01 |
| 07LM | n/a | n/a |
| 07LD | n/a | n/a |
| 071B | n/a | n/a |
| 07NM | n/a | n/a |
| 0806 | 5.16 | 2.62 |
| 071A | n/a | n/a |
| 07ME | n/a | n/a |
| 07LJ | n/a | n/a |
| 0507 | 6.41 | 5.15 |
| 0503 | 6.36 | 4.68 |
| 0607 | 5.99 | 4.16 |
| 0608 | 6 | 4.7 |
| 25ML | n/a | n/a |
| 25MN | n/a | n/a |
| 35LD | n/a | n/a |
| 35LE | n/a | n/a |
| 35LF | n/a | n/a |
| 2506 | 6.95 | 5.58 |
| 2501 | 6.76 | 5.28 |
| 2504 | 6.82 | 5.1 |
| 35LC | n/a | n/a |
| 2507 | 6.79 | 5.15 |
| 2505 | 6.65 | 5.28 |
| 25MJ | n/a | n/a |
| 35NK | 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.**

# Asset Location Search Sewer Map - ALS/ALS Standard/2016_3238630

**TQ2076SW**




The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520250,176250

**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.**

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 |
|---|---|---|
| 3103 | 6.12 | 1.37 |
| 1104 | 5.93 | 4.19 |
| 3102 | 5.77 | 1.35 |
| 4102B | n/a | -4.73 |
| 4101 | 3.47 | 1.08 |
| 0102 | n/a | n/a |
| 0103 | n/a | n/a |
| 3101 | 4.14 | .92 |
| 0104 | n/a | n/a |
| 3104 | n/a | -4.82 |
| 1103 | 5.88 | 1.73 |
| 1102 | n/a | n/a |
| 2101 | n/a | n/a |
| 1101 | n/a | n/a |
| 1206A | 5.06 | 4 |
| 1201 | n/a | n/a |
| 1202 | n/a | n/a |
| 2202 | 4.53 | .29 |
| 1203 | n/a | n/a |
| 2201 | n/a | n/a |
| 2203 | n/a | -4.99 |
| 1204 | n/a | n/a |
| 1205 | 4.62 | 2.02 |
| 1206B | n/a | -5.07 |
| 0302 | n/a | -5.16 |
| 3450 | 10.79 | 1.9 |
| 3451 | 9.23 | 2.01 |
| 0003 | n/a | n/a |
| 0105 | n/a | n/a |
| 0101 | n/a | n/a |
| 0301 | n/a | -5.24 |
| 2002 | n/a | n/a |
| 2001 | n/a | n/a |
| 3008 | n/a | n/a |
| 3007 | 6.65 | 1.7 |
| 3006 | 6.59 | 1.59 |
| 3003 | 6.06 | 2.01 |
| 3005 | 5.56 | 1.22 |
| 3004 | 4.81 | 1.77 |
| 0004 | n/a | n/a |
| 0006 | 5.52 | 4.54 |
| 1005 | 6.3 | 3.66 |
| 1006 | 6.3 | 1.96 |
| 1001 | 6.3 | 1.96 |
| 1004 | 6.26 | 2.79 |

# Asset Location Search Sewer Map - ALS/ALS Standard/2016_3238630

**TQ2075NE**


The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520750,175750

**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.**

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 |
|---|---|---|
| 96MD | n/a | n/a |
| 971E | n/a | n/a |
| 96LF | n/a | n/a |
| 96LE | n/a | n/a |
| 96LL | n/a | n/a |
| 96LM | n/a | n/a |
| 96LN | n/a | n/a |
| 96MC | n/a | n/a |
| 96ME | n/a | n/a |
| 9710 | 6.67 | 4.13 |
| 971F | n/a | n/a |
| 9707 | 6.64 | 2.63 |
| 96LK | n/a | n/a |
| 9601 | 6.12 | 2.72 |
| 97MJ | n/a | n/a |
| 9609 | 6.31 | 4.48 |
| 9602 | 6.33 | 2.85 |
| 96KN | n/a | n/a |
| 97MK | n/a | n/a |
| 96KF | n/a | n/a |
| 97MN | n/a | n/a |
| 96LD | n/a | n/a |
| 96LC | n/a | n/a |
| 971G | n/a | n/a |
| 851C | n/a | n/a |
| 851D | n/a | n/a |
| 851A | n/a | n/a |
| 8503 | 6.32 | 4.8 |
| 8513 | 6.29 | 5.27 |
| 951D | n/a | n/a |
| 951B | n/a | n/a |
| 951C | n/a | n/a |
| 961B | n/a | n/a |
| 95NC | n/a | n/a |
| 9603 | 6.17 | 4.47 |
| 9608 | 6.18 | 4.65 |
| 9604 | 6.14 | 4.4 |
| 9507 | 5.96 | 4.66 |
| 9510 | 5.92 | 4.84 |
| 95HH | n/a | n/a |
| 951A | n/a | n/a |
| 96NM | n/a | n/a |
| 95HJ | n/a | n/a |
| 9511 | 5.91 | 4.65 |
| 9501 | 6.01 | 2.93 |
| 95JC | n/a | n/a |
| 8804 | 5.61 | 4.52 |
| 88MF | n/a | n/a |
| 8801 | 5.95 | 2.33 |
| 88LM | n/a | n/a |
| 88MK | n/a | n/a |
| 88MM | n/a | n/a |
| 88MN | n/a | n/a |
| 8709 | 6.12 | 3.86 |
| 88MH | n/a | n/a |
| 8705 | 6.09 | 2.51 |
| 88LN | n/a | n/a |
| 9806 | 5.91 | 4.13 |
| 9805 | 5.91 | 3.33 |
| 9708 | 6.06 | 3.86 |
| 9702 | 6.14 | 2.54 |
| 9703 | 6.11 | n/a |
| 9709 | 5.94 | 4.62 |
| 9804 | 5.62 | 4.66 |
| 98KJ | n/a | n/a |
| 98KE | n/a | n/a |
| 98KC | n/a | n/a |
| 9802 | 5.7 | 3.13 |
| 9801 | 5.44 | 2.75 |
| 8802 | 5.62 | 2.12 |
| 8910 | 5.9 | 4.51 |
| 8903 | 5.91 | 3.91 |
| 99MM | n/a | n/a |
| 99MN | n/a | n/a |
| 9905 | 5.4 | 4.49 |
| 891B | n/a | n/a |
| 9902 | 5.43 | n/a |
| 9901 | 5.71 | 2.13 |
| 89ND | n/a | n/a |
| 89NE | n/a | n/a |
| 861A | n/a | n/a |
| 871A | n/a | n/a |
| 861C | n/a | n/a |
| 861D | n/a | n/a |
| 8711 | 6.83 | 4.51 |
| 8704 | 6.85 | 4.1 |
| 8701 | 6.37 | 4.24 |
| 87NH | n/a | n/a |
| 8601 | 6.19 | 4.92 |
| 8611 | 6.14 | 4.94 |
| 97MM | n/a | n/a |

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 96MJ | n/a | n/a |
| 96MK | n/a | n/a |
| 961C | n/a | n/a |
| 96ML | n/a | n/a |
| 96MM | n/a | n/a |
| 961A | n/a | n/a |
| 971A | n/a | n/a |
| 97MF | n/a | n/a |
| 9605 | 6.24 | 5 |
| 971B | n/a | n/a |
| 96KL | n/a | n/a |
| 971C | n/a | n/a |
| 971D | n/a | n/a |
| 97MD | n/a | n/a |
| 96KJ | n/a | n/a |
| 96LH | n/a | n/a |
| 7709 | 6.39 | 3.48 |
| 7706 | 6.29 | 3.83 |
| 77MK | n/a | n/a |
| 77NF | n/a | n/a |
| 77NC | n/a | n/a |
| 77NH | n/a | n/a |
| 7602 | 6.24 | 4.7 |
| 7601 | 6.39 | 4.58 |
| 7704 | 6.45 | 4.56 |
| 77MN | n/a | n/a |
| 7703 | 6.89 | 4.35 |
| 7713 | 6.37 | 4.63 |
| 77KN | n/a | n/a |
| 7621 | n/a | n/a |
| 7610 | n/a | n/a |
| 77MC | n/a | n/a |
| 7708 | 6.18 | 3.64 |
| 7701 | 6.1 | 3.73 |
| 761A | n/a | n/a |
| 761B | n/a | n/a |
| 771A | n/a | n/a |
| 8707 | 6.77 | 4.33 |
| 8706 | 6.16 | 1.91 |
| 8708 | 6.38 | 4.35 |
| 8602 | 6.35 | 4.39 |
| 8710 | 6.83 | 4.66 |
| 861B | n/a | n/a |
| 7917 | 5.32 | 2.72 |
| 7916 | 5.32 | 2.75 |
| 7915 | 5.31 | 2.8 |
| 7910 | n/a | 2.98 |
| 7914 | 5.41 | 2.87 |
| 7913 | 5.07 | 3.02 |
| 7901 | 4.94 | 1.5 |
| 7904 | 5.06 | 2.39 |
| 7919 | n/a | n/a |
| 7805 | n/a | n/a |
| 7911 | 5.13 | 3.41 |
| 7918 | 5.14 | 2.67 |
| 791B | n/a | n/a |
| 791A | n/a | n/a |
| 7905 | 5.32 | 2.96 |
| 7912 | 5.21 | 3.71 |
| 781A | n/a | n/a |
| 791C | n/a | n/a |
| 781B | n/a | n/a |
| 7902 | 5.37 | 1.76 |
| 7906 | 5.76 | 3.88 |
| 8911 | n/a | n/a |
| 8909 | 5.67 | 4.34 |
| 8904 | 5.68 | 2.08 |
| 8908 | 5.52 | 3.96 |
| 8905 | 5.55 | 1.97 |
| 891C | n/a | n/a |
| 8901 | 5.61 | 1.86 |
| 7613 | 6.53 | 4.74 |
| 7614 | 6.39 | 5.01 |
| 8606 | 6.3 | 4.55 |
| 861E | n/a | n/a |
| 7615 | n/a | n/a |
| 7604 | n/a | n/a |
| 66NH | n/a | n/a |
| 66NL | n/a | n/a |
| 8605 | 6.32 | 2.1 |
| 7605 | n/a | n/a |
| 8604 | 6.3 | 4.52 |
| 7606 | n/a | n/a |
| 7616 | n/a | n/a |
| 8610 | 6.29 | 4.09 |
| 7617 | n/a | n/a |
| 7618 | 6.11 | 5.01 |
| 76JF | n/a | n/a |
| 76HC | n/a | n/a |
| 7607 | 6.16 | 5.12 |
| 76MJ | n/a | n/a |
| 7619 | 6.37 | 4.27 |
| 7608 | n/a | n/a |

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 8603 | 6.25 | 4.44 |
| 8609 | 6.27 | 4.84 |
| 7622 | n/a | n/a |
| 7609 | n/a | n/a |
| 7620 | 6.3 | 4.27 |
| 6520 | 6.28 | 4.78 |
| 6506 | 6.31 | 5.29 |
| 65LM | n/a | n/a |
| 65MK | n/a | n/a |
| 65MM | n/a | n/a |
| 65NE | n/a | n/a |
| 65NC | n/a | n/a |
| 6511 | n/a | n/a |
| 6512 | n/a | n/a |
| 7612 | 6.38 | 4.92 |
| 75NG | n/a | n/a |
| 75NF | n/a | n/a |
| 751B | n/a | n/a |
| 75NH | n/a | n/a |
| 7511 | 6.4 | 4.85 |
| 7510 | 6.39 | 4.86 |
| 7508 | 6.1 | 5.05 |
| 75NM | n/a | n/a |
| 7507 | 6.51 | 5.34 |
| 75NL | n/a | n/a |
| 77LF | n/a | n/a |
| 6808 | 5.94 | 4.75 |
| 68LJ | n/a | n/a |
| 78KN | n/a | n/a |
| 6809 | 5.95 | 3.03 |
| 78LH | n/a | n/a |
| 68JM | n/a | n/a |
| 68JC | n/a | n/a |
| 68LL | n/a | n/a |
| 68MD | n/a | n/a |
| 68JF | n/a | n/a |
| 68JD | n/a | n/a |
| 7804 | n/a | n/a |
| 7802 | 5.84 | 3.2 |
| 68MF | n/a | n/a |
| 78NM | n/a | n/a |
| 78ML | n/a | n/a |
| 7801 | 5.67 | 3.09 |
| 7803 | 5.69 | 3.92 |
| 68LC | n/a | n/a |
| 68KH | n/a | n/a |
| 78ME | n/a | n/a |
| 78NF | n/a | n/a |
| 68ND | n/a | n/a |
| 7806 | n/a | n/a |
| 6807 | 5.66 | 4.37 |
| 68MN | n/a | n/a |
| 6907 | 5.38 | 2.03 |
| 69NK | n/a | n/a |
| 68NH | n/a | n/a |
| 6912 | 4.72 | 2.17 |
| 68MM | n/a | n/a |
| 681B | n/a | n/a |
| 68ML | n/a | n/a |
| 6914 | 5.5 | 1.63 |
| 6915 | 5.27 | 1.67 |
| 6913 | 4.82 | 1.52 |
| 6917 | 4.57 | 1.51 |
| 69NC | n/a | n/a |
| 6806 | 5.34 | 2.58 |
| 6918 | 4.6 | 1.82 |
| 6919 | 4.82 | 2.06 |
| 6805 | 5.36 | 3.72 |
| 6903 | 4.71 | 1.07 |
| 6803 | 5.3 | 3.44 |
| 6920 | 4.9 | 2.26 |
| 6921 | 4.91 | 3.31 |
| 6804 | 5.26 | 2.5 |
| 6908 | 4.96 | 2.33 |
| 68NM | n/a | n/a |
| 78LM | n/a | n/a |
| 7909 | 4.94 | 2.63 |
| 6707 | 6.05 | 4.43 |
| 6704 | 6.04 | 4.24 |
| 67KL | n/a | n/a |
| 67LF | n/a | n/a |
| 67LD | n/a | n/a |
| 6703 | 5.93 | 4.58 |
| 67MJ | n/a | n/a |
| 67ML | n/a | n/a |
| 6708 | 5.92 | 4.26 |
| 6706 | 6.73 | 3.34 |
| 67MH | n/a | n/a |
| 67MK | n/a | n/a |
| 7712 | 6.05 | 3.64 |
| 77LH | n/a | n/a |
| 77LK | n/a | n/a |
| 7705 | 6.46 | 1.76 |

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 77LE | n/a | n/a |
| 7710 | 6.73 | 3.44 |
| 7702 | 6.75 | 4.27 |
| 7711 | 6.78 | 4.67 |
| 76HK | n/a | n/a |
| 76FF | n/a | n/a |
| 7611 | 5.99 | 4.16 |
| 76FH | n/a | n/a |
| 76NL | n/a | n/a |
| 76NM | n/a | n/a |
| 7603 | 6.02 | 4.9 |
| 65NM | n/a | n/a |
| 55JL | n/a | n/a |
| 6501 | n/a | n/a |
| 55JK | n/a | n/a |
| 65KE | n/a | n/a |
| 66LD | n/a | n/a |
| 66LF | n/a | n/a |
| 6604 | 6.22 | 5.14 |
| 6605 | 6.21 | 5.01 |
| 66LE | n/a | n/a |
| 6606 | 6.26 | 4.81 |
| 6601 | n/a | n/a |
| 66LK | n/a | n/a |
| 66LN | n/a | n/a |
| 6608 | n/a | n/a |
| 66LJ | n/a | n/a |
| 66LM | n/a | n/a |
| 6602 | n/a | n/a |
| 6609 | 6.09 | 4.68 |
| 6603 | 6.08 | 4.75 |
| 6607 | 6.03 | 3.82 |
| 66ND | n/a | n/a |
| 66LH | n/a | n/a |
| 66LL | n/a | n/a |
| 66MM | n/a | n/a |
| 661B | n/a | n/a |
| 661A | n/a | n/a |
| 5514 | 6.58 | 5.12 |
| 55MN | n/a | n/a |
| 65NL | n/a | n/a |
| 65JJ | n/a | n/a |
| 65JE | n/a | n/a |
| 65HN | n/a | n/a |
| 65HK | n/a | n/a |
| 651B | n/a | n/a |
| 6514 | n/a | n/a |
| 65HF | n/a | n/a |
| 65KC | n/a | n/a |
| 65JD | n/a | n/a |
| 65HM | n/a | n/a |
| 6516 | 6.27 | 5.28 |
| 65HJ | n/a | n/a |
| 651A | n/a | n/a |
| 6503 | 6.31 | 4.79 |
| 65HE | n/a | n/a |
| 6515 | 6.33 | 5.14 |
| 6504 | n/a | n/a |
| 6521 | 6.31 | 4.13 |
| 6518 | 6.37 | 5.51 |
| 6505 | 6.36 | 4.54 |
| 6519 | 6.32 | 4.23 |
| 65KK | n/a | n/a |
| 65LC | n/a | n/a |
| 65LF | n/a | n/a |
| 65MD | n/a | n/a |
| 57NH | n/a | n/a |
| 5803 | n/a | 1.33 |
| 5705 | n/a | n/a |
| 58LK | n/a | n/a |
| 5704 | 6.83 | 3.79 |
| 581A | n/a | n/a |
| 5718 | 6.57 | 5.16 |
| 5804 | 6.28 | 1.37 |
| 5717 | 6.88 | 4.38 |
| 57ML | n/a | n/a |
| 5808 | 6.27 | 5.43 |
| 5806 | 6.21 | 4.15 |
| 5710 | 6.2 | 1.5 |
| 5712 | 6.26 | 5.22 |
| 5713 | 6.04 | 4.5 |
| 5706 | 6.04 | 3.81 |
| 67NM | n/a | n/a |

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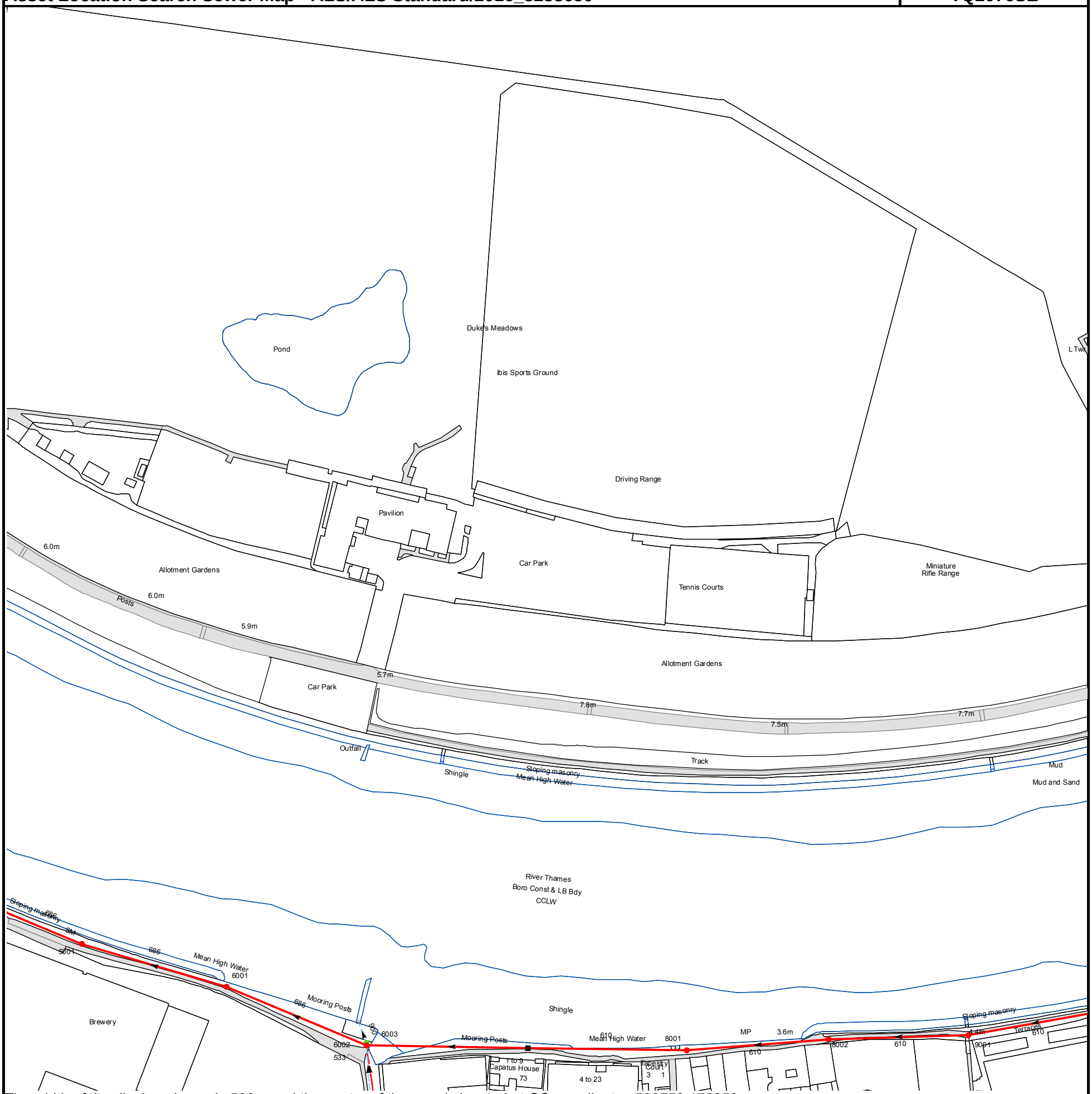
| Asset Location Search Sewer Map - ALS/ALS Standard/2016_3238630 | TQ2076SE |
|---|---|




The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520750,176250

**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.**

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 |
|---|---|---|
| 8002 | n/a | -4.15 |
| 9001 | n/a | -4.06 |
| 8001 | n/a | -4.23 |
| 6003 | 3.64 | .92 |
| 6002 | n/a | -4.41 |
| 6001 | n/a | -4.49 |
| 5001 | n/a | -4.57 |

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# 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

## 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

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

**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.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. 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.

# Asset Location Search Water Map - ALS/ALS Standard/2016_3238630

**TQ2075NW**


The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520250,175750

**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.**

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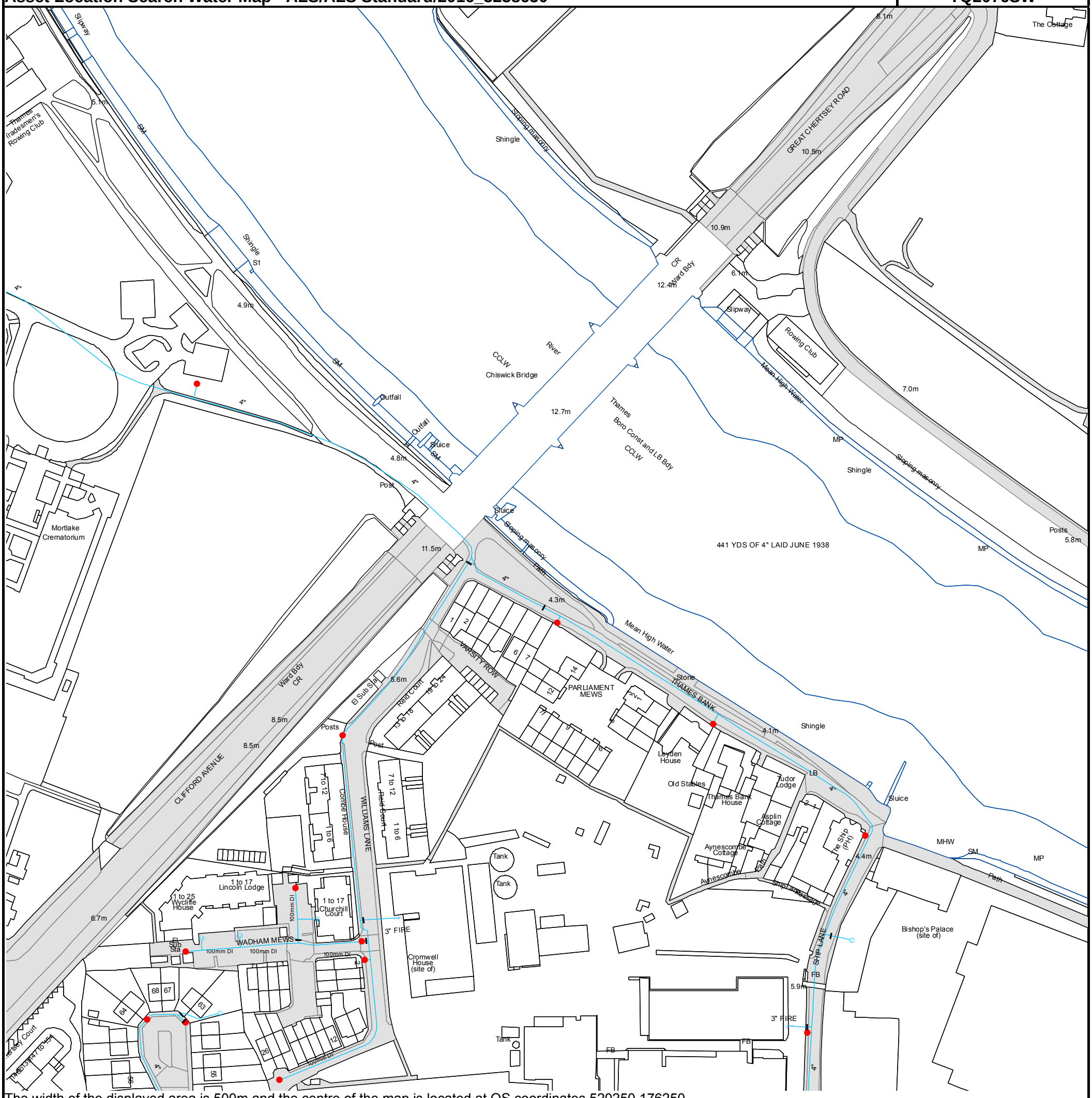
# Asset Location Search Water Map - ALS/ALS Standard/2016_3238630

**TQ2076SW**




The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520250,176250

**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.**

# Asset Location Search Water Map - ALS/ALS Standard/2016_3238630

**TQ2075NE**


The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520750,175750

**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.**

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| Asset Location Search Water Map - ALS/ALS Standard/2016_3238630 | TQ2076SE |
|---|---|


The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520750,176250

**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 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:** Indiates 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.

Miss Nora Balboni
Pickfords Wharf
Clink Street
SE1 9DG

**Our ref:** DS6041473

**0800 009 3921**
Monday to Friday, 8am to 5pm

13 May 2018

## Pre-planning enquiry: Confirmation of sufficient capacity

Dear Miss Balboni

Thank you for providing information on your development **Stag Brewery, Mortlake, SW14 7QR, OS grid ref. 520380, 176003.**

**Redevelopment of the former Stag Brewery site to provide mix use development (Flats: 687, Primary School for 1200 pupils, Cinema: 475 seats, Sports Hall: 189 people, Hotel: 20 rooms, Car Home: 220 beds, Offices: 2424m$^2$, Warehouse: 5113m$^2$). Foul Water discharging by gravity into multiple outfalls. Surface Water to be attenuated and discharged by gravity and pump into multiple outfalls (50% betterment anticipated from existing sw run-off). Surface Water from the north-eastern part of the site discharging into the River Thames.**

If your proposals progress in line with the details you've provided (drawings ref: WIE SA 92 0004 Rev A05, WIE SA 92 0005 Rev A05, WIE SA 92 0006 Rev A05, WIE SA 92 0007 Rev A05) we're pleased to confirm that there will be sufficient sewerage capacity to serve your development.

However, Thames Water has concerns with capacity to the West of the development based on the proposed flows and connection points. We request that the developer updates Thames Water in advance of building phases as they come forwards in order to ensure that any investigative or upgrade works can be carried out before development commences.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

**Please note that you must keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient sewerage capacity.**

### What happens next?

Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you've any further questions, please contact me on 0203 577 8082.

Yours sincerely

Artur Jaroma

Thames Water

# C. Onsite Drainage Records

GENERAL NOTES

LEGEND

- Trade Sewers
- Trade Connections to buildings (Unsurveyed)
- Foul Sewers
- Surface Water Sewers
- Gulley Connections
- Assumed Gulley Connections
- Redundant
- New, Stainless Steel

NOTE 1 : SHOWS TRADE TO FOUL FURTHER CLARIFICATION REQUIRED.
NOTE 2 : SHOWS SURFACE WATER TO FOUL FURTHER CLARIFICATION REQUIRED.
NOTE 3 : ASSUMED ROUTE TO SHIP LANE (TO BE CONFIRMED)

| No. | DATE | DESCRIPTION OF REVISION OR ISSUE | BY | CK. | PROJ. ENGR. APPROVAL |
|---|---|---|---|---|---|
| D | 3.12.04 | TRADE SEWER AT TRASH COMPACTION ADDED | TR | ACJ | |
| C | 17.11.04 | SITE BOUNDARY UPDATED. | TR | ACJ | |
| B | 14.10.04 | SITE UPDATED. FILTER ROOM SURVEY ADDED | TR | ACJ | |
| A | 4.10.04 | SITE UPDATED. BOTTLING DRAINAGE ADDED | TR | ACJ | |

PTS DRG. REF. P979/07/31

CONSULTANT

PENBORN TECHNICAL SERVICES
Garrett House, Manor Road
Brentford, Middlesex TW8 0QA
Tel. 020-8569-7979
Fax. 020-8568-1621
E-mail: pts@penborn.co.uk

PTS PROJ. REF.

| | |
|---|---|
| ESR | |
| DESIGNED | |
| DRAWN | |
| CHECKED | |
| SCALE | 1:500 @ A0 |
| DATE | |
| KEY PLAN | |

ANHEUSER–BUSCH COMPANIES

PROJ.

BID

# SITE PLAN SHOWING EXIST. SERVICES ALL SERVICES

BLDG. NAME

BLDG. No.

ENGINEER APPROVED

OWNER APPROVED

| PLANT | BLDG. No. | DIV. | DWG. No. | REV. |
|---|---|---|---|---|
| STAG | O | M | 1016 | D |

## D. Greater London Authority Correspondence

## Nora Balboni

**From:** Katherine Wood <Katherine.Wood@london.gov.uk>
**Sent:** 08 February 2019 17:12
**To:** Nora Balboni; Stuart McTaggart; Abby Crisostomo
**Cc:** Anna Gargan; Suzanne Robson
**Subject:** RE: Stag Brewery (GLA ref: 4172a/b) drainage strategy

Hi Nora,

Apologies, I should have confirmed with you that Stuart had reviewed this response and confirmed that it addressed outstanding issues on drainage.

Kind regards,

Katherine

**Katherine Wood**
**Team Leader, Development Management**
GREATER**LONDON**AUTHORITY
City Hall, The Queen's Walk, London SE1 2AA
020 7983 5743
**www.london.gov.uk/what-we-do/planning**
katherine.wood@london.gov.uk

---

**From:** Nora Balboni <nora.balboni@watermangroup.com>
**Sent:** 08 February 2019 17:07
**To:** Stuart McTaggart <Stuart.McTaggart@london.gov.uk>; Abby Crisostomo <Abby.Crisostomo@london.gov.uk>; Katherine Wood <Katherine.Wood@london.gov.uk>
**Cc:** Anna Gargan <AGargan@geraldeve.com>; Suzanne Robson <SRobson@geraldeve.com>
**Subject:** FW: Stag Brewery (GLA ref: 4172a/b) drainage strategy

Hi Stuart

Hope you are well. Have you had the chance to look at the Briefing Note?

Kind regards,

**Nora Balboni**
**Flood Risk Engineer**
**Waterman Infrastructure & Environment Ltd**

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www.watermangroup.com | LinkedIn | Twitter

---

**From:** Nora Balboni
**Sent:** 08 January 2019 16:22
**To:** 'Stuart McTaggart' <Stuart.McTaggart@london.gov.uk>
**Cc:** 'Anna Gargan' <AGargan@geraldeve.com>; 'Abby Crisostomo' <Abby.Crisostomo@london.gov.uk>; 'Katherine Wood' <Katherine.Wood@london.gov.uk>; Ellen Smith <ellen.smith@watermangroup.com>; Donal O'Donovan

<donal.odonovan@watermangroup.com>; Harry Chetty <harry.chetty@watermangroup.com>
**Subject:** RE: Stag Brewery (GLA ref: 4172a/b) drainage strategy

Hi Stuart

Happy new year, I hope you had a great break.

Please find attached the Briefing Note outlining the amendments to the drainage strategy for the Stag Brewery development as per our agreements below.

Let me know if you have any queries.

Kind regards,

**Nora Balboni**
**Flood Risk Engineer**
**Waterman Infrastructure & Environment Ltd**

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---

**From:** Nora Balboni
**Sent:** 12 December 2018 09:24
**To:** Stuart McTaggart <Stuart.McTaggart@london.gov.uk>
**Cc:** Anna Gargan <AGargan@geraldeve.com>; Ellen Smith <ellen.smith@watermangroup.com>; Donal O'Donovan <donal.odonovan@watermangroup.com>; Abby Crisostomo <Abby.Crisostomo@london.gov.uk>; Katherine Wood <Katherine.Wood@london.gov.uk>
**Subject:** RE: Stag Brewery (GLA ref: 4172a/b) drainage strategy [Filed 12 Dec 2018 09:24]

Hi Stuart

Thank you for confirming.

As discussed, we will provide a Briefing Note which will cover the following:

- Amended drainage strategy plan to show permeable paving extents;
- Volume calculations to estimate the attenuation available within the permeable paving sub-base and rain garden feature to show that a restriction of surface water runoff beyond the minimum 50% requirement is achieved;
- Sports pitch in south-west of site removed from surface water calculations under the assumption that it would drain freely, subject to ground investigations during detailed design; and
- Summary of all SuDS included.

Kind regards,

**Nora Balboni**
**Flood Risk Engineer**
**Waterman Infrastructure & Environment Ltd**

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**t** +44 207 928 7888 | **d** +44 3300 602 725
www.watermangroup.com | LinkedIn | Twitter

---

**From:** Stuart McTaggart <Stuart.McTaggart@london.gov.uk>
**Sent:** 11 December 2018 15:23
**To:** Nora Balboni <nora.balboni@watermangroup.com>
**Cc:** Anna Gargan <AGargan@geraldeve.com>; Ellen Smith <ellen.smith@watermangroup.com>; Donal O'Donovan <donal.odonovan@watermangroup.com>; Abby Crisostomo <Abby.Crisostomo@london.gov.uk>; Katherine Wood

<Katherine.Wood@london.gov.uk>
**Subject:** Re: Stag Brewery (GLA ref: 4172a/b) drainage strategy [Filed 12 Dec 2018 09:17]

Hi Nora,

To summarise our chat earlier:

1. The intent of the original drainage strategy was to show that it is possible within site constraints to meet the absolute minimum requirements of London Plan policy 5.13.
2. We would like to see that all efforts have been made to get as close to possible to the policy targets (i.e. greenfield runoff, drainage hierarchy, and a preference for SuDS with multiple benefits). We expect that on large sites such as this the policy targets should be able to be met in most cases.
3. Waterman will produce an addendum to the drainage strategy to more clearly show how the drainage will integrate SuDS with multiple benefits and identify an approximate maximum reduction in discharge rate. Where appropriate the reduction in discharge rate can be caveated with assumptions/risks that need confirmation during detailed design (e.g. infiltration rates of the subgrade below the 3G pitch).

Regards,

**Stuart McTaggart**
**Flood Risk, Drainage & Water Policy Officer**
Development, Enterprise & Environment
Greater London Authority
City Hall, The Queens Walk, London SE1 2AA

Email: stuart.mctaggart@london.gov.uk
Web: Greening London / Greater London Authority
Follow the GLA's Environment team on Twitter @LDN_Environment
Sign up to our e-newsletter

---

**From:** Nora Balboni <nora.balboni@watermangroup.com>
**Sent:** 04 December 2018 10:32
**To:** Stuart McTaggart <Stuart.McTaggart@london.gov.uk>
**Cc:** Anna Gargan <AGargan@geraldeve.com>; Ellen Smith <ellen.smith@watermangroup.com>; Donal O'Donovan <donal.odonovan@watermangroup.com>
**Subject:** RE: GLA Flood Feedback

Hi Stuart

Thanks for your comments. Please feel free to give me a call to discuss as I don't have your contact number.

We understand that developments should aim to achieve greenfield runoff rates, or as close as feasible. To endeavour to achieve this we took the following approach:

1. As per the drainage hierarchy, the amount of surface water that could be discharged into the River Thames was maximised by incorporating the innovative shallow conveyance channel system;

2. For the remaining site, where discharge into the Thames was not feasible due to levels or crossing third party land, as many tanks were incorporated as possible. The horizontal constraints for the tanks include the basement extent, proposed building outlines, and landscaping. The vertical constraints include the required soil depth for tree pits and achieving a gravity connection into the surrounding sewer network. London Borough of Richmond accepted the 50% restriction during pre-application consultation. Conscious that the constraints of the site preclude a greater reduction in runoff, Thames Water were consulted to ensure that the surrounding sewer network has sufficient capacity. Thames Water confirmed capacity for both surface and foul water flows. It is important to note that the surface water flows from the development are only conveyed within the Thames Water network for maximum of 350m before discharging into the River Thames.

We are keen to find a solution to reduce runoff further to find an agreeable solution. I would appreciate your thoughts on the following options:

- Allowing the proposed sports pitch to drain freely, i.e. excluding it from the surface water calculations and therefore reducing the size requirement for the tank beneath the MUGA pitch. Subject to levels I could explore the possibility of directing surface water from other areas into this tank, reducing the restriction beyond the 50% mark. In the current strategy we assumed that the pitch would need to be positively drained due to the underlying London Clay to avoid potential water logging beneath the pitch. However, if no other areas would drain towards the pitch, allowing it to free drain could be considered.

- We took a conservative approach when designing the current drainage strategy, assuming 100% impermeable proposed area (discounting the park area in the south eastern corner of the site). We did not quantify the attenuation available within the rain garden along the green link and within the permeable paving, to demonstrate the worst-case scenario that the minimum required restriction (i.e. 50%) can be achieved within the tanks themselves. I will do a quick calculation to demonstrate the additional attenuating volume that these features would hold, reducing the restriction beyond the 50% mark.

- Exploring further areas for incorporation of permeable paving.

- The current proposals do not include for blue roofs. However, green roofs are proposed throughout the development, which, although not quantifiable, provide a betterment to the surface water runoff regime.

Let me know whether you find the above agreeable, I will then amend the drainage strategy drawing to show the constraints to the attenuation volumes and incorporate any changes, and will re-issue for you to review.

Kind regards,

**Nora Balboni**
**Flood Risk Engineer**
**Waterman Infrastructure & Environment Ltd**

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www.watermangroup.com | LinkedIn | Twitter

---

**From:** Anna Gargan
**Sent:** 28 November 2018 16:51
**To:** 'Ellen Smith'; 'Nora Balboni'
**Cc:** Guy Duckworth; Susie Taylor; Neil Henderson
**Subject:** GLA Flood Feedback

Hi Ellen / Nora,

I hope you are well.

The GLA has provided the following response to Flood comments issued on 20 November 2018.

Please can you review and respond. The officer states that he is happy to speak with you directly.

Kind regards,
Anna

*"I have reviewed the Applicant's second response to our Stage 1 comments. Following our previous response at the end of October the final point of contention appears to be the proposed discharge rate where the site will drain to the public sewer.*

*It is noted that the London Plan and DEFRA national guidance require a development to achieve as close to greenfield runoff rate as possible (approximately a >90% reduction from pre-development rates for a brownfield site). In this case the Applicant is proposing to reduce the discharge by 50%, well short of the policy requirements. The Applicant should calculate the greenfield runoff rate and provide calculations showing the attenuation storage required to meet this discharge rate. The Applicant should then seek to include additional attenuation storage to get as close to this value as possible. Our original comments suggested building the biodiverse roofs as green/blue roofs to provide additional storage and this has not been addressed to date. The Applicant should then provide a clear drawing or markup clearly showing the constraints to expanding attenuation storage if discharge at greenfield runoff rate is not proposed.*

*I am happy to discuss directly with the Applicant's consultant to resolve this if required.*

*Regards,*

***Stuart McTaggart***
***Flood Risk, Drainage & Water Policy Officer***
*Development, Enterprise & Environment*
*Greater London Authority*
*City Hall, The Queens Walk, London SE1 2AA*

*Email: stuart.mctaggart@london.gov.uk*

**Anna Gargan**
Planning Consultant

Tel. +44 (0)20 7518 7240
Mobile. +44 (0) 7979532721
AGargan@geraldeve.com

Gerald Eve LLP
72 Welbeck Street London W1G 0AY
www.geraldeve.com

## E. Existing and Proposed Drainage Strategy Plan

TWMH1104
CL:
IL: -4.99

TWMH2201

225

TWMH1104
CL: 4.53
IL: 0.29

150

TWMH1206A
CL: 5.06
IL: 4.00

300

600

TWMH2101

TWMH1103
CL: 5.88
IL: 1.73

TWMH3104
CL:
IL: -4.82

TWMH3001
CL: 4.14
IL: 0.92

225

600

TWMH4101
CL: 3.47
IL: 1.08

TWMH4102B
CL:
IL: -4.73

TWMH1104
CL: 5.93
IL: 4.19

600

TWMH3002
CL: 5.77
IL: 1.35

ASSUMED CONNECTION TO THAMES WATER SEWER NETWORK

TWMH3003
CL: 6.12
IL: 1.37

TWMH3004
CL: 4.81
IL: 1.77

TWMH3006
CL: 6.59
IL: 1.59

TWMH3007
CL: 6.65
IL: 1.70

TWMH3008

TWMH2001

225

TWMH2002

225

600

TWMH3005
CL: 5.56
IL: 1.22

TWMH1006
CL: 6.30
IL: 1.96

TWMH1001
CL: 6.30
IL: 1.96

TWMH1004
CL: 6.26
IL: 2.79

TWMH3003
CL: 6.06
IL: 2.01

225

TWMH1005
CL: 6.30
IL: 3.86

600

TWMH1901

TWMH3007
CL: 5.99
IL: 1.99

1:500 0 10m 20m 30m 40m 50m

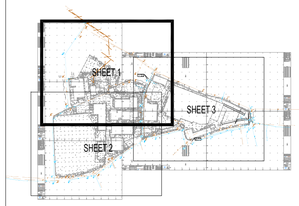
1:1 0 10 20 30 40 50 60 70 80 90 100

LEGEND

- EXISTING PRIVATE SURFACE WATER SEWER
- EXISTING PRIVATE FOUL SEWER
- EXISTING PRIVATE COMBINED SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING PUBLIC FOUL SEWER
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PUBLIC RISING MAIN

NOTES

1) EXISTING DRAINAGE LAYOUT BASED ON THAMES WATER SEWER RECORDS AND PENBORN TECHNICAL SERVICES DRAWING (REF: P979/07/31).




| Rev | Date | Description | By |
|---|---|---|---|
| A01 | 20.10.16 | PRELIMINARY ISSUE | DO |

Amendments

Project
STAG BREWERY

Title
EXISTING FOUL AND SURFACE WATER DRAINAGE LAYOUT SHEET 1 OF 3

Client
DARTMOUTH CAPITAL ADVISORS LIMITED

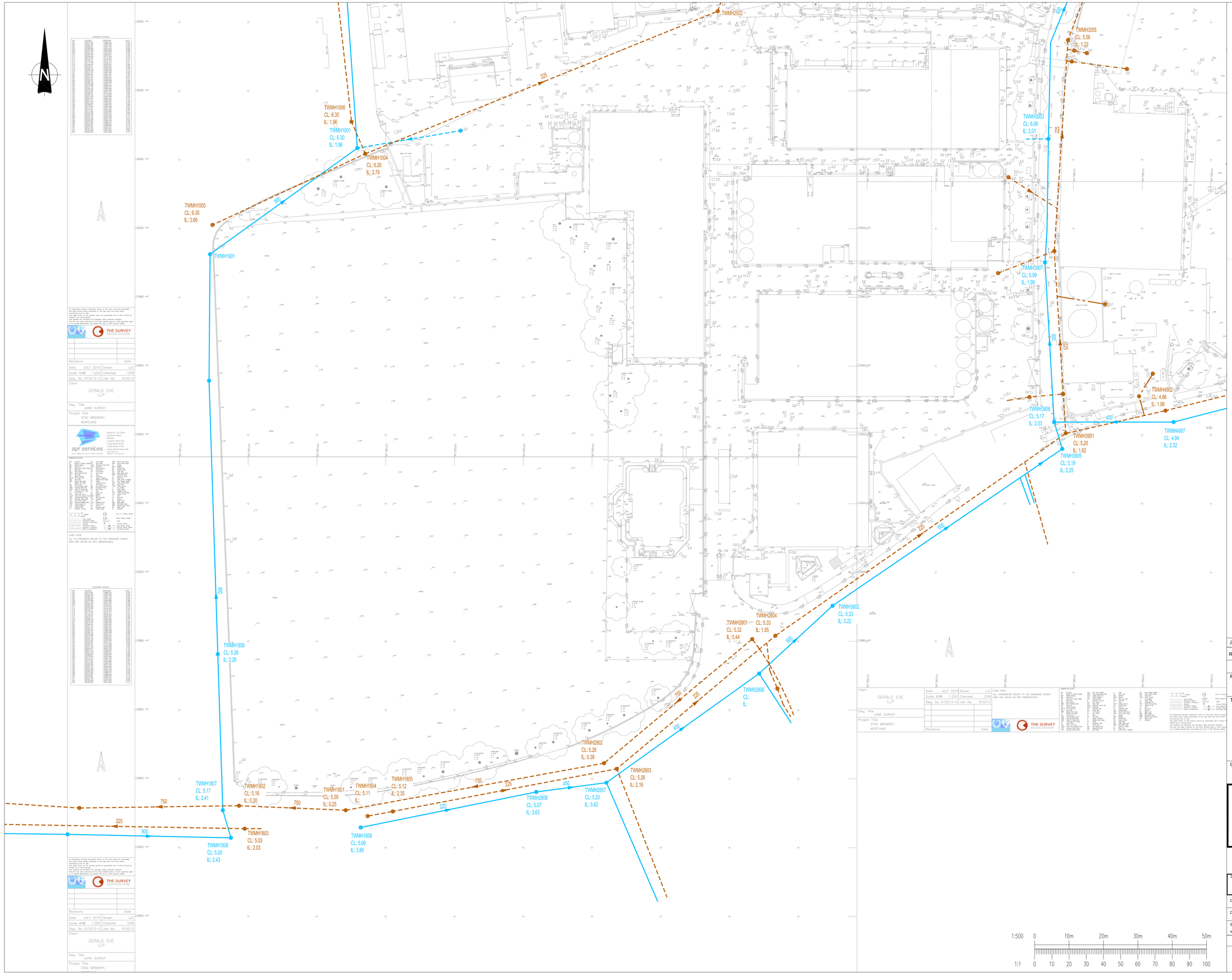

Waterman
Pickfords Wharf Clink Street London SE1 9DG
t 0207928 7888
mail@watermangroup.com www.watermangroup.com


Drawing Status
PRELIMINARY

| | | | |
|---|---|---|---|
| Designed by - | Checked by DO | Project No | WIE10667 |
| Drawn by DO | Date OCTOBER 2016 | | |
| Scales @ A1 work to figured dimensions only 1:500 | | Computer File No | WIE10667CSA920001.dwg |

| Publisher | Zone | Category | Number | Revision |
|---|---|---|---|---|
| WIE | SA | 92 | 0001 | A01 |

A1-Wat-S, Topographical Survey, WIE10667-X-EX-DRAINAGE




LEGEND

- EXISTING PRIVATE SURFACE WATER SEWER
- EXISTING PRIVATE FOUL SEWER
- EXISTING PRIVATE COMBINED SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING PUBLIC FOUL SEWER
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PUBLIC RISING MAIN

NOTES

1) EXISTING DRAINAGE LAYOUT BASED ON THAMES WATER SEWER RECORDS AND PENBORN TECHNICAL SERVICES DRAWING (REF: P979/07/31).

1:500 0 10m 20m 30m 40m 50m

1:1 0 10 20 30 40 50 60 70 80 90 100

| Rev | Date | Description | By |
|---|---|---|---|
| A01 | 20.10.16 | PRELIMINARY ISSUE | DO |

Amendments

Project
STAG BREWERY

Title
EXISTING FOUL AND SURFACE WATER DRAINAGE LAYOUT SHEET 2 OF 3

Client
DARTMOUTH CAPITAL ADVISORS LIMITED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mail@watermangroup.com www.watermangroup.com


Drawing Status
PRELIMINARY

| | | | |
|---|---|---|---|
| Designed by | - | Checked by | DO |
| Drawn by | DO | Date | OCTOBER 2016 |
| Scales @ A1 work to figured dimensions only | 1:500 | | |

Project No: WIE10667
Computer File No: WIE10667CSA920002.dwg

| Publisher | Zone | Category | Number | Revision |
|---|---|---|---|---|
| WIE | SA | 92 | 0002 | A01 |

A1-Wat-S, Topographical Survey, WIE10667-X-EX-DRAINAGE

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CL: 4.14
IL: 0.92

TWMH3002
CL: 5.77
IL: 1.35

TWMH3003
CL: 6.12
IL: 1.37

TWMH3004
CL: 4.81
IL: 1.77

TWMH4101
CL: 3.47
IL: 1.08

TWMH4102B
CL:
IL: -4.73

ASSUMED CONNECTION TO THAMES WATER SEWER NETWORK

TWMH3005
CL: 5.56
IL: 1.22

TWMH3003
CL: 6.06
IL: 2.01

TWMH3907
CL: 5.99
IL: 1.99

TWMH3906
CL: 5.17
IL: 2.03

TWMH3901
CL: 5.20
IL: 1.62

TWMH3905
CL: 5.19
IL: 2.25

TWMH4902
CL: 4.86
IL: 1.96

TWMH4907
CL: 4.94
IL: 2.32

TWMH4901
CL: 4.93
IL: 2.36

TWMH4906
CL: 4.96
IL:

TWMH4903
CL: 5.08
IL: 0.89

TWMH4905
CL: 5.03
IL: 2.59

ASSUMED CONNECTION TO THAMES WATER SEWER NETWORK

TWMH5904
CL: 5.33
IL: 3.55

TWMH5905
CL: 5.22
IL: 3.40

TWMH5906
CL: 5.39
IL: 2.77

TWMH5902
CL: 5.15
IL: 1.11

TWMH5001
CL:
IL: -4.57

TWMH6001
CL:
IL: -4.49

TWMH6901
CL: 5.06
IL: 1.13

TWMH6902
CL: 4.82
IL: 1.21

TWMH6912
CL: 4.72
IL: 2.17

TWMH6910

TWMH6913
CL: 4.82
IL: 1.52

TWMH6002
CL:
IL: -4.41

TWMH6003
CL: 3.64
IL: 0.92

TWMH6917
CL: 4.57
IL: 1.51

TWMH6918
CL: 4.60
IL: 1.82

TWMH6903
CL: 4.71
IL: 1.07

TWMH6919
CL: 4.82
IL: 2.06

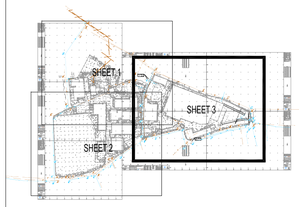
N

LEGEND

- EXISTING PRIVATE SURFACE WATER SEWER
- EXISTING PRIVATE FOUL SEWER
- EXISTING PRIVATE COMBINED SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING PUBLIC FOUL SEWER
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PUBLIC RISING MAIN

NOTES

1) EXISTING DRAINAGE LAYOUT BASED ON THAMES WATER SEWER RECORDS AND PENBORN TECHNICAL SERVICES DRAWING (REF: P979/07/31).




1:500 0 10m 20m 30m 40m 50m

1:1 0 10 20 30 40 50 60 70 80 90 100

| Rev | Date | Description | By |
|---|---|---|---|
| A03 | 21.11.16 | INVERT/COVER LEVELS ADDED | DO |
| A02 | 24.10.16 | VIEWPORT AMENDED | DO |
| A01 | 20.10.16 | PRELIMINARY ISSUE | DO |

Amendments

Project
STAG BREWERY

Title
EXISTING FOUL AND SURFACE WATER DRAINAGE LAYOUT SHEET 3 OF 3

Client
DARTMOUTH CAPITAL ADVISORS LIMITED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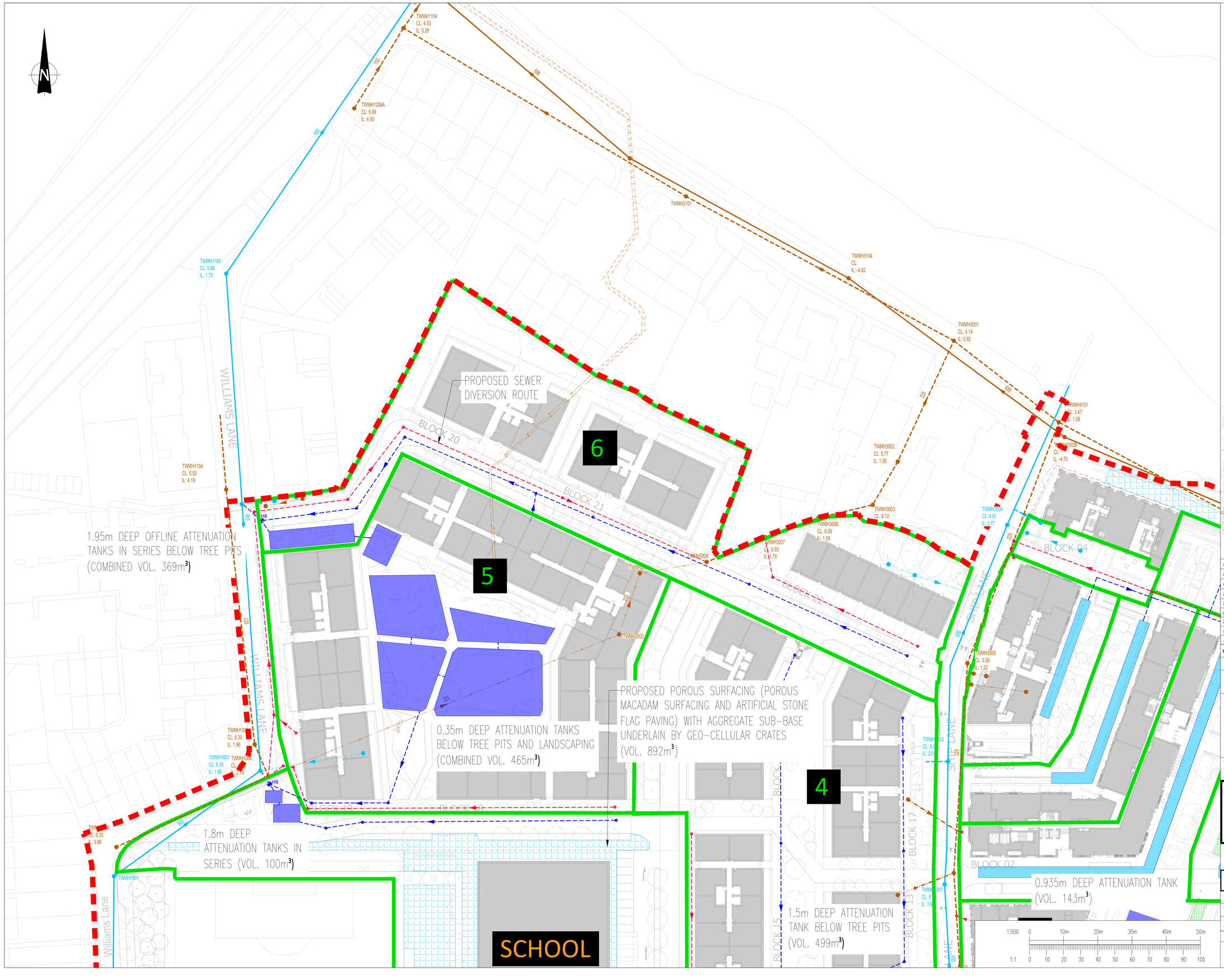
Drawing Status
PRELIMINARY

| | | | |
|---|---|---|---|
| Designed by | - | Checked by | DO |
| Drawn by | DO | Date | OCTOBER 2016 |
| Scales @ A1 work to figured dimensions only | 1:500 | | |

Project No: WIE10667
Computer File No: WIE10667CSA920003.dwg

| Publisher | Zone | Category | Number | Revision |
|---|---|---|---|---|
| WIE | SA | 92 | 0003 | A03 |

A1-Wat-S, Topographical Survey, WIE10667-X-EX-DRAINAGE

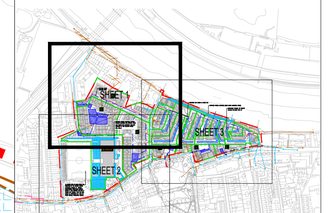



## GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
3. THE CONTRACTOR MUST ENSURE AND WILL BE HELD RESPONSIBLE FOR THE OVERALL STABILITY OF THE BUILDING/STRUCTURE/EXCAVATION AT ALL STAGES OF THE WORK.
4. ALL WORK BY THE CONTRACTOR MUST BE CARRIED OUT IN SUCH A WAY THAT ALL REQUIREMENTS UNDER THE HEALTH AND SAFETY AT WORK ACT ARE SATISFIED.
5. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.
6. EXISTING DRAINAGE LAYOUT BASED ON THAMES WATER SEWER RECORDS AND PENBORN TECHNICAL SERVICES DRAWING (REF P979/07/31).
7. EXISTING FOUL AND SURFACE WATER CONNECTIONS TO BE RE-USED WHERE FEASIBLE, SUBJECT TO DETAILED DESIGN.

LEGEND

- EXISTING SURFACE WATER SEWER
- EXISTING FOUL SEWER
- EXISTING COMBINED SEWER
- EXISTING PUBLIC RISING MAIN
- EXISTING SEWER TO BE ABANDONED
- PROPOSED FOUL WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED ATTENUATION TANK
- PROPOSED CONVEYANCE CHANNEL
- PROPOSED POROUS SURFACING
- PROPOSED RAIN GARDEN
- APPLICATION A BOUNDARY
- SURFACE WATER DRAINAGE CATCHMENT
- 1 DRAINAGE CATCHMENT NO.




| Rev | Date | Description | By |
|---|---|---|---|
| A09 | 07.04.20 | AMENDED SCHEME PLANS | NB |
| A08 | 30.10.19 | AMENDED SCHEME PLANS | NB |
| A07 | 09.09.19 | BASEMENT TANKS REMOVED/REPLACED | NB |
| A06 | 20.12.18 | PERMEABLE PAVING AND RAIN GARDEN ADDED | NB |
| A05 | 13.02.18 | UPDATED APPLICATION BOUNDARY | NB |
| A04 | 29.01.18 | UPDATED ARCHITECT LAYOUT | NB |
| A03 | 01.11.17 | TEAM ISSUE | NB |
| A02 | 23.10.17 | SURFACE WATER ATTENUATION AMMENDED | NB |
| A01 | 29.09.17 | PRELIMINARY ISSUE | MAC |

Amendments

Project: STAG BREWERY

Title: PROPOSED FOUL AND SURFACE WATER DRAINAGE LAYOUT SHEET 1 OF 3

Client: RESELTON PROPERTIES LIMITED

Waterman
Pickfords Wharf Clink Street London SE1 9DG
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mail@watermangroup.com www.watermangroup.com

Drawing Status: PRELIMINARY

| | | | | | |
|---|---|---|---|---|---|
| Designed by | NB | Checked by | DO | Project No | WIE15582 |
| Drawn by | NB | Date | SEPTEMBER 2017 | | |
| Scales @ A1 work to figured dimensions only | 1:500 | | | Computer File No | 15582-WIE-ZZ-XX-DR-92004.dwg |

| Publisher | Zone | Category | Number | Revision |
|---|---|---|---|---|
| WIE | ZZ | 92 | 0004 | A09 |

File Path: \\Richuser\Projects\WIE15582\100_Drainage and River Wall\7. CAD\02. Drawings\

15582-WIE-ZZ-XX-M1-D-92001_18125_C645_MP_P_00_001_C - GF, A1-Wat-S

PROPOSED POROUS SURFACING (POROUS MACADAM SURFACING AND ARTIFICIAL STONE FLAG PAVING) WITH AGGREGATE SUB-BASE UNDERLAIN BY GEO-CELLULAR CRATES (VOL. 892m³)

0.35m DEEP ATTENUATION TANKS BELOW TREE PITS AND LANDSCAPING (COMBINED VOL. 465m³)

1.8m DEEP ATTENUATION TANKS IN SERIES (VOL. 100m³)

1.5m DEEP ATTENUATION TANK BELOW TREE PITS (VOL. 499m³)

0.935m DEEP ATTENU
(VOL. 143m³)

SCHOOL

3G SPORTS PITCH TO DRAIN FREELY (AS REQUESTED BY THE GREATER LONDON AUTHORITY), SUBJECT TO GROUND INVESTIGATIONS UNDERTAKEN DETAILED DESIGN. IF FREE DRAINING THIS AREA IS PROVEN NOT FEASIBLE, THEN THIS AREA WOULD BE ATTENUATED VIA A TANK OR OTHER SUITABLE ATTENUATION FEATURE.

PROPOSED CONNECTION INTO EXISTING SEWER

Williams Lane

Lower Richmond Road

BLOCK 01 BLOCK 02 BLOCK 03 BLOCK 04 BLOCK 05 BLOCK 06 BLOCK 07 BLOCK 08 BLOCK 09 BLOCK 10 BLOCK 11 BLOCK 12 BLOCK 13 BLOCK 14 BLOCK 15 BLOCK 16 BLOCK 17 BLOCK 18 BLOCK 19 BLOCK 20

SLIP LANE

TWMH1001 CL: 6.30 IL: 1.96
TWMH1002 CL: 6.30 IL: 1.96
TWMH1003 CL: 6.30 IL: 3.66
TWMH1004 CL: 6.30 IL: 2.79
TWMH1801
TWMH1802 CL: 5.20 IL: 0.20
TWMH1803 CL: 5.03 IL: 2.03
TWMH1804 CL: 5.39 IL: 0.25
TWMH1805 CL: 5.42 IL: 2.35
TWMH1806 CL: 5.00 IL: 2.43
TWMH1807 CL: 5.17 IL: 2.41
TWMH1808 CL: 5.26 IL: 2.26
TWMH1809 CL: 5.06 IL: 3.86
TWMH2002
TWMH2801 CL: 5.32 IL: 0.44
TWMH2802 CL: 5.28 IL: 0.38
TWMH2803 CL: 5.26 IL: 2.16
TWMH2806
TWMH2807 CL: 5.20 IL: 3.42
TWMH2808 CL: 5.07 IL: 3.63
TWMH3001 CL: 5.33 IL: 3.22
TWMH3002 CL: 5.33 IL: 1.95
TWMH3003 CL: 6.0 IL: 2.0
TWMH3005 CL: 5.56 IL: 1.22
TWMH3901 CL: 5.20 IL: 1.62
TWMH3902 CL: 5.19 IL: 2.25
TWMH3903 CL: 5.17 IL: 2.03
TWMH3907 CL: 5.
TWMH4902 CL: 4.86 IL: 1.96
TWMH4907 CL: 4.94 IL: 2.32

HB

1:500 0 10m 20m 30m 40m 50m
1:1 0 10 20 30 40 50 60 70 80 90 100

## GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
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- EXISTING SURFACE WATER SEWER
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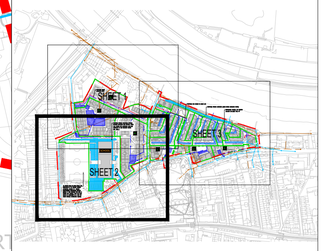
- EXISTING PUBLIC RISING MAIN
- EXISTING SEWER TO BE ABANDONED
- PROPOSED FOUL WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED ATTENUATION TANK
- PROPOSED CONVEYANCE CHANNEL
- PROPOSED POROUS SURFACING
- PROPOSED RAIN GARDEN
- APPLICATION A BOUNDARY
- SURFACE WATER DRAINAGE CATCHMENT
- 1 DRAINAGE CATCHMENT NO.




| Rev | Date | Description | By |
|---|---|---|---|
| A10 | 07.04.20 | AMENDED SCHEME PLANS | NB |
| A09 | 30.10.19 | AMENDED SCHEME PLANS | NB |
| A08 | 09.09.19 | BASEMENT TANKS REMOVED/REPLACED | NB |
| A07 | 08.01.19 | MINOR AMENDMENT TO TEXT | NB |
| A06 | 20.12.18 | PERMEABLE PAVING AND RAIN GARDEN ADDED | NB |
| A05 | 13.02.18 | UPDATED APPLICATION BOUNDARY | NB |
| A04 | 29.01.18 | UPDATED ARCHITECT LAYOUT | NB |
| A03 | 01.11.17 | TEAM ISSUE | NB |
| A02 | 23.10.17 | SURFACE WATER ATTENUATION AMMENDED | NB |
| A01 | 29.09.17 | PRELIMINARY ISSUE | MAC |

Amendments

Project
STAG BREWERY

Title
PROPOSED FOUL AND SURFACE WATER DRAINAGE LAYOUT
SHEET 2 OF 3

Client
RESELTON PROPERTIES LIMITED


Waterman
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Drawing Status
PRELIMINARY

| | | | |
|---|---|---|---|
| Designed by | NB | Checked by | DO |
| Drawn by | NB | Date | SEPTEMBER 2017 |
| Scales @ A1 work to figured dimensions only | 1:500 | | |

Project No WIE15582
Computer File No 15582-WIE-ZZ-XX-DR-92005.dwg

| Publisher | Zone | Category | Number | Revision |
|---|---|---|---|---|
| WIE | SA | 92 | 0005 | A10 |

File Path: I:\Hcc\Live\Projects\WIE15582\18_-Drainage and River Wall\7. CAD\02. Drawings\

15582-WIE-ZZ-XX-M1-D-92001, 18125_C645_MP_P_00_001_A - PROPOSED MASTERPLAN GROUND FLOOR LEVEL, A1-Wat-S

PROPOSED OUTFALL

PROPOSED RAIN GARDEN IN GREEN LINK

PROPOSED POROUS SURFACING (RESIN BOUND AGGREGATE PAVING)

CONVEYANCE CHANNEL SET BENEATH SHALLOW (1M DEEP) TREE PIT

PROPOSED OUTFALL

CONNECTION INTO EXISTING OUTFALL; BACKWALL TO BE RECONSTRUCTED

RIVER THAMES

0.935m DEEP ATTENUATION TANK (VOL. 143m³)

0.935m DEEP ATTENUATION TANK BELOW TREE PITS (VOL. 117m³)

0.935m DEEP ATTENUATION TANK BELOW TREE PITS (VOL. 84m³)

1

2

3

BLOCK 01 BLOCK 02 BLOCK 03 BLOCK 04 BLOCK 05 BLOCK 07 BLOCK 08 BLOCK 09 BLOCK 10 BLOCK 11 BLOCK 12 BLOCK 13 BLOCK 17

CHEW LANE

SHEEN LANE

MORTLAKE HIGH STREET

MORTLAKE GREEN

TWICKENHAM ROAD

RICHMOND ROAD

TWMH3001 CL: 4.14 IL: 0.92

TWMH3002 CL: 5.77 IL: 1.35

TWMH3003 CL: 6.12

TWMH3004 CL: 4.81 IL: 1.77

TWMH3005 CL: 5.56 IL: 1.22

TWMH3006 CL: 6.0 IL: 2.0

TWMH3907 CL: 5 IL: 1.9

TWMH3906 CL: 5.17 IL: 2.03

TWMH3901 CL: 5.20 IL: 1.62

TWMH3905 CL: 5.19 IL: 2.25

TWMH4101 CL: 3.47 IL: 1.08

TWMH4102B CL: IL: -4.73

TWMH4901 CL: 4.93 IL: 2.36

TWMH4902 CL: 4.86 IL: 1.96

TWMH4907 CL: 4.94 IL: 2.32

TWMH4806 CL: 4.96

TWMH4903 CL: 5.08 IL: 0.89

TWMH4905 CL: 5.03 IL: 2.59

TWMH5001 IL: -4.57

TWMH5902 CL: 5.45 IL: 1.11

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TWMH5904 CL: 5.33 IL: 3.55

TWMH6001 IL: -4.49

TWMH6901 CL: 5.06 IL: 1.73

TWMH6902 CL: 4.92 IL: 1.21

TWMH6912 CL: 4.72 IL: 2.17

TWMH6913 CL: 4.82 IL: 1.52

TWMH6910

TWMH6917 CL: 4.67 IL: 1.17

TWMH6918 CL: 4.60 IL: 1.62

TWMH6903 CL: 4.71 IL: 1.07

TWMH6919 CL: 4.82 IL: 2.06

TWMH6003 CL: 3.64 IL: 0.92

NEW CONNECTION

1:500 0 10m 20m 30m 40m 50m

1:1 0 10 20 30 40 50 60 70 80 90 100

## GENERAL NOTES

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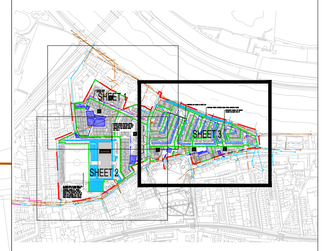


| Rev | Date | Description | By |
|---|---|---|---|
| A09 | 07.04.20 | AMENDED SCHEME PLANS | NB |
| A08 | 30.10.19 | AMENDED SCHEME PLANS | NB |
| A07 | 09.09.19 | MINOR UPDATES IN TEXT | NB |
| A06 | 20.12.18 | PERMEABLE PAVING AND RAIN GARDEN ADDED | NB |
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| A03 | 01.11.17 | TEAM ISSUE | NB |
| A02 | 23.10.17 | SURFACE WATER ATTENUATION AMMENDED | NB |
| A01 | 29.09.17 | PRELIMINARY ISSUE | MAC |

Amendments

Project
STAG BREWERY

Title
PROPOSED FOUL AND SURFACE WATER DRAINAGE LAYOUT SHEET 3 OF 3

Client
RESELTON PROPERTIES LIMITED


Waterman
Pickfords Wharf Clink Street London SE1 9DG
t 020 7928 7888
mail@watermangroup.com www.watermangroup.com


Drawing Status
PRELIMINARY

| | | | |
|---|---|---|---|
| Designed by | NB | Checked by | DO |
| Drawn by | NB | Date | SEPTEMBER 2017 |
| Scales @ A1 work to figured dimensions only | 1:500 | | |
| Project No | WIE15582 | | |
| Computer File No | 15582-WIE-ZZ-XX-DR-92006.dwg | | |

| Publisher | Zone | Category | Number | Revision |
|---|---|---|---|---|
| WIE | ZZ | 92 | 0006 | A09 |

15582-WIE-ZZ-XX-M1-D-92001, 18125_C645_MP_P_00_001_A - PROPOSED MASTERPLAN GROUND FLOOR LEVEL, A1-Wat-S

File Path - I:\Active\Projects\WIE15582\10k - Drainage and River Wall\7 CAD\92 Drainage\

# F. London Borough Richmond upon Thames (LBRuT) Correspondence

## O'Donovan, Donal

**From:** Brian Humphris <brian.humphris@richmond.gov.uk>
**Sent:** 03 March 2016 15:32
**To:** O'Donovan, Donal
**Subject:** RE: WIE10667 160122 DOBH Stag Brewery Flood Risk Enquiry
**Attachments:** Gully reports.xlsx

Donal

In response to your questions below:-

1. Not sure who would be the best contact but they have area teams, so any enquiry relating to Stag site would be referred to them.
2. I can find no record of a name either. OS plan indicates that the culvert is fed by open ditches along both sides of Sheen Common, but nothing is indicated south of the common, within Richmond Park.
3. Please see attached – reports as logged on our system.

Regards Brian

Brian Humphris
Highway Asset Co-ordinator

020 8891 7738

---

**From:** O'Donovan, Donal [mailto:donal.odonovan@watermangroup.com]
**Sent:** 03 March 2016 12:03
**To:** Brian Humphris
**Subject:** RE: WIE10667 160122 DOBH Stag Brewery Flood Risk Enquiry

Hi Brian,

Many thanks for the response, I have a few follow up queries that I hope you will be able to answer.

1. You mentioned that we would need to confirmed if the Site had passed the Sequential Test with the Planners. Do you have the contact details for the best person/team to contact in relation to this.

2. You provided plan showing a culverted watercourse that has an outlet adjacent to the Site. Do you know what this watercourse is called? I have had a look online but not had any luck.

3. You mentioned that there have been some records of flooding due to blocked gullies. Can you provide any further information in relation to these (ie. extent, date, location etc.).

If you have any queries please feel free to give me a call.

Cheers,

Donal

---

**From:** Brian Humphris [mailto:brian.humphris@richmond.gov.uk]
**Sent:** 24 February 2016 16:23
**To:** O'Donovan, Donal <donal.odonovan@watermangroup.com>
**Subject:** RE: WIE10667 160122 DOBH Stag Brewery Flood Risk Enquiry

Hi Donal

Please accept my apologies for the delay in responding to your enquiry. Unfortunately some of the information that you requested has taken some time to obtain. Please see comments below.

Regards Brian

Brian Humphris
Highway Asset Co-ordinator

020 8891 7738

---

**From:** O'Donovan, Donal [mailto:donal.odonovan@watermangroup.com]
**Sent:** 22 January 2016 14:34
**To:** Brian Humphris
**Subject:** WIE10667 160122 DOBH Stag Brewery Flood Risk Enquiry

Hi Brian,

Thanks for speaking to me earlier.

**Stag Brewery – Flood Risk Enquiry**

I'm writing regarding the proposed redevelopment of Stag Brewery, located within the London Borough of Richmond upon Thames. The Site is approximately 9ha in size, and is located at approximate postcode SW14 7ET, please find attached a location plan for your information. The proposals comprise construction of a residential led mixed use development.

We have been commissioned to investigate the risk of flooding to the proposed development. I would be grateful if you could provide information relating to the following:

1. The Environment Agency mapping shows that the Site lies within Flood Zones 2 and 3, and is generally shown as being defended The River Thames defences are identified as being continuous in this location, please could you confirm that the Site is fully defended from tidal and fluvial flooding.
   We do not have detailed records of River Defences. However photographs on pages 24 & 25 of the SPD show that there are no defences at Ship Lane. Street View images from the river appear to show river levels approx. 1m below the towpath level, although there is no way of knowing what the Tide Status was at that time. There are defences at Bulls Alley, as indicated on Page 13 of the SPD.

2. The Stag Brewery SPD sets out the planning brief for potential development at the Site. Please could you confirm that the Sequential Test has been passed.
   This would need to be confirmed by our Planners.

3. As it is very early in the decision process it is currently unknown where development would be located. However, the design would ensure that appropriate mitigation steps would be incorporated. In line with other Sites within London we currently assume that commercial and retail ('less vulnerable') uses would be acceptable on the ground floor. We also assume that duplex residential uses would be acceptable on the ground and first floor (bedrooms location on the first floor), as a means of egress would be available to ensure safety. Please could you confirm this. We will further consul once the scheme plans have evolved.
   This approach is reasonable but Planners would make final approval. At other developments within Flood Zones floor levels are usually raised to at least 300mm above ground level to reduce flood risk.

4. Could you please provide a map showing the location of any Ordinary Watercourses near the Site, and note any development restrictions that would therefore apply.

Please note plans attached. Watercourses plan shows a watercourse under the site, although the alignment is probably only indicative. OS plan is marked with the known extents of relevant section – 'outlet' is marked on the plan.

5. Please could you confirm whether or not there are any 'lost rivers' in the vicinity of the Site. Please could you provide any information you have relating to this, to include a map.
   See above

6. Please could you provide your Risk of Flooding from Surface Water map in the vicinity of the Site, as the EA's online version is difficult to interpret due to the scale.
   Richmond does not have its own Flood risk maps, we use the EA plans.

7. Please provide us with details of any historic tidal, fluvial, groundwater, surface water or sewer flooding affecting or in the vicinity of the Site. Alternatively, please confirm that you have no records of flooding in the vicinity.
   Our Highways Enquiry System has no record of any flooding reports at Mortlake High Street, Lower Richmond Road, Ship Lane or Williams Lane, other than blocked gully reports.

8. Please could you confirm the likely groundwater levels in the vicinity of the Site.
   Unfortunately we do not have records of likely Groundwater Levels.

9. It is still very early in the design process and at this stage the drainage strategy is still being developed. We are currently looking at all options available to drain surface water runoff from the Site. Our approach will follow the drainage hierarchy where possible, with the preference of draining the site to the River Thames (unrestricted due to the tidal nature of the River). Should it not be possible to drain to the River Thames due to Site constraints, we would connect to the public sewer network. Following the requirements of the London Plan, we would limit surface water runoff from the Site to 50% of the existing rate, for the 1 in 100 year event, including for the predicted increase in rainfall intensity over the lifetime of the development due to climate change. Please could you confirm that this approach is acceptable.
   This approach is acceptable.

We are also writing to the Environment Agency and Thames Water requesting details of recorded flooding incidents and relevant information. If you are aware of any other parties that may have useful information please let me know.

This information is required as soon as possible and we would be grateful if you could provide your written response by 5th February 2016. If this is unlikely to be achievable or you require any further information please feel free to get in contact.

Please feel free to give me a call if you wish to discuss the above.

Cheers,

Donal

**C. Donal O'Donovan**
**Engineer**
**Waterman Infrastructure & Environment Ltd**

Pickfords Wharf | Clink Street | London SE1 9DG
**t** +44 207 928 7888 | **d** +44 3300 602 316
www.watermangroup.com | LinkedIn | Twitter

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# G. Tide Locking Calculations

# CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 1 of 1 | Project No: | WIE10667 |
| By | N Balboni | Date | 27.09.2017 |
| Checked: | D O'Donovan | Date | 27.09.2017 |

**Project Title:** **Former Stag Brewery, Mortlake**

**Calculations Title:** **Tide Locking Calculation**

## CALCULATIONS

The 'rule of twelfths' is a rule of thumb that allows the tide level to be estimated based on the high and low water levels. The rule is an approxiamtion assuming six hours between high and low water, and does not take account of geographical location.

Source: Port of London Authority, 2017. *Tide Tables and Port Information*

Closest tidal stations: Barnes and Chiswick.

| | |
|---|---|
| Barnes MHWS (m AOD) | 4.13 |
| Chiswick MHWS (m AOD) | 4.08 |

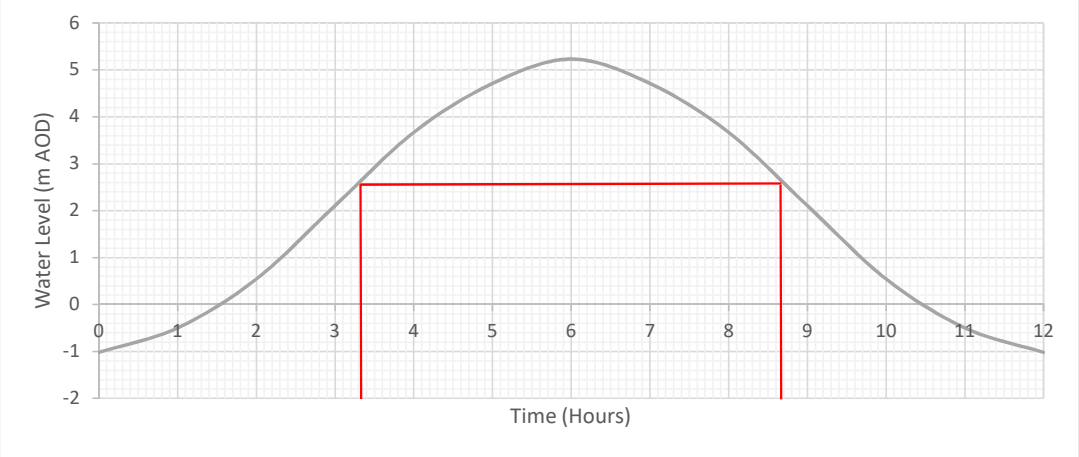
**Inputs**

| | | | |
|---|---|---|---|
| Mean High Water Spring | = | 5.23 | m AOD |
| Mean Low Water Spring | = | -1.02 | m AOD |
| Invert Level of Outfall | = | 2.60 | m AOD |

**Rule of Twelfths**

| Hour | Change | Water Level |
|---|---|---|
| 0 | - | -1.02 |
| 1 | 1/12 | -0.50 |
| 2 | 1/6 | 0.54 |
| 3 | 1/4 | 2.11 |
| 4 | 1/4 | 3.67 |
| 5 | 1/6 | 4.71 |
| 6 | 1/12 | 5.23 |
| 7 | 1/12 | 4.71 |
| 8 | 1/6 | 3.67 |
| 9 | 1/4 | 2.11 |
| 10 | 1/4 | 0.54 |
| 11 | 1/6 | -0.50 |
| 12 | 1/12 | -1.02 |

**Output**




| | | |
|---|---|---|
| Time that outfall becomes submerged (hrs) | = | 3.3 |
| Time that outfall becomes unsubmerged (hrs) | = | 8.6 |
| **Total time that outfall is submerged (hrs)** | **=** | **5.3** |

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

| | |
|---|---|
| Return Period (years) | 100 |
| FEH Rainfall Version | 1999 |
| Site Location | GB 520450 176000 TQ 20450 76000 |
| C (1km) | -0.024 |
| D1 (1km) | 0.322 |
| D2 (1km) | 0.262 |
| D3 (1km) | 0.219 |
| E (1km) | 0.306 |
| F (1km) | 2.539 |
| Maximum Rainfall (mm/hr) | 0 |
| Maximum Time of Concentration (mins) | 5 |
| Foul Sewage (l/s/ha) | 0.000 |
| Volumetric Runoff Coeff. | 0.750 |
| PIMP (%) | 100 |
| Add Flow / Climate Change (%) | 40 |
| Minimum Backdrop Height (m) | 0.200 |
| Maximum Backdrop Height (m) | 1.500 |
| Min Design Depth for Optimisation (m) | 1.200 |
| Min Vel for Auto Design only (m/s) | 1.00 |
| Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Network Design Table for Storm

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 124.000 | 0.012 | 10333.3 | 0.300 | 5.00 | 0.0 | 0.600 | [] | -1 | Pipe/Conduit | |
| 1.001 | 2.949 | 0.590 | 5.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 675 | Pipe/Conduit | |
| 1.002 | 7.594 | 0.051 | 150.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 675 | Pipe/Conduit | |
| 1.003 | 25.890 | 1.295 | 20.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 675 | Pipe/Conduit | |

### Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 0.00 | 5.00 | 5.480 | 0.300 | 0.0 | 0.0 | 0.0 | 0.14 | 67.5 | 0.0 |
| 1.001 | 0.00 | 5.00 | 4.945 | 0.300 | 0.0 | 0.0 | 0.0 | 11.77 | 4211.0 | 0.0 |
| 1.002 | 0.00 | 5.00 | 4.355 | 0.300 | 0.0 | 0.0 | 0.0 | 2.14 | 765.0 | 0.0 |
| 1.003 | 0.00 | 5.00 | 4.305 | 0.300 | 0.0 | 0.0 | 0.0 | 5.88 | 2103.1 | 0.0 |

## PIPELINE SCHEDULES for Storm

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| 1.000 | [] | -1 | 1 | 6.030 | 5.480 | 0.400 | Open Manhole | 3000 |
| 1.001 | o | 675 | 2 | 6.030 | 4.945 | 0.410 | Open Manhole | 3000 |
| 1.002 | o | 675 | 3 | 6.030 | 4.355 | 1.000 | Open Manhole | 1500 |
| 1.003 | o | 675 | 3 | 6.030 | 4.305 | 1.050 | Open Manhole | 2100 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 124.000 | 10333.3 | 2 | 6.030 | 5.468 | 0.412 | Open Manhole | 3000 |
| 1.001 | 2.949 | 5.0 | 3 | 6.030 | 4.355 | 1.000 | Open Manhole | 1500 |
| 1.002 | 7.594 | 150.0 | 3 | 6.030 | 4.305 | 1.050 | Open Manhole | 2100 |
| 1.003 | 25.890 | 20.0 | | 4.500 | 3.010 | 0.815 | Open Manhole | 675 |

### Surcharged Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| 1.003 | | 4.500 | 3.010 | 2.625 | 675 | 0 |

Datum (m) 0.000 Offset (mins) 0

| Time (mins) | Depth (m) | Time (mins) | Depth (m) | Time (mins) | Depth (m) | Time (mins) | Depth (m) | Time (mins) | Depth (m) | Time (mins) | Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 5.230 | 90 | 5.230 | 150 | 5.230 | 210 | 5.230 | 270 | 5.230 | 330 | 5.230 |
| 60 | 5.230 | 120 | 5.230 | 180 | 5.230 | 240 | 5.230 | 300 | 5.230 | 360 | 5.230 |

### Simulation Criteria for Storm

| | | | |
|---|---|---|---|
| Volumetric Runoff Coeff | 0.750 | Additional Flow - % of Total Flow | 0.000 |
| Areal Reduction Factor | 1.000 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start (mins) | 0 | Inlet Coeffiecient | 0.800 |
| Hot Start Level (mm) | 0 | Flow per Person per Day (l/per/day) | 0.000 |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins) | 60 |
| Foul Sewage per hectare (l/s) | 0.000 | Output Interval (mins) | 1 |

| | | | |
|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Storage Structures | 0 |
| Number of Online Controls | 0 | Number of Time/Area Diagrams | 0 |
| Number of Offline Controls | 0 | Number of Real Time Controls | 0 |

### Synthetic Rainfall Details

## Synthetic Rainfall Details

| | |
|---|---|
| Rainfall Model | FEH |
| Return Period (years) | 100 |
| FEH Rainfall Version | 1999 |
| Site Location | GB 520450 176000 TQ 20450 76000 |
| C (1km) | -0.024 |
| D1 (1km) | 0.322 |
| D2 (1km) | 0.262 |
| D3 (1km) | 0.219 |
| E (1km) | 0.306 |
| F (1km) | 2.539 |
| Summer Storms | Yes |
| Winter Storms | No |
| Cv (Summer) | 0.750 |
| Cv (Winter) | 0.840 |
| Storm Duration (mins) | 30 |

## Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

| | | | |
|---|---|---|---|
| Areal Reduction Factor | 1.000 | Additional Flow - % of Total Flow | 0.000 |
| Hot Start (mins) | 0 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start Level (mm) | 0 | Inlet Coeffiecient | 0.800 |
| Manhole Headloss Coeff (Global) | 0.500 | Flow per Person per Day (l/per/day) | 0.000 |
| Foul Sewage per hectare (l/s) | 0.000 | | |

| | | | |
|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Storage Structures | 0 |
| Number of Online Controls | 0 | Number of Time/Area Diagrams | 0 |
| Number of Offline Controls | 0 | Number of Real Time Controls | 0 |

### Synthetic Rainfall Details

| | |
|---|---|
| Rainfall Model | FEH |
| FEH Rainfall Version | 1999 |
| Site Location | GB 520450 176000 TQ 20450 76000 |
| C (1km) | -0.024 |
| D1 (1km) | 0.322 |
| D2 (1km) | 0.262 |
| D3 (1km) | 0.219 |
| E (1km) | 0.306 |
| F (1km) | 2.539 |
| Cv (Summer) | 0.750 |
| Cv (Winter) | 0.840 |

| | | | |
|---|---|---|---|
| Margin for Flood Risk Warning (mm) | 300.0 | DVD Status | OFF |
| Analysis Timestep | Fine | Inertia Status | OFF |
| DTS Status | ON | | |

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 |
| Return Period(s) (years) | 100 |
| Climate Change (%) | 40 |

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 5.824 |
| 1.001 | 2 | 60 Summer | 100 | +40% | | | | | 5.274 |
| 1.002 | 3 | 60 Summer | 100 | +40% | 100/30 Summer | | | | 5.267 |
| 1.003 | 3 | 60 Summer | 100 | +40% | 100/30 Summer | | | | 5.254 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 0.194 | 0.000 | 1.29 | | 285.9 | FLOOD RISK | |
| 1.001 | 2 | -0.346 | 0.000 | 0.15 | | 147.8 | OK | |
| 1.002 | 3 | 0.237 | 0.000 | 0.35 | | 148.7 | SURCHARGED | |

Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| 1.003 | 3 | 0.274 | 0.000 | 0.10 | | 149.6 | SURCHARGED | |

# CHART DATUMS & STANDARD LEVELS IN THE PORT OF LONDON

1. **Chart Datum** is set to approximately the level of Lowest Astronomical Tide (L.A.T.)
2. **Low Water levels** in the upper reaches of the tidal Thames are greatly affected by the land water flow at Teddington Weir. **They frequently fall below chart datum** when this flow is significantly reduced, typically during the summer months.
3. **Maintained level** and chart datum above Richmond half tide weir are both 1.72 metres above Ordnance Datum (Newlyn).
4. **Trinity High Water (T.H.W.)** is deemed, by the Port of London Act, 1968, to be a level having a value of 11.4 feet **(i.e. 3.475 metres)** above Ordnance Datum (Newlyn).

| Tidal Station | Level of Chart Datum below Ordnance Datum (Newlyn) m | Standard levels above local C.D. | | | | |
|---|---|---|---|---|---|---|
| | | Mean Low Water Springs MLWS | Mean Low Water Neaps MLWN | Mean High Water Neaps MHWN | Mean High Water Springs MHWS | Highest Astronomical Tide (HAT) |
| WALTON | 2.16 | 0.5 | 1.1 | 3.5 | 4.3 | 4.7 |
| MARGATE | 2.50 | 0.6 | 1.3 | 4.0 | 4.8 | 5.1 |
| SHIVERING SAND | - | 0.6 | 1.4 | 4.4 | 5.4 | 5.7 |
| SOUTHEND | 2.90 | 0.6 | 1.4 | 4.8 | 5.9 | 6.3 |
| CANVEY | 2.97 | 0.6 | 1.4 | 5.0 | 6.1 | 6.6 |
| CORYTON | 3.05 | 0.6 | 1.5 | 5.1 | 6.2 | 6.7 |
| TILBURY | 3.12 | 0.6 | 1.5 | 5.4 | 6.6 | 7.0 |
| GREENHITHE | 3.20 | 0.6 | 1.6 | 5.6 | 6.7 | 7.2 |
| DAGENHAM | 3.28 | 0.6 | 1.6 | 5.8 | 7.0 | 7.5 |
| NORTH WOOLWICH | 3.35 | 0.6 | 1.6 | 5.9 | 7.2 | 7.7 |
| TOWER | 3.20 | 0.5 | 1.5 | 5.9 | 7.1 | 7.6 |
| BLACKFRIARS | 3.05 | 0.5 | 1.4 | 5.8 | 7.0 | 7.5 |
| WESTMINSTER | 2.90 | 0.5 | 1.3 | 5.7 | 6.9 | 7.4 |
| VAUXHALL | 2.59 | 0.3 | 1.0 | 5.4 | 6.6 | 7.1 |
| VICTORIA RAIL | 2.44 | 0.3 | 0.9 | 5.3 | 6.5 | 6.9 |
| ALBERT BRIDGE | 2.29 | 0.3 | 0.9 | 5.1 | 6.3 | 6.8 |
| WANDSWORTH | 2.13 | 0.3 | 0.9 | 5.0 | 6.2 | 6.7 |
| PUTNEY | 1.98 | 0.3 | 0.8 | 4.9 | 6.1 | 6.6 |
| HAMMERSMITH | 1.68 | 0.3 | 0.7 | 4.7 | 5.8 | 6.4 |
| BARNES | 1.37 | 0.2 | 0.6 | 4.4 | 5.5 | 6.1 |
| CHISWICK | 1.22 | 0.2 | 0.5 | 4.3 | 5.3 | 6.0 |
| KEW | 1.07 | 0.2 | 0.5 | 4.2 | 5.2 | 5.9 |
| BRENTFORD | 0.91 | 0.1 | 0.4 | 4.0 | 5.0 | 5.7 |
| RICHMOND | 0.61 | 0.1 | 0.2 | 3.8 | 4.8 | 5.5 |
| TWICKENHAM | Note 3 | - | | 1.5 | 2.5 | 3.2 |

## H. Surface Water Calculations

# CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 1 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | D O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Surface Water Management - Summary Sheet**

LOCATION | CALCULATIONS | OPTIONS

Surface water at the Site will be managed in accordance with the Local Authority requirements, i.e. surface water discharge restricted to the existing existing rate, including for the impacts of climate change.

**Existing Surface Water Discharge Regime (M100_60)**

| | Area (ha) | Calculation method | Discharge Rate |
|---|---|---|---|
| Site Area* | 4.82 | Wallingford (Page 2) | 688 l/s |
| (calculated with PIMP of 100 %) | | | 143 l/s/ha |
| Site Area** | 5.89 | Wallingford (Page 3) | 841 l/s |
| (calculated with PIMP of 100 %) | | | 143 l/s/ha |

*excludes area of the site which is proposed to discharge unrestricted into the River Thames

**area that discharges into the Thames Water network in the existing case

**Proposed Surface Water Discharge Regime**

Minimum requirement = 50% of existing rate 420.4 l/s

Attenuation is maximised within each catchment, providing the following reduction in flows:

| Catchment | Area (ha) | Ex. Rate (l/s) | Pr. Rate (l/s) | Att. (m3) | Betterment (%) |
|---|---|---|---|---|---|
| East - 1 | 0.30 | 42.8 | 20.0 | 143 | 53 |
| East - 2 | 0.25 | 35.7 | 17.8 | 117 | 50 |
| East - 3 | 0.18 | 25.7 | 12.8 | 84 | 50 |
| West - school | 1.31 | 187.0 | 16.0 | 992 | 91 |
| West - 4 | 1.07 | 152.7 | 76.2 | 499 | 50 |
| West - 5 | 0.92 | 131.3 | 49.5 | 465 | 62 |
| West - 6 | 0.79 | 112.8 | 56.3 | 369 | 50 |
| Sub-Total | 4.82 | 688 | 249 | 2667 | 64 |

The proposed drainage strategy maximises the area of the site that is drained into the River Thames, directing surface water into the River Thames that in the existing situation drains into the Thames Water sewer network, thus providing a further betterment in surface water discharge rates, as below.

| | | | | | |
|---|---|---|---|---|---|
| **Total** | **5.89*** | **841** | **249** | **2667** | **70** |

*includes area of the Site which is proposed to discharge unrestricted into the River Thames

## CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 2 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | D O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Existing Discharge Rate (excluding area proposed to discharge into River Thames) - Modified Rational Method**

| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | Calculations based on: Design and Analysis of urban storm drainage. The Wallingford Procedure, Volume 1 Principles methods and practice. | | | |
| | **User Input Data** | | | |
| | Total site area | **4.82** | ha | |
| | SAAR (From FEH) | 605 | | |
| | Rainfall Intensity (From FEH) | 51.80 | | |
| | PIMP (% impervious) | 100 | % | |
| | Soil Type | 0.40 | | |
| | Very Low Runoff (well drained sandy, loamy or earthy peat soils) | 0.15 | | |
| | Low Runoff (Very permeable soils (e.g. gravel, sand) | 0.30 | | |
| | Moderate (Very fine sands, silts and sedimentary clays) | 0.40 | | |
| | High Runoff (Clayey or loamy soils) | 0.45 | | |
| | Very High Runoff (Soils of the wet uplands) | 0.50 | | |
| Fig. 9.7 | UCWI (From Figure 9.7 of Wallingford Method) | 52 | | |
| Eqn. 13 | Qp (peak discharge) = 2.78 Cv CR i A | | | |
| | Where: Qp (Peak Discharge) i = rainfall intensity A = Total Area | | | |
| From FEH | Average rainfall Intensity (i) | | | |
| | M100_60 is: 51.80 mm | | | |
| Eqn 7.20 | Cv = PR/100 | | | |
| Eqn 7.3 | PR = (0.829 PIMP) + (25.0 SOIL) + (0.078 UCWI) - 20.7 | | | |
| | PIMP (Percentage of catchment which is impervious) | 100 | % | |
| Page 52 | Note: PIMP can not be less than 40% | 40 | % | |
| | Thus value of PIMP to be used | 100 | % | |
| | Soil: 0.40 UCWI: 52 | | | |
| | PR = | 76.26 | | |
| | Thus Cv = | 0.76 | | |
| Sec 7.10 | CR (Recommended for simulation and design) | 1.3 | | |
| | Qp for 1 in 100 year 60 minute duration = | **688.1** | **l/s** | **142.8** **l/s/ha** |

## CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 3 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | D O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Existing Discharge Rate (whole site currently draining to Thames Water network) - Modified Rational Method**

| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | Calculations based on: Design and Analysis of urban storm drainage. The Wallingford Procedure, Volume 1 Principles methods and practice. | | | |
| | **User Input Data** | | | |
| | Total site area | **5.89** | ha | |
| | SAAR (From FEH) | 605 | | |
| | Rainfall Intensity (From FEH) | 51.80 | | |
| | PIMP (% impervious) | 100 | % | |
| | Soil Type | 0.40 | | |
| | Very Low Runoff (well drained sandy, loamy or earthy peat soils) | 0.15 | | |
| | Low Runoff (Very permeable soils (e.g. gravel, sand) | 0.30 | | |
| | Moderate (Very fine sands, silts and sedimentary clays) | 0.40 | | |
| | High Runoff (Clayey or loamy soils) | 0.45 | | |
| | Very High Runoff (Soils of the wet uplands) | 0.50 | | |
| Fig. 9.7 | UCWI (From Figure 9.7 of Wallingford Method) | 52 | | |
| Eqn. 13 | Qp (peak discharge) = 2.78 Cv CR i A | | | |
| | Where: Qp (Peak Discharge) i = rainfall intensity A = Total Area | | | |
| From FEH | Average rainfall Intensity (i) | | | |
| | M100_60 is: 51.80 mm | | | |
| Eqn 7.20 | Cv = PR/100 | | | |
| Eqn 7.3 | PR = (0.829 PIMP) + (25.0 SOIL) + (0.078 UCWI) - 20.7 | | | |
| | PIMP (Percentage of catchment which is impervious) | 100 | % | |
| Page 52 | Note: PIMP can not be less than 40% | 40 | % | |
| | Thus value of PIMP to be used | 100 | % | |
| | Soil: 0.40 UCWI: 52 | | | |
| | PR = | 76.26 | | |
| | Thus Cv = | 0.76 | | |
| Sec 7.10 | CR (Recommended for simulation and design) | 1.3 | | |
| | Qp for 1 in 100 year 60 minute duration = | **840.8** | **l/s** | **142.8** **l/s/ha** |
| | 50% of the existing runoff rate= | **420.4** | **l/s** | **71.4** **l/s/ha** |

# CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 4 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | D O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Greenfield Runoff Rate (IoH 124)**

| LOCATION | CALCULATIONS | OPTIONS |
|---|---|---|

In order to calculate the rate of surface water discharge from the permeable portion of the Site, the Windes Microdrainage version 2017.1.2 Source Control module has been utilised. Rural runoff has been calculated using the IoH 124 Methodology. The input and output data for which are shown below;

An area of 50ha has been used in the calculations as this is the lowest catchment area which the IoH 124 method can calculate. The 50ha output is then prorated as set out in IoH 124

| | |
|---|---|
| Waterman Group | Page 1 |
| Pickfords Wharf<br>Clink Street<br>London, SE1 9DG | |
| Date 10/09/2019 09:37 | Designed by csnb2 |
| File | Checked by |
| Innovyze | Source Control 2019.1 |

IH 124 Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 100 | Soil | 0.400 |
| Area (ha) | 50.000 | Urban | 0.000 |
| SAAR (mm) | 605 | Region Number | Region 6 |

**Results l/s**

| | |
|---|---|
| QBAR Rural | 143.4 |
| QBAR Urban | 143.4 |
| Q100 years | 457.5 |
| Q1 year | 121.9 |
| Q2 years | 126.4 |
| Q5 years | 183.6 |
| Q10 years | 232.4 |
| Q20 years | 287.3 |
| Q25 years | 308.1 |
| Q30 years | 325.1 |
| Q50 years | 375.8 |
| Q100 years | 457.5 |
| Q200 years | 537.9 |
| Q250 years | 563.7 |
| Q1000 years | 740.1 |

| | | | | | |
|---|---|---|---|---|---|
| 1 in 1 | 121.9 | l/s/50ha | 2.4 | l/s/ha | 11.8 l/s |
| Qbar (1 in 2.333) | 143.4 | l/s/50ha | 2.9 | l/s/ha | 13.8 l/s |
| 1 in 100 | 457.5 | l/s/50ha | 9.2 | l/s/ha | 44.1 l/s |

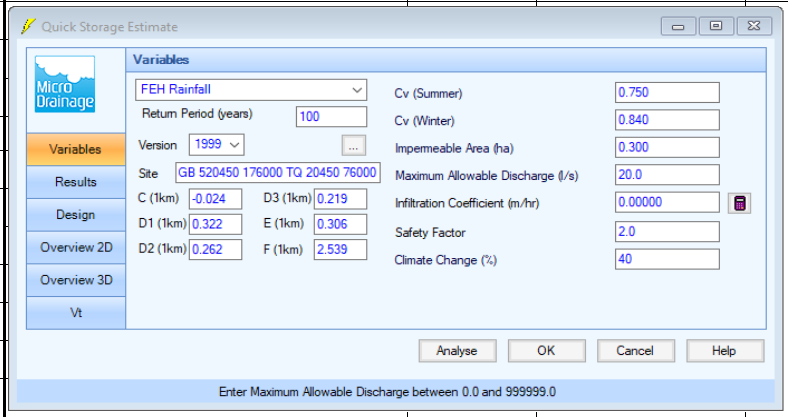
# CALCULATIONS

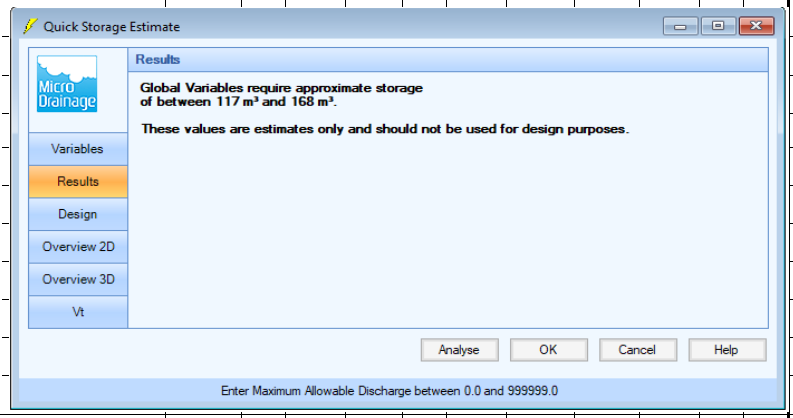
| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 5 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | O O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Surface water attenuation volume - catchment East 1**

| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2018.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below; | | | |
| | **Drainage Catchment - East 1** | | | |
| | Area | 0.30 | ha | |
| | Attenuation available | 143 | m3 | |
| | Discharge rate | 20.0 | l/s | |



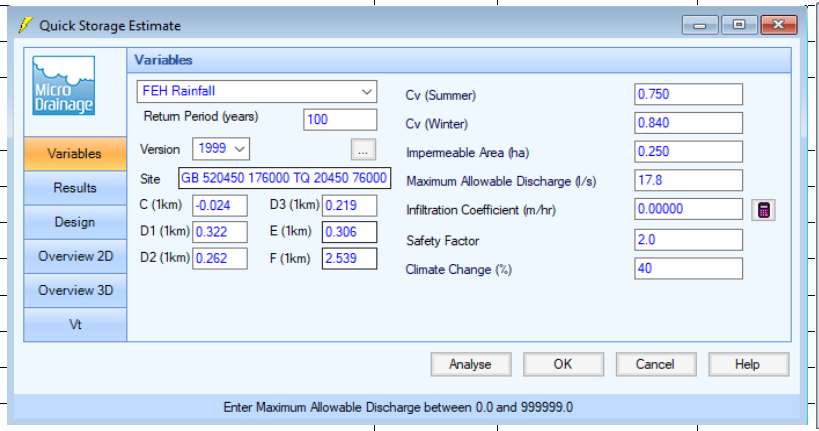
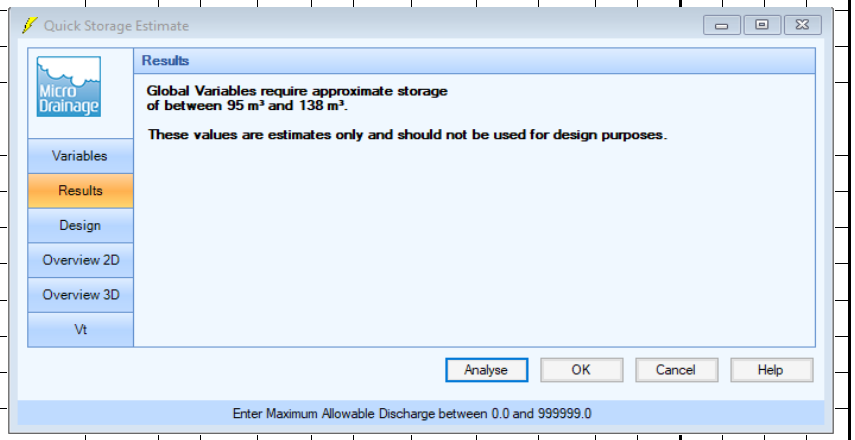

| | | | |
|---|---|---|---|
| | Required volume to achieve 20.0 l/s | | |
| | Attenuation volume (m3) | 143 | |

# CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 6 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | O O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Surface water attenuation volume - catchment East 2**

| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2016.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below; | | | |
| | **Drainage Catchment - East 2** | | | |
| | Area | 0.25 | ha | |
| | Attenuation available | 117 | m3 | |
| | Discharge rate | 17.8 | l/s | |
| |  | | | |
| |  | | | |
| | Required volume to achieve 17.8 l/s | | | |
| | Attenuation volume (m3) | 117 | | |

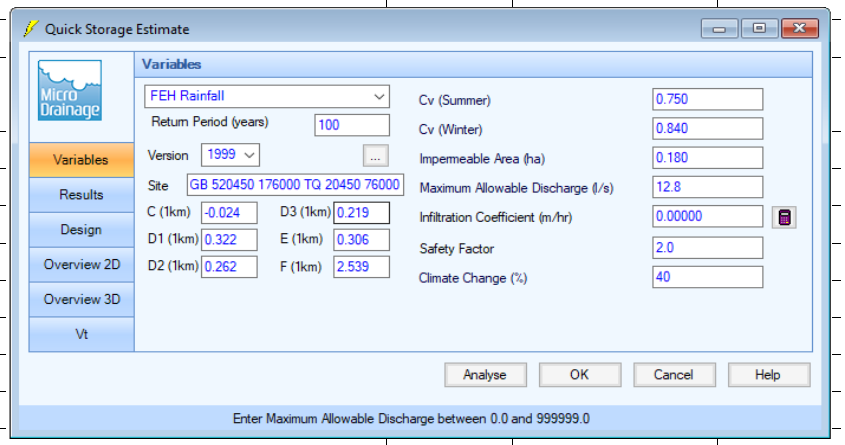
## CALCULATIONS

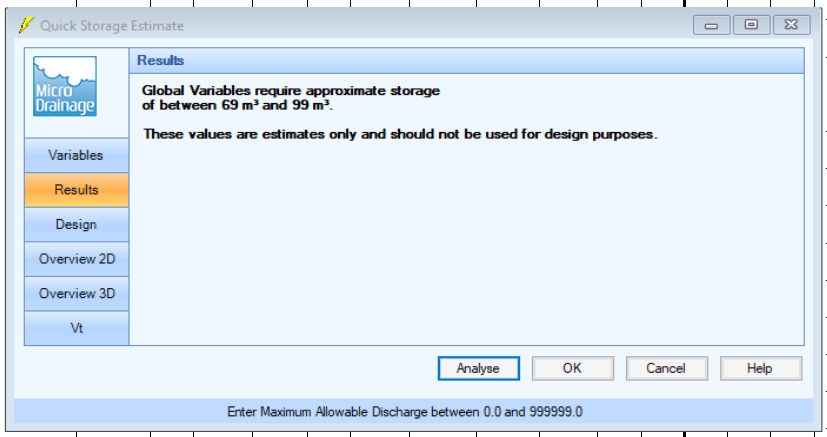
| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 7 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | O O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Surface water attenuation volume - catchment East 3**

| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2016.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below; | | | |
| | **Drainage Catchment - East 3** | | | |
| | Area | 0.18 | ha | |
| | Attenuation available | 84 | m3 | |
| | Discharge rate | 12.8 | l/s | |



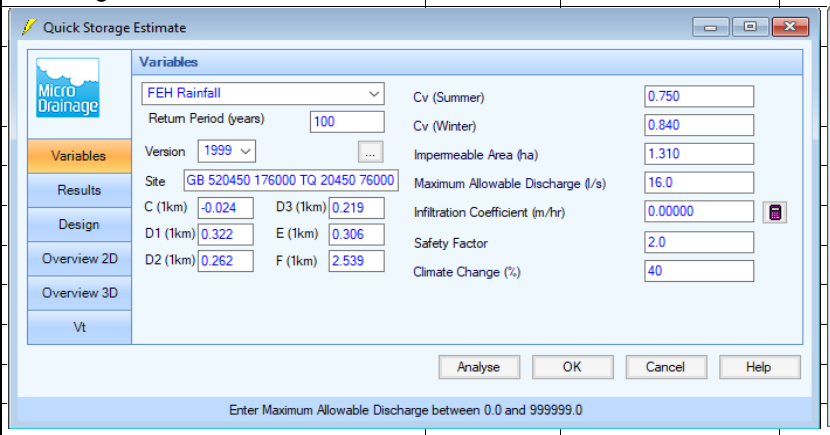
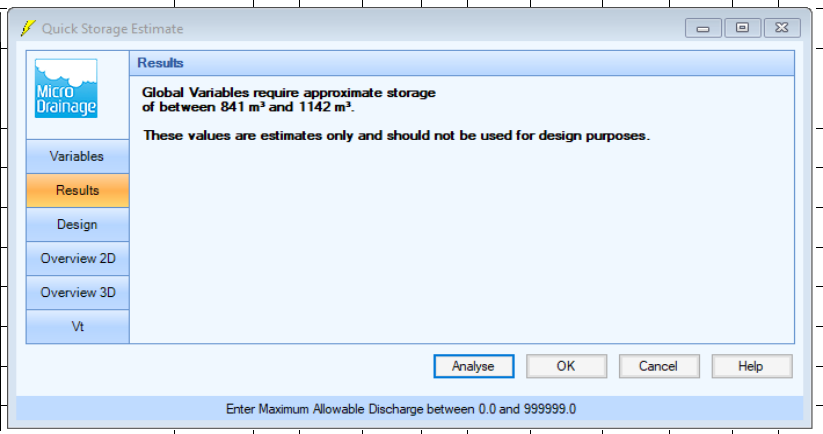

| | | | |
|---|---|---|---|
| | Required volume to achieve 12.8 l/s | | |
| | Attenuation volume (m3) | 84 | |

# CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 8 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | O O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Surface water attenuation volume - catchment West School**

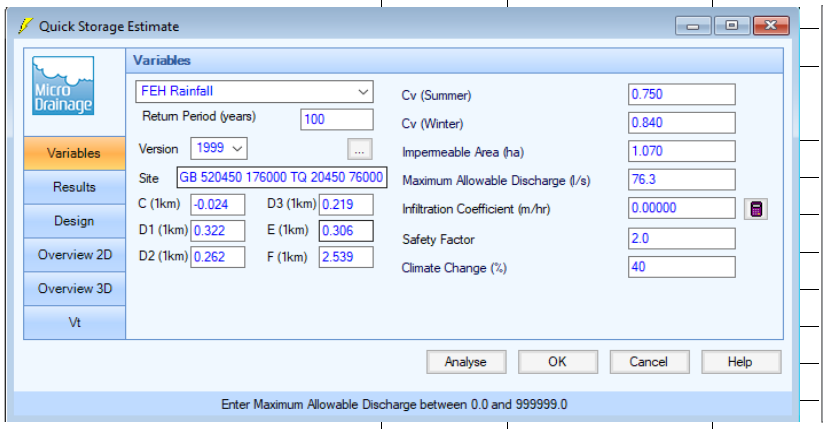
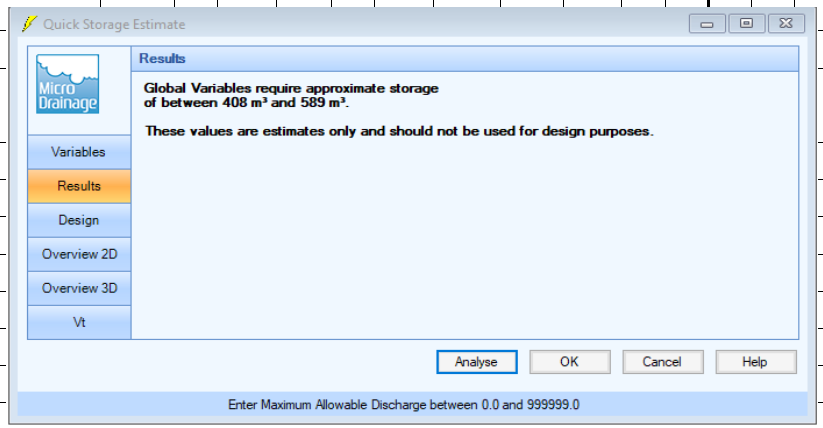
| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2018.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below; | | | |
| | **Drainage Catchment - West School** | | | |
| | Area | 1.31 | ha | |
| | Attenuation available | 992 | m3 | |
| | Discharge rate | 16.0 | l/s | |
| |   | | | |
| | Required volume to achieve 16.0 l/s | | | |
| | Attenuation volume (m3) | 992 | | |

## CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 9 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | O O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Surface water attenuation volume - catchment West 4**

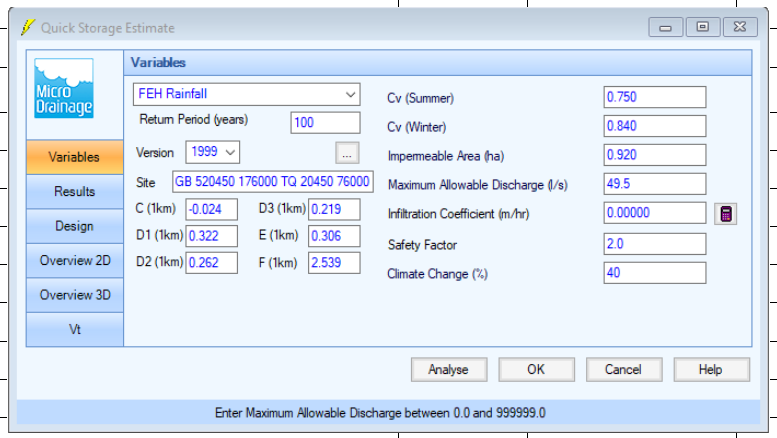
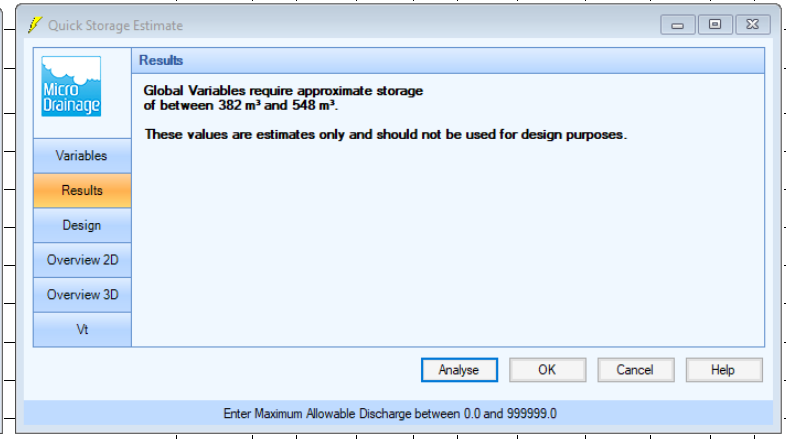
| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2016.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below; | | | |
| | **Drainage Catchment - West 4** | | | |
| | Area | 1.07 | ha | |
| | Attenuation available | 499 | m3 | |
| | Discharge rate | 76.3 | l/s | |
| |  | | | |
| |  | | | |
| | Required volume to achieve 76.3 l/s | | | |
| | Attenuation volume (m3) | 499 | | |

# CALCULATIONS

| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 10 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | O O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Surface water attenuation volume - catchment West 5**

| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2016.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below; | | | |
| | **Drainage Catchment - West 5** | | | |
| | Area | 0.92 | ha | |
| | Attenuation available | 465 | m3 | |
| | Discharge rate | 49.5 | l/s | |
| |  | | | |
| |  | | | |
| | Required volume to achieve 49.5 l/s | | | |
| | Attenuation volume (m3) | 465 | | |

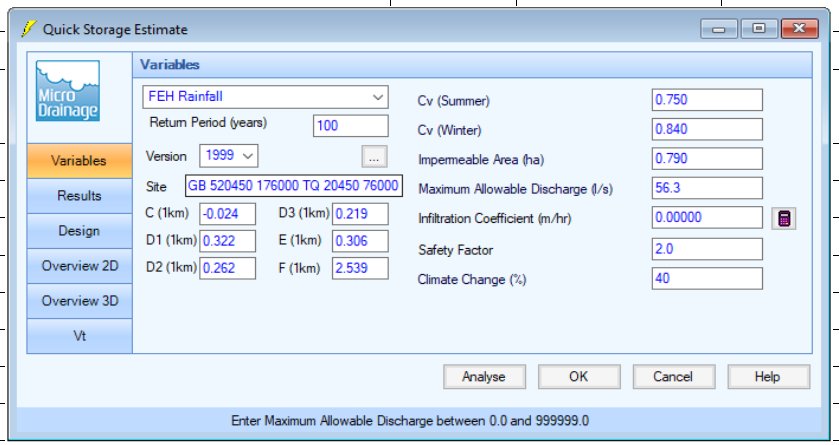
# CALCULATIONS

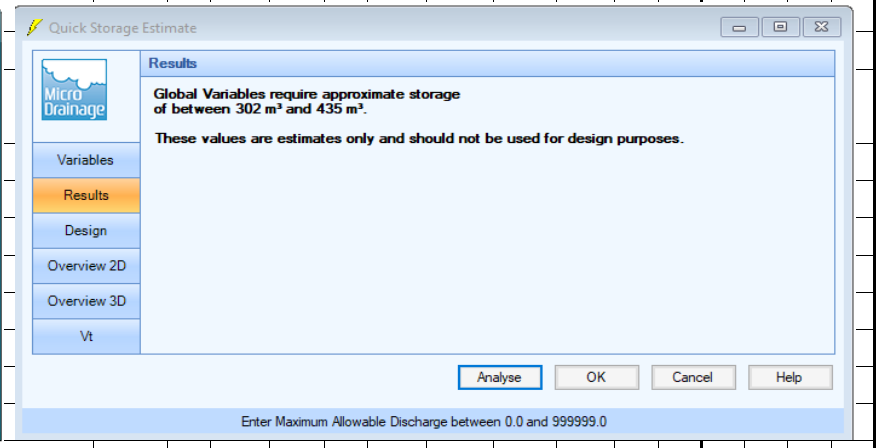
| | | | |
|---|---|---|---|
| Company: | WIE | Office: | London |
| Sheet No: | 11 of 11 | Project No: | WIE15582 |
| By | N Balboni | Date | 10/09/2019 |
| Checked: | O O'Donovan | Date | 10/09/2019 |

**Project Title** **Former Stag Brewery, Mortlake**

**Calculations Title** **Surface water attenuation volume - catchment West 6**

| LOCATION | CALCULATIONS | | | OPTIONS |
|---|---|---|---|---|
| | In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2016.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below; | | | |
| | **Drainage Catchment - West 6** | | | |
| | Area | 0.79 | ha | |
| | Attenuation available | 369 | m3 | |
| | Discharge rate | 56.3 | l/s | |




| | | | | |
|---|---|---|---|---|
| | Required volume to achieve 56.3 l/s | | | |
| | Attenuation volume (m3) | 369 | | |

# I. Foul Flow Estimate

| | | | | | |
|---|---|---|---|---|---|
| Sheet No: | 1 of 2 | Project No: | WIE15582 | | |
| By: | N Balboni | Date: | 30/10/2019 | | |
| Checked: | D O'Donovan | Date: | 30/10/2019 | | |

**Project Title:** **Stag Brewery**
**Calculations Title:** **Existing Foul Flow Estimate**

| | | Dry Weather Flow Rate (per day) | Source | Number of ..... | Factor | Profile (hours) | Peak Flow Rate (litres/second) |
|---|---|---|---|---|---|---|---|
| **Residential** | | | | | 2.12 | 24 | |
| *Existing property =* | *160 litres/person/day* | 368.0 litres per unit | Thames Water Guidelines (2016) | 0 existing units | | | 0.0 |
| *New property =* | *125 litres/person/day* | 287.5 litres per unit | Thames Water Guidelines (2016) | 0 proposed units | | | 0.0 |
| *Occupancy =* | *2.3 persons* | | | | | | |
| **Hotel** | | 500.0 litres per room | British Water (2013) | 15 rooms | 3 | 24 | 0.3 |
| **Student Accommodation** | | 200.0 litres per bed | Thames Water Guidelines (2016) | 0 beds | 3 | 24 | 0.0 |
| **Offices** | | 750.0 litres per $100m^2$ | Jones (1992) | 2318 $m^2$ | 3 | 10 | 1.4 |
| **Retail** | | 400.0 litres per $100m^2$ | Jones (1992) | 0 $m^2$ | 3 | 12 | 0.0 |
| **Cinema** | | 10.0 litres per seat | Jones (1992) | 0 seats* | 3 | 8 | 0.0 |
| **Health Club/Sports Centre** | | 50.0 litres per customer | British Water (2013) | 168 customers** | 3 | 16 | 0.4 |
| **Day School** | | 90.0 litres per pupil | British Water (2013) | 0 pupils | 3 | 10 | 0.0 |
| **Boarding School** | | 175.0 litres per pupil | British Water (2013) | 0 pupils | 3 | 24 | 0.0 |
| **Hospital** | | 625.0 litres per bed | Jones (1992) | 0 beds | 3 | 24 | 0.0 |
| **Nursing Home** | | 350.0 litres per bed | British Water (2013) | 0 beds | 3 | 24 | 0.0 |
| **Restaurant** | | 30.0 litres per cover | British Water (2013) | 0 covers | 3 | 8 | 0.0 |
| **Pub/Club** | | 15.0 litres per customer | Butler and Davies (2004) | 0 customers*** | 3 | 12 | 0.0 |
| **Warehouse** | | 150.0 litres per $100m^2$ | Jones (1992) | 0 $m^2$ | 3 | 12 | 0.0 |
| **Manufacturing** | | 550.0 litres per $100m^2$ | Jones (1992) | 28671 $m^2$ | 3 | 12 | 11.0 |
| **Commercial** | | 300.0 litres per $100m^2$ | Jones (1992) | 0 $m^2$ | 3 | 12 | 0.0 |
| **SUB TOTAL** | | | | | | | 13.1 |
| **Infiltration percentage** | 10% | | | | | | 1.3 |
| **TOTAL** | | | | | | | **14.4** |

* Foul flow rate needs to be calculated based on number of seats. An allowance of $4m^2$ has been made for each seat.

Floor area = 0 $m^2$ 4 $m^2$ per person

** Foul flow rate needs to be calculated based on number of customers. An allowance of $4m^2$ has been made for each customer.

Floor area = 672 $m^2$ 4 $m^2$ per person

*** Foul flow rate needs to be calculated based on number of customers. An allowance of $4m^2$ has been made for each customer.

Floor area = 0 $m^2$ 4 $m^2$ per person

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Sheet No: | 2 of 2 | Project No: | WIE15582 | | |
| **Project Title:** | **Stag Brewery** | By: | N Balboni | Date: | 08/04/2020 | | |
| **Calculations Title:** | **Proposed Foul Flow Estimate** | Checked: | D O'Donovan | Date: | 08/04/2020 | | |

| | | Dry Weather Flow Rate (per day) | Source | Number of ..... | Factor | Profile (hours) | Peak Flow Rate (litres/second) |
|---|---|---|---|---|---|---|---|
| **Residential** | | | | | 2.12 | 24 | |
| *Existing property =* | *160 litres/person/day* | 400.0 litres per unit | Thames Water Guidelines (2016) | 0 existing units | | | 0.0 |
| *New property =* | *125 litres/person/day* | 312.5 litres per unit | Thames Water Guidelines (2016) | 1250 proposed units | | | 9.6 |
| *Occupancy =* | *2.5 persons* | | | | | | |
| **Hotel** | | 500.0 litres per room | British Water (2013) | 16 rooms | 3 | 24 | 0.3 |
| **Student Accommodation** | | 200.0 litres per bed | Thames Water Guidelines (2016) | 0 beds | 3 | 24 | 0.0 |
| **Offices** | | 750.0 litres per $100m^2$ | Jones (1992) | 10555 $m^2$ | 3 | 10 | 6.6 |
| **Retail** | | 400.0 litres per $100m^2$ | Jones (1992) | 0 $m^2$ | 3 | 12 | 0.0 |
| **Cinema** | | 10.0 litres per seat | Jones (1992) | 402 seats* | 3 | 8 | 0.4 |
| **Health Club/Sports Centre** | | 50.0 litres per customer | British Water (2013) | 0 customers** | 3 | 16 | 0.0 |
| **Day School** | | 90.0 litres per pupil | British Water (2013) | 1200 pupils | 3 | 10 | 9.0 |
| **Boarding School** | | 175.0 litres per pupil | British Water (2013) | 0 pupils | 3 | 24 | 0.0 |
| **Hospital** | | 625.0 litres per bed | Jones (1992) | 0 beds | 3 | 24 | 0.0 |
| **Nursing Home** | | 350.0 litres per bed | British Water (2013) | 0 beds | 3 | 24 | 0.0 |
| **Restaurant** | | 30.0 litres per cover | British Water (2013) | 0 covers | 3 | 8 | 0.0 |
| **Pub/Club** | | 15.0 litres per customer | Butler and Davies (2004) | 0 customers*** | 3 | 12 | 0.0 |
| **Warehouse** | | 150.0 litres per $100m^2$ | Jones (1992) | 0 $m^2$ | 3 | 12 | 0.0 |
| **Manufacturing** | | 550.0 litres per $100m^2$ | Jones (1992) | 0 $m^2$ | 3 | 12 | 0.0 |
| **Commercial** | | 300.0 litres per $100m^2$ | Jones (1992) | 0 $m^2$ | 3 | 12 | 0.0 |
| **SUB TOTAL** | | | | | | | 25.9 |
| **Infiltration percentage** | 10% | | | | | | 2.6 |
| **TOTAL** | | | | | | | **28.5** |

* Foul flow rate needs to be calculated based on number of seats. An allowance of $4m^2$ has been made for each seat.

Floor area = 1606 $m^2$ 4 $m^2$ per person

** Foul flow rate needs to be calculated based on number of customers. An allowance of $4m^2$ has been made for each customer.

Floor area = 0 $m^2$ 4 $m^2$ per person

*** Foul flow rate needs to be calculated based on number of customers. An allowance of $4m^2$ has been made for each customer.

Floor area = 0 $m^2$ 4 $m^2$ per person

Waterman

# UK and Ireland Office Locations