FLOOD RISK ASSESSMENT REPORT FOR A MIXED USE DEVELOPMENT AT LIFFORDS PLACE, BARNES HIGH STREET

PROJECT NO: C1458

PREPARED BY

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APPENDICES

1. INTRODUCTION

1.1. Appointment and Brief

Nimbus Engineering has been commissioned by Avis Appleton and Associates to provide support a planning application at 1-4 Liffords Place, Barnes High Street, London, SW13 9LR. The grid reference is TQ 216 702. The proposed development involves the creation of a mixed use development, commercial units and residential flats.

The site currently consists of a furniture warehouse, car wash, builder's office/store and two vacant units, one derelict.

The government has placed increasing priority on the need to take full account of the risks associated with flooding at all stages of the planning and development process. This policy seeks to reduce the future damage to property and the risk to life from incidents of flooding. Nimbus Engineering Consultants Ltd have prepared this Flood Risk Assessment in line with guidance in National Planning Policy Framework (NPPF).

Government policy with respect to development in flood risk areas is described in National Planning Policy Framework (NPPF) and the National Planning Policy Framework's Technical Guidance.

The Local Planning Authority has the responsibility of making the final decision on any planning application. The Environment Agency has the lead role in providing advice on flood issues at a strategic level and in a relation to some site specific planning applications, and is a statutory consultee to the planning process.

There have been a number planning applications for the site including: 01/01303, 99/1607, and 03/3485.

A Level 1 Strategic Flood Risk Assessment (SFRA) report has been prepared by the London Borough of Richmond Upon Thames, dated August 2010, this has been referenced throughout this report.

A review of the Environment Agency's Flood Map shows that the proposed development site lies within Flood Zone 3a. This report has been produced to demonstrate that the proposed development will not increase risk to life, will not increase flood risk elsewhere and will be safe for the lifetime of the development.

1.2. Limitations

The general limitations of this report are that:

- A number of data and information sources have been used to prepare this report. Whilst Nimbus Engineering believes them to be trustworthy, Nimbus Engineering is unable to guarantee the accuracy of data and information that has been provided by others;
- This report has been prepared using best data and information that was available at the time of writing. There is the potential for further information or data to become available, leading to changes in the conclusions drawn by this report, for which Nimbus Engineering cannot be held responsible.

2. SITE SPECIFIC INFORMATION

2.1. Site Location & Layout Plan

The site of the proposed development is located at 2-6 Liffords Place, Barnes High Street, London, SW13 9LR. OS Grid reference TQ 216 763. Liffords Place situated to the south of Barnes High Street, as described in Figures 1 and 2 below.

Figure 1 – Location of the proposed site (Source: OS Getamap)

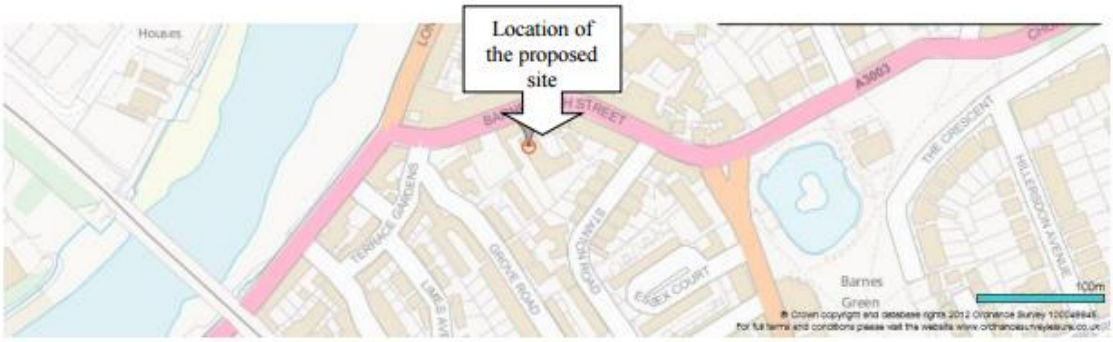


Figure 2 – Location of the development area (Source: OS Getamap)

2.2. Geology of the Area

According to the British Geological Survey, the bedrock of the area is London Clay, overlain by clay, silt, sands and gravels (Figures 3 and 4 overleaf).

Figure 3- Bedrock at the site (contains British Geological Survey materials © NERC 2015).

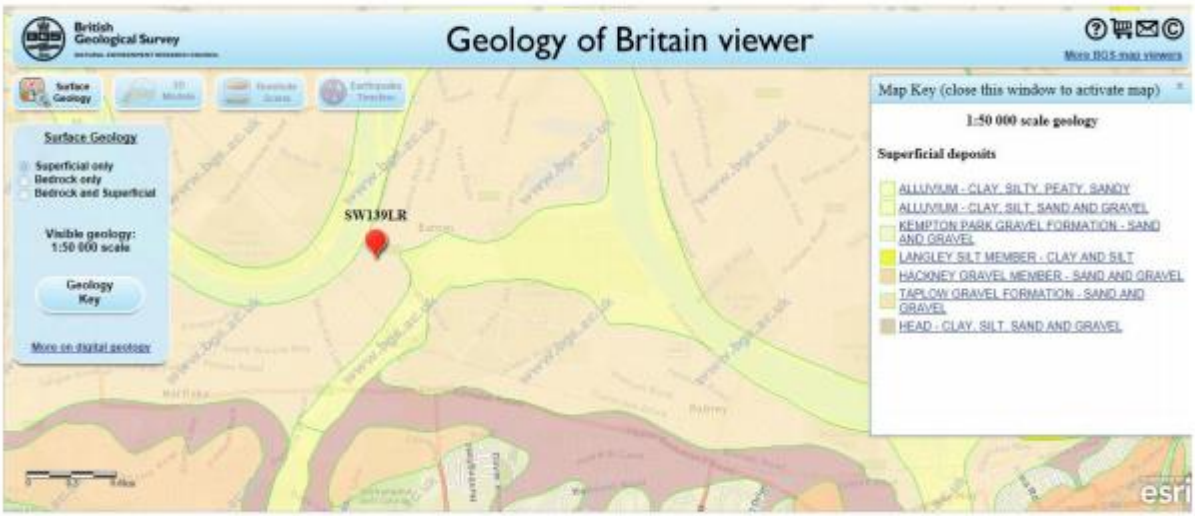


Figure 4- Superficial deposits at the site (contains British Geological Survey materials © NERC 2015).

2.3. Site Topography

According to the topographic survey, included as Appendix C, ground levels at the site range from:

- 5.2m AOD North;
- 5.5m AOD in the South.

There is an ordnance survey benchmark (unmaintained) at the junction of St Anns Road, Melrose Road and Barnes High Street which provides a level of **5.4m AOD**. Another benchmark provides the same value at the junction of Stanton Road and Barnes High Street. There is also a benchmark outside of the police station on Barnes High Street (opposite the entrance to Liffords Place) which provides a value of **5.63m AOD.**

3. PROPOSED DEVELOPMENT

The site is currently occupied by a number of businesses namely a furniture warehouse, car wash, builder's office /store and two vacant office units one of which is derelict. The proposal is to create 18no self-contained flats, (6no 2 bed and 11no 1 bed & 1no studio flat) with terraces constructed around a central courtyard area which would serve two purposes, one for general circulation within the site and the other as an open amenity space.

The proposed development comprises commercial units on the ground floor and residential units on the first, second and third floor / roof over built around the courtyard. The overall site area is 1238sqm, the development increases the built upon foot print of the site by 14% from an original figure of 557sqm to 632sqm.

A proposed site layout plan, can be found in Appendix A.

3.1. Local Watercourses

The site is in close proximity of the River Thames, which is located immediately to 100m to the east of the proposed development.

3.2. Development Planning Background and Environment Agency Data

Figure 5 overleaf, shows the flood map which was downloaded from the Environment Agency's website, March 2015. This indicative map suggests the site is located within Flood Zone 3, an area classified as having 1% probability of fluvial flooding or a 0.5% probability of flooding from the sea in any given year.

Figure 5 – Flood Map for the proposed site

A more detailed flood map was provided by the Environment Agency following a request for information. The Environment Agency's response is included as Appendix B.

4. FLOOD RISK ASSESSMENT

NPPF states that a flood risk assessment should be proportionate to the risk and appropriate to the scale, nature and location of the development. In this specific instance Avis Appleton & Associates Ltd to submit an application for a mixed used development, which includes commercial and residential development. Residential development is considered 'more vulnerable' in terms of flood risk.

The most significant recent flooding event, occurred January 2014 when sustained heavy rainfall caused flooding from surface water, rivers and sewers to combine to impact properties across the London Borough of Richmond.

4.1. Predicted Flood Risk in the area

Flooding from Rivers and Tidal Flooding

The site lies within Flood Zone 3 (there is a 0.5% or greater probability of tidal flooding in any given year); in an area which benefits from flood defences. These zones are produced for an undefended scenario.

Environment Agency maps suggest that tidal flooding could occur from the River Thames. A surge tide could cause a rapid increase in water levels along this stretch of the River Thames, which could pose a risk to residents of this site without defences being in place. Defences have been designed to reduce the risk tidal surges. However, it is important to consider the residual risk should they fail.

In-channel flood levels for the tidal River Thames have been provided by the Environment Agency, these have been taken from the Thames Estuary 2100 (TE2100) study. The most appropriate node for the site is 2.17d, which shows a predicted current day extreme water level of 5.17m AOD.

Location	Node	Easting	Northing	Extreme water level (m)	Left defence (m)	Right defence (m)	Allow for future defence raising to a level of...	
							Left Bank (m)	Right Bank (m)
	2.17d	521099	176083	5.17	5.94	5.94	6.70	6.70
	2.18	521644	177047	5.04	5.54	5.94	6.40	6.40

TE2100 2008 levels (Source: Environment Agency Product 4 data request, September 2016 (Results of Thames Estuary 2100 Study))

				2065 to 2100		2100	
Location	Node	Easting	Northing	Design water level	Defence level (both banks)	Design water level	Defence level (both banks)
	2.17d	521099	176083	5.55	6.25	6.00	6.70
	2.18	521644	177047	5.50	6.25	5.94	6.70

TE2100 climate change levels (Source: Environment Agency Product 4 data request, September 2016 (Results of Thames Estuary 2100 Study))

Breach modelling suggests the site lies on the periphery of the predicted flood extent for the 0.5% AEP 2005. Within Richmond Borough, the River Thames is tidally influenced up to Teddington Weir. This model simulates tidal breaches along the River Thames from Teddington to the Mar Dyke and River Darent. It is based upon the 2008 Extreme Water Modelling, 0.5% AEP tidal event (Thames Barrier operational). Based upon node 2, the predicted breach level at this location is 5.89m AOD, modelled for year 2100 and including allowances for climate change.

The crest level of the flood defences are maintained to a level of 5.94m AOD. The most recent information provided by the Environment Agency suggests they are in good condition.

Future flood levels were also considered as part of this assessment. The TE2100 project suggests future in channel flood levels of 5.55 AOD (2065 to 2100) and 6.00m AOD (future 2100). However, future flood defence levels are likely to be raised to 6.25m AOD (2065 to 2100) and 6.70m AOD (2100) to compensate for future rises in water levels.

Information provided by the Environment Agency (Appendix B), suggests the proposed site and the surrounding area have not been subject to flooding from the River Thames previously, although it should be noted that this data set may be incomplete.

Overland Flow Flooding

The London Borough of Richmond SFRA (Figure G of the SFRA) suggests that the proposed site is not susceptible to surface water flooding. This is also confirmed by the Environment Agency's surface water flood map.

Figure 6 overleaf, shows the predicted extent of the surface water flooding across the site from the Environment Agency flood map. This suggests that the majority of the

site is not at risk from surface water flooding. There is only a small area where localized ponding has been identified, which is generally considered low risk.

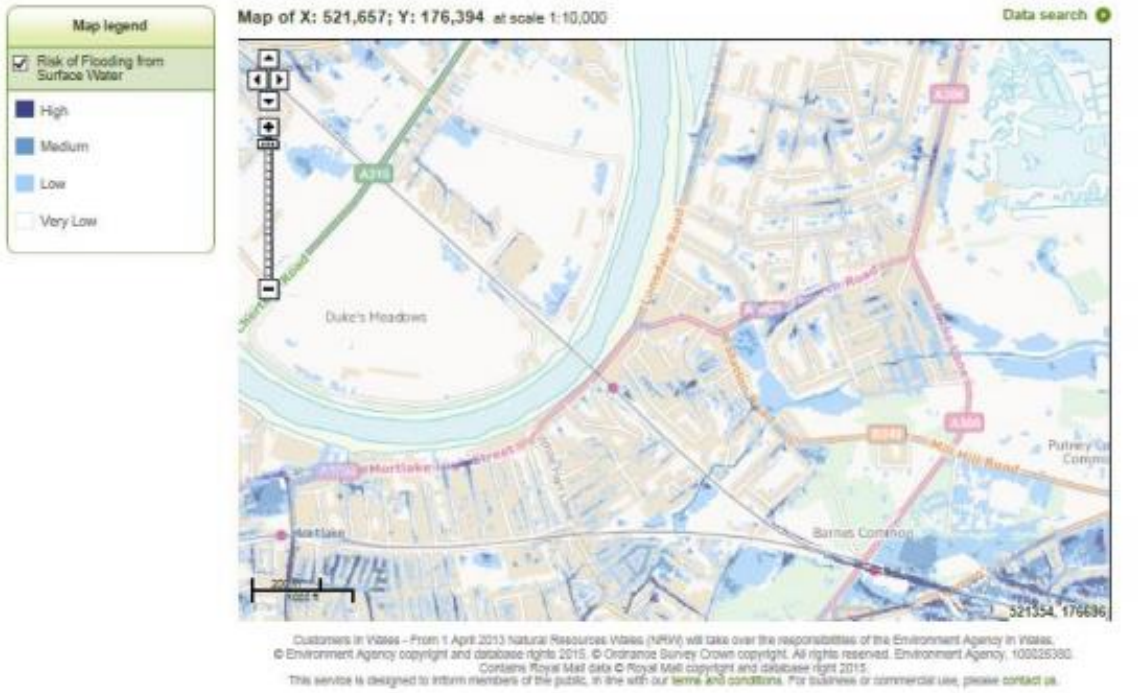


Figure 6 – Environment Agency surface water flood map

Flooding from Groundwater

Groundwater flooding occurs when water levels in the ground rise above surface levels which is most likely to occur in areas underlain by permeable rocks, and is likely to occur after seasonal periods of prolonged rainfall.

In areas in close proximity to the River Thames, there are deposits of gravel which overlay the London Clay, and this can lead to localised incidents of groundwater flooding. However, the Level 1 SFRA (2010) suggests that there have been no groundwater flooding incidents in the vicinity of the site (Figure D of the SFRA). As described in Figure 7 overleaf, which has been extract from the Environment Agency's website (March 2015) the site is located above a minor high aquifer.

Figure 7 – Extract from Environment Agency' s Groundwater Map

There are no known instances of groundwater flooding at the proposed development site.

A report was also carried out as part of the Surface Water Management Plan for the area titles 'Intermediate Assessment of Groundwater Flooding Susceptibility, March 2011. This also confirmed that there had been no groundwater flooding in the vicinity.

<u>Flooding from foul and surface water sewers</u>

We are not aware of any instances of flooding at the site. The SWMP (2011) suggests that there have been 21 to 50 instances of sewer flooding within the SW13 9 postcode area, but no site specific information is available.

The catchment is underlain by London Clay which has very limited permeability and can generate significant volumes of rapid surface water runoff during periods of heavy rainfall. The urbanised nature of the catchment means also increases response times.

The proposed foul drainage for the original development was designed in accordance with Approved Document H (The Building Regulations 2000) and 'Sewers for Adoption'. As SUDS will be provided to regulate runoff generated by the site, this will

control surface water run off entering the existing surface water network and improve the existing situation.

Flooding from reservoirs, canals and other artificial sources

There are no canals in close proximity to the proposed site. However, as described in Figure 8, which is an extract from the Environment Agency's reservoir maps, the site is at risk of flooding from this source. However, the risk of flooding from a reservoir is considered low.

Figure 8 – Environment Agency Map Showing Areas at Risk from Reservoir Flooding

Within Richmond Borough there are artificial lakes located in Richmond Park and Bushby Park, as well as several reservoir storage areas in the south west of the Borough.

4.2. Climate Change

Table 5 from NPPF's technical guidance suggests that by 2050 rainfall will increase by 20% due to climate change. There is more uncertainty regarding climate change, but any increase in flows could result in more frequent and more extensive flooding. The increase in rainfall combined with an increase of land movement, which is

generally falling in the south east and rising in the north west of the UK, will contribute to an increase in river levels.

The following table extracted from NPPF's technical guidance highlights the recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights, over a range of design horizons.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%
Peak River Flow	+10%	+20%		
Offshore Wind Speed	+5%		+10%	
Extreme Wave Height	+5%		+10%	

All modelled river levels, provided by the Environment Agency, that have been used for this FRA, included an allowance for climate change.

4.3. Impact of Proposed Development

The development will not impact on any flood flow route and will not alter flood storage. SUDS will be employed to control runoff generated by the site.

5. USE OF SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS)

Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

Reducing the rate of surface water discharge from urban sites is one of the most effective ways of reducing and managing flood risk.

Traditional piped surface water systems work by removing surface water from our developments as quickly as possible, however this can cause various adverse impacts:

- Increased downstream flooding, and sudden rises in flow rates and water levels in local water courses.
- Reduction in groundwater levels and dry weather flows in watercourses.
- Reduce amenity and adversely affect biodiversity due to the surface water run-off containing contaminants such as oil, organic matter and toxic materials.

SUDS are defined as a sequence of management principles and control structures designed to drain surface water in a more sustainable fashion than conventional piped drainage techniques. SUDS should utilise the natural landscape of an area which as well as slowing down the rate of runoff provides a number of environmental, ecological and social benefits.

These include:

- Protection and enhancement of water quality – As well as providing on-site attenuation, SUDS treat the water, resulting in an improved quality of water leaving the site. This is achieved when the water passes through fine soils and the roots of specially selected plants, pollutants washed off the hard landscaping by rainfall will be safely removed before the water reaches the natural receiving water course.
- A sympathetic approach to the environmental setting by providing opportunities to create habitats for flora and fauna in urban watercourses and open spaces.
- Meeting the amenity and social needs of the local community and residents in the creation of attractive green spaces.

The various types of SUDS include:

Permeable paving	
Soakaways;	
Swales and basins;	
Bioretention/ rain gardens;	
Green roofs and rainwater re-use;	
Infiltration trenches and filter drains	
Ponds and wetlands.	

Preferably a combination of these techniques should be used as part of the surface water management train, and it is important for all stakeholders, such as developers, architects, landscape architects and engineers to work together at the planning stage in order to determine a feasible solution.

Local Policy DM SD 7 Sustainable Drainage states:

'*All development proposals are required to follow the drainage hierarchy when disposing of surface water and must utilise Sustainable Drainage Systems wherever practical. Any discharge should be reduced to greenfield run-off rates wherever feasible'.*

5.1. Runoff from the Existing Site

The existing site is almost entirely covered by impermeable surfaces. The approximate dimensions of the existing site are as follows:

- Total area of site = 1,238m^2;
- Area of hardstanding/buildings = 1,238 m^2;
- Permeable area = 0 m^2;

The existing runoff for the development was calculated for the 1, 30 and 100 year flood events. The pre-development runoff rate has been calculated as 8.7 l/s for a 1 in 1 year storm.

5.2. Runoff Post-Development

Runoff from the proposed site will be controlled by the use of SUDS. Surface water calculations are provided in Appendix D.

- Total area of proposed development = 1,238m^2;
- Area of proposed hardstanding =760m^2 ;
- Area of proposed landscaping = 21.4m^2
- Area of proposed permeable paving = 456.6m^2
- Restricted discharge = 5 l/s (based upon calculations contained in Appendix D)

The preferred options in terms of SUDS:

- Permeable paving for access roads, vehicle turning area and courtyard;
- Rainwater harvesting (storage provided below fountain shown on plan in Appendix A);
- Raingarden (planting areas shown on plan in Appendix A).

Details of the volume of attenuation required are described in Appendix D. Figure 9 shows the typical layout of a raingarden arrangement within a similar development.

Figure 9 – A Typical Raingarden Arrangement (Source: Thames21.org.uk)

5.3. Maintenance of SUDS

All SUDS will be constructed as per CIRIA C698 Site handbook for the Construction of SUDS and CIRIA C697 the SUDS Manual.

Tables 1 and 2 overleaf, describe expected maintenance activities and the minimum frequency maintenance which is required, based upon a variety of studies carried out within the UK. We are unable at this stage to confirm who will be responsible for the operation and maintenance of the SUDS, as the site may be sold on and ownership may change. However, we expect that a suitable management company will be appointed to carry out the required maintenance activities.

Table 1- Maintenance activities and frequency of maintenance for permeable paving.

Maintenance category	Maintenance activity	Comments	Frequency
Routine maintenance	Litter and debris removal.	Regular inspection is required,	**Monthly.**
	Weeding	Weeding should be conducted by hand or use non-toxic and biodegradable weed killer. Invasive species should be removed in accordance with best practice.	**Monthly or as required.**
	Sweeping	Regular sweeping to removed accumulated sediment and silts	**At least three times a year at the end of winter, mid-summer and after leaf fall or as required**
Infrequent maintenance	Stabilise and mow contributing and adjacent areas		**As required.**
Corrective maintenance	Replace damaged blocks and repair of any depressions		**As required.**
	Rehabilitation of surface and upper sub-structure		**As required**

Table 2 Raingarden operation and maintenance requirements

Maintenance Category	Maintenance activity	Comments	Frequency
Routine Maintenance	Litter and debris removal	Litter & debris to be removed prior to any pruning activity.	**Monthly or as required**
	Mulching – removal and replace		**Annually**
	Pruning and weeding		**Monthly or as required**
Infrequent Maintenance	Replacement of plants		**As required**
Corrective Maintenance	Treatment of diseased vegetation		**As required**
	Silt removal		**As required**
	Repair of perforated pipe		**As required**

It should be noted that remedial work will be required should any of the SUDS be impacted by fluvial flooding. It is likely maintenance will be carried out by a private maintenance company.

6. SEQUENTIAL TEST

NPPF outlines the requirement for a sequential risk based approach to be adopted for determining the suitability of land for development in flood risk areas (either through fluvial, coastal, sewer, groundwater and/or surface water flooding mechanisms). Central to this approach is the application of a **Sequential Test** to prioritise sites in order of flood risk probability and suitability for development.

The test is used to assess what land is available for development and direct development to areas of lowest risk in the first instance. Where development is proposed within either medium (Zone 2) or high (Zone 3) flood risk zones, NPPF requires that a Sequential Test is carried to demonstrate that there are no reasonable alternative development sites in areas of lower risk. However, development of sites within flood risk areas must take account of how development impacts can be mitigated as well as the probability of the flood risk.

Residential development is classed as 'more vulnerable', as described in the National Planning Policy Framework. The site lies within Flood Zone 3, and therefore according to the National Planning Policy Framework, areas at risk from flooding would only be suitable for particular land uses (Table 3). In terms of local planning policy:

Local Policy DM SD 6 Flood states**:**

'Development will be guided to areas of lower risk by applying the Sequential Test Unacceptable developments and land uses will be restricted in line with PPS25 and as outlined below. Developments and Flood Risk Assessments must consider all sources of flooding and the likely impacts of climate change'.

Table 3 - Flood risk vulnerability and flood zone compatibility

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

Source: Government and Local Communities (2012) Technical Guidance to the National Planning Policy Framework

The Core Strategy includes an objective relating to housing provision which states:

"…that there is a suitable stock of sound housing to meet the needs of all residents, particularly encouraging more affordable housing to meet the acute need in the Borough and housing for those with specific needs."

The Strategy identifies five areas that the provision will be shared:

- **Twickenham** – Twickenham Riverside Ward; St Margaret's and North Twickenham Ward; South Twickenham Ward; West Twickenham Ward.
- **Richmond** – Ham, Petersham and Richmond Riverside Ward; South Richmond Ward; North Richmond Ward; Kew Ward.
- **East Sheen** – East Sheen Ward; Mortlake and Barnes Common Ward; Barnes Ward.
- **Whitton** – Whitton Ward; Heathfield.
- **Teddington and Hampton** – Hampton North Ward; Hampton Ward; Fulwell and Hampton Hill; Teddington Ward; Hampton Wick Ward.

The Borough has a housing target of 2700 units from 2007 to 2017. The Local Housing Availability Assessment (LHAA, 2008) identified 34 sites to accommodate development, 20 of which already have planning permission. Therefore 14 sites were sequentially tested for the Strategy, none of which were in the Barnes area. A previous appeal statement, for a residential development in Flood Zone 2, which was granted planning permission at Accrington Road, Whalley states that a 400m radius of the service centre, namely the town centre, should be assessed. This assessment has not identified any alternative sites in the Barnes area.

The 2010 SFRA recognizes that a large proportion of the character area of Barnes is within zone 3a high probability.

In summary, no alternative site at lower risk from flooding has therefore been identified to accommodate this development. It can therefore be concluded that the Sequential Test has been passed.

7. EXCEPTION TEST

In certain cases the Sequential Test may not identify sites that are purely in low flood risk areas. In these circumstances, where development is necessary to meet the needs of the community and/or provides wider sustainability benefits, the Exception Test is used to assess the safety of that potential development in Flood Zones 2 and 3.

For the Exception Test to be passed, a development must satisfy all of the following three criteria:

a. The development provides **wider sustainability benefits** to the community that outweigh the flood risk, informed by a SFRA where one has been prepared. If the Development Plan Document has reached the 'submission stage', the benefits of the development should contribute to the Core Strategy Sustainability Appraisal.
b. The development should be **on developable previously-developed land** (commonly known as 'Brownfield land') or, if it is not on previously-developed land, it should be shown that there are no reasonable alternative sites on developable previously-developed land.
c. A Flood Risk Assessment (FRA) must demonstrate the development will be **safe**, **without increasing flood risk elsewhere** and, where possible, will reduce the flood risk overall.

As described in the Table 4 overleaf, which is based upon the requirements of NPPF, for residential development to be acceptable in Flood Zone 3, it must pass the Exception Test.

Table 4 – Liffords Place, Barnes High Street	
Flood Risk Constraint	Flood Zone 3a (at the periphery of the site)
Part a) ***Wider Sustainability Benefits***	This is a brownfield site, partially located within Flood Zone 3. No suitable alternative sites have been identified in the sequential test. This is an area identified as being in need of regeneration.
Part b) ***Previously Developed Land***	Brownfield site in need of regeneration. This is a site, which would benefit from investment
Part c): ***Safe Development***	To ensure the residential and commercial development is not subject to flooding: • Finished floor levels of residential accommodation will be above the predicted 1% plus climate change flood level plus freeboard allowance; • All buildings will be designed to be flood resilient, with mitigation measures available to speed up recovery should the building flood. • Adequate warning is available should flooding occur, though the Environment Agency's Floodline service. Residents will also be asked to sign up to this service. • Safe access and egress can be provided at all times • The proposed development will not impact on existing flood storage or any flood flow route. • SUDS will be used to control runoff generated by the site, improving existing conditions.

In terms of Part (a) of the Exception Test, which relates to wider sustainability benefits. The London Borough of Richmond Upon Thames Core Strategy (adopted April 2009), vision has 3 inter-related themes of 'A Sustainable Future', 'Protecting Local Character' and 'Meeting People's Needs'.

The Revised Sustainable Appraisal for Site Allocations (dated July 2013) identifies the key areas of sustainable development as being:

'building a strong and competitive economy, ensuring the vitality of town centres, promoting sustainable transport, delivering a wide choice of high quality homes, requiring good design, promoting healthy communities, mitigating and adapting to climate change, protecting and enhancing the environment, ensuring social cohesion and inclusion, and managing natural resources more prudently and responsibly'.

The appraisal also suggests 'The Local Plan should aim to reduce the risks of flooding to communities (people, properties and infrastructure) and ensure that flooding is given appropriate weight when considering the location and design of new development. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure'.

The Core strategy refers to the need to bring forward a series of small affordable housing schemes over the lifetime of the Plan. The Revised Sustainability Appraisal (July 2013) also states 'the Local Plan should aim to create sustainable, high quality homes and consider issues such as design, mixtures of housing types and tenures, associated open amenity spaces and proximity to local centres'. The 2008 Strategic Housing Land Availability Assessment suggests the Borough has a housing target of 2700 units from 2007 to 2017. This equivalent to 270 units per annum. The 2005 London-wide Housing Capacity Study anticipated that during this period that: 1706 would come from small sites.

In terms of economic benefits, the Revised Sustainability Appraisal (dated July 2013) suggests 'the Local Plan should promote the development of positive strategies to underpin the planning and development of town centres'. Barnes is considered one of the more deprived areas in the Borough and would benefit this proposed regeneration of derelict buildings.

In terms of benefits which will be provided by the proposed development:

- The site is currently occupied by a number of businesses namely a furniture warehouse, car wash, Builders office /store and to vacant office units one of which is derelict.
- The proposals will improve the dilapidated state of the overall site to provide good quality outlets to the ground floor and a diversity of much needed modern and highly energy efficient residential units in an area where the existing housing stock is predominately family houses built pre 1920's and the flats pre 1960's both of which are difficult to renovate to today's standards.
- The creation of predominately one and two bedroom units will provide valuable residential units at the lower end of the price scale within Barnes and would appeal to either young purchasers starting out on the property ladder or the older purchaser, looking to downsize but stay in a the local area.
- The mix of office/retail/public space will enhance the quality of the development and create a vibrant courtyard atmosphere away from the busy high street.

- There will be no loss of employment, should the application be granted as it will create more jobs in line with (EMP14) in an area which is designated for mixed use.

8. MITIGIATION MEASURES

Ground levels at the site are generally between **5.2m and 5.5m AOD**. The predicted present day in channel flood levels are below these figures, but the predicted 2065 to 2100 and beyond in-channel flood levels are greater. However, appropriate, well maintained, defences are in place to reduce this risk of flooding.

As there is a risk of flooding at this location, appropriate mitigation measures will be employed.

No sleeping accommodation is proposed for any of the ground floors of the development, as described in the layout plan provided in Appendix A. The ground floor will be used for commercial purposes and will be designed to be resilient to any flooding.

The primary risk of flooding is that associated with overtopping or breaching of the existing flood defences during extreme storm events. The finished floor level of any residential accommodation will be constructed as a minimum, above the 1 in 200 year plus climate change in-channel tidal flood level (6m AOD for the year 2100, assuming the lifetime of the development is 100 years) to provide adequate protection from an extreme flooding event. As residential accommodation is to be situated in the upper floors the finished floor levels will have a substantial freeboard above this predicted flood level (Appendix E).

As there is the potential for flood water to enter at ground floor level in the future, it is important that appropriate mitigation measures are provided.

As a precautionary measure, the owners of the ground floor commercial premises will be requested to sign up to Floodline Warnings direct on 0845 988 1188 in order to receive flood warnings from the Environment Agency via text, phone or email, as well as being presented with a copy of this Flood Risk Assessment in order to understand the access and egress risks to the property.

Various resilience measures will also be incorporated into the fabric of the building. Fixtures and fittings will be put in place to ensure that if any flood water does enter the property during flooding, impact of floodwater on the property will be minimal. These measures will ensure drying and cleaning is simpler, and that the structural integrity of the building is not compromised, and ultimately they will reduce the time required until the property can be re-occupied.

The resilience measures to be adopted, will include:

- Electricity consumer unit and mains connection point to be located as high as possible;
- Non return valves to be used in drainage design to prevent back up of flow;

- All water, electricity and gas meters to be located, as high as possible;
- Adequate sealing of joints between the internal units required to prevent any penetration of water behind fittings;
- Heating systems such as boiler units and ancillary devices to be installed as high as possible;
- Walls will have closed-cell cavity insulation and a damp proof course.
- The floor will consist of a cast concrete slab with screed.
- Internal walls will be painted, not wallpapered.

8.1. Floodplain Compensation

The site is subject to flooding from the River Thames and flood storage will not be impacted by these proposals.

8.2. Flood Warning

In terms of the residents on the upper floors Local Policy DM SD 6 states:

'In areas at risk of flooding, all proposals on sites of 10 dwellings or 1000sqm of nonresidential development or more are required to submit a Flood Warning and Evacuation Plan'

As a precautionary measure the owners of these properties will be requested to sign up to Floodline Warnings direct on 0845 988 1188 in order to receive flood warnings from the Environment Agency via text, phone or email, as well as being presented with a copy of this Flood Risk Assessment in order to understand the access and egress risks to the property.

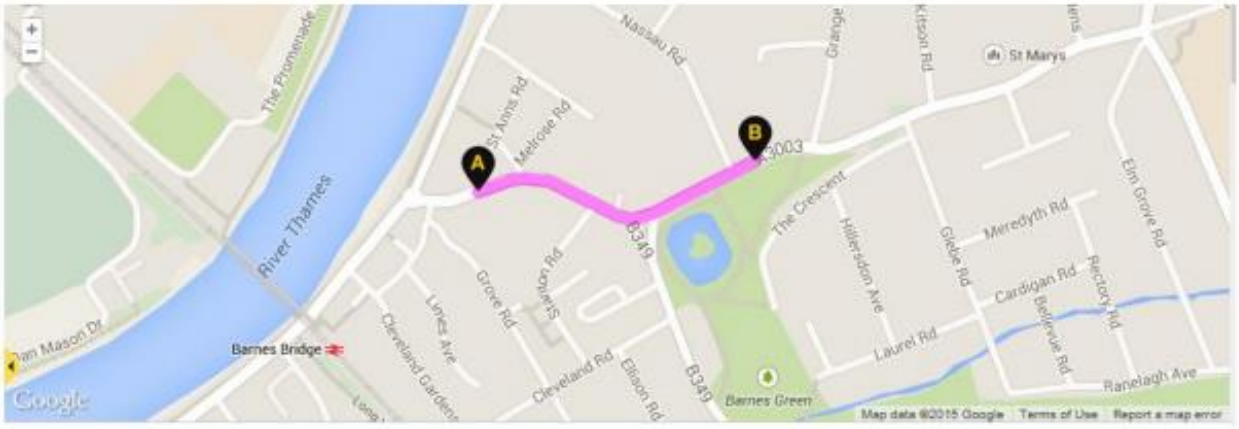
8.3. Finished Floor Levels

Finished floor levels for residential accommodation will be well above the predicted flood level and therefore the properties will not be at risk from flooding.

8.4. Safe Access/Egress

The safest option is for residents to remain in their properties and not attempt to walk through flood water. Staff of the commercial premises should use the internal staircases provided and make their way to the upper floors of the building, where safe refuge will be available at all times.

In the unlikely event of the properties being evacuated, residents and staff will be directed to St Osmunds Primary School, approximately 300m along Church Road. This should only occur when directed to do so by the emergency services.



Breach modelling carried out as part of the SFRA (August 2010) suggests 4 hours after breach failure, inundation levels are approximately 5.0m AOD, which is roughly the same ground level of the site. It is therefore likely that residents will have up to 4 hours' notice, once a breach occurs.

9. CONCLUSION

The London Borough of Richmond Upon Thames has requested that a Flood Risk Assessment report must be submitted as part of the planning application.

Consultation of the Environment Agency's Flood Map on their website suggested that the proposed development site lies within Flood Zone 3, which was confirmed through consultation with the Environment Agency.

This report has been produced to demonstrate that the proposed development will not increase risk to life and will not increase flood risk to the site itself or areas adjacent to the site.

A Sequential Test was carried out demonstrating that there are no alternative sites in areas at lower risk from flooding. An Exception Test has also been carried out which has demonstrated that the development is appropriate and safe.

It has been demonstrated that the proposals will not impact on any flood flow routes and there will be no loss of flood storage as a result of the development.

The proposed residential accommodation will not flood, as the finished floor levels are significantly above the predicted flood level, plus an allowance for climate change.

The proposed commercial development may flood during an extreme event, but are designed to be flood resilient.

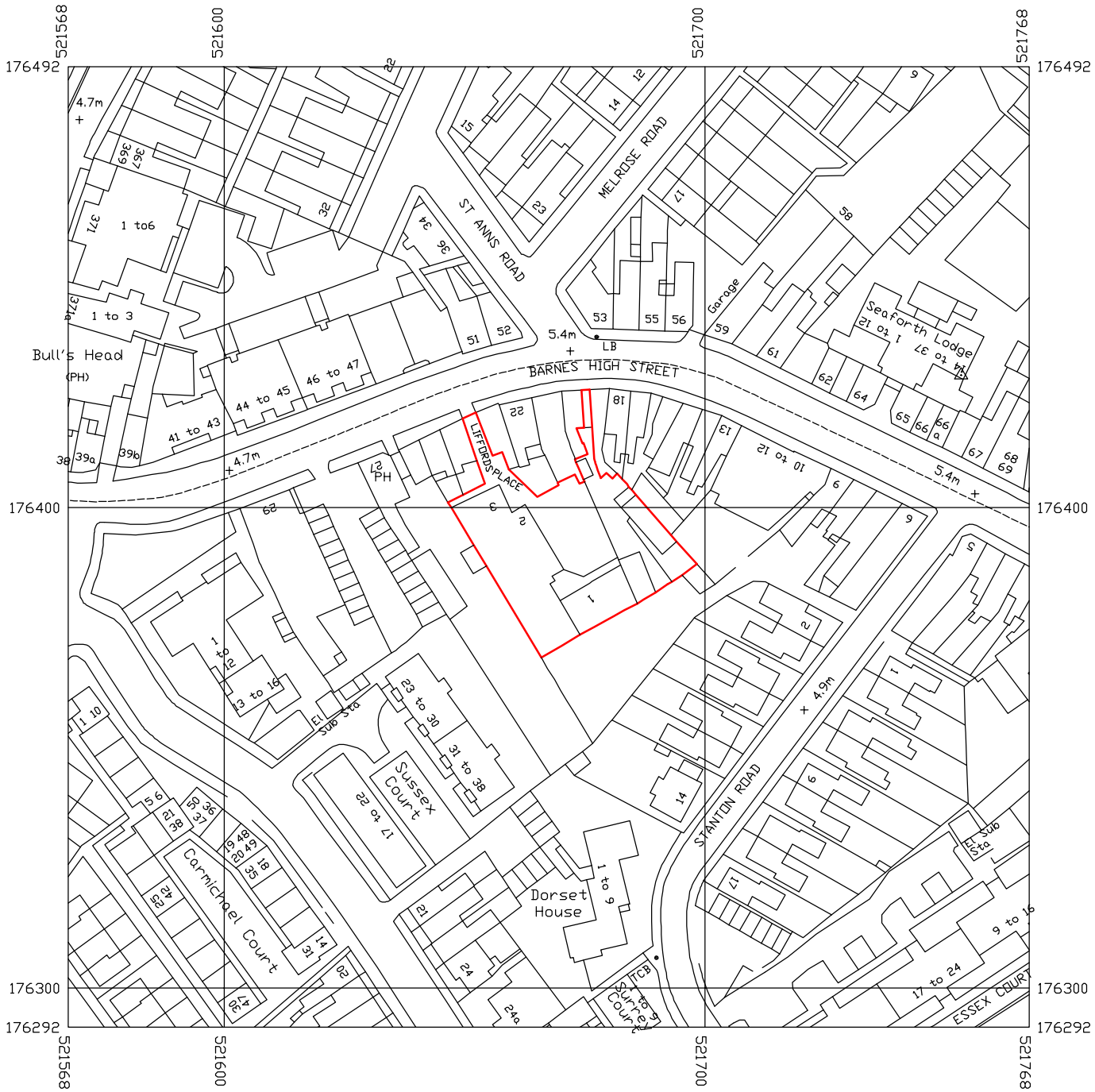
Safe access and egress can be provided.

SUDS will be employed to control runoff generated by the site and to provide water quality improvements.

Discussions will take place with Thames Water over the sewerage infrastructure. However, it is assumed that there is adequate capacity to deal with discharges from the site, as there are existing connections from the current buildings.

It can therefore be concluded that the proposed development will be safe for the lifetime of the development, will not increase risk to life and will reduce the risk of flooding at the site itself and elsewhere by controlling runoff generated by the site.

APPENDIX A- SITE DETAILS



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0 20 40 60 80

SITE LOCATION PLAN @ 1.1250

BLOCK PLAN @ 1.500

NORTH

Figured dimensions only to be taken from this drawing.
Any errors or omissions to be reported to the architect.

client :
BARRY MARSH

drawing title :
SITE LOCATION & BLOCK PLAN

property :
LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

AVIS APPLETON & ASSOCIATES
11 Barmouth Road
Wandsworth
London SW18 2DT
t: 0208 877 9170
e: post@avisappleton.com

scale : A3 @ AS NOTED
date : 13.09.13
drawing number : 13:8355:01
drawn by : JG

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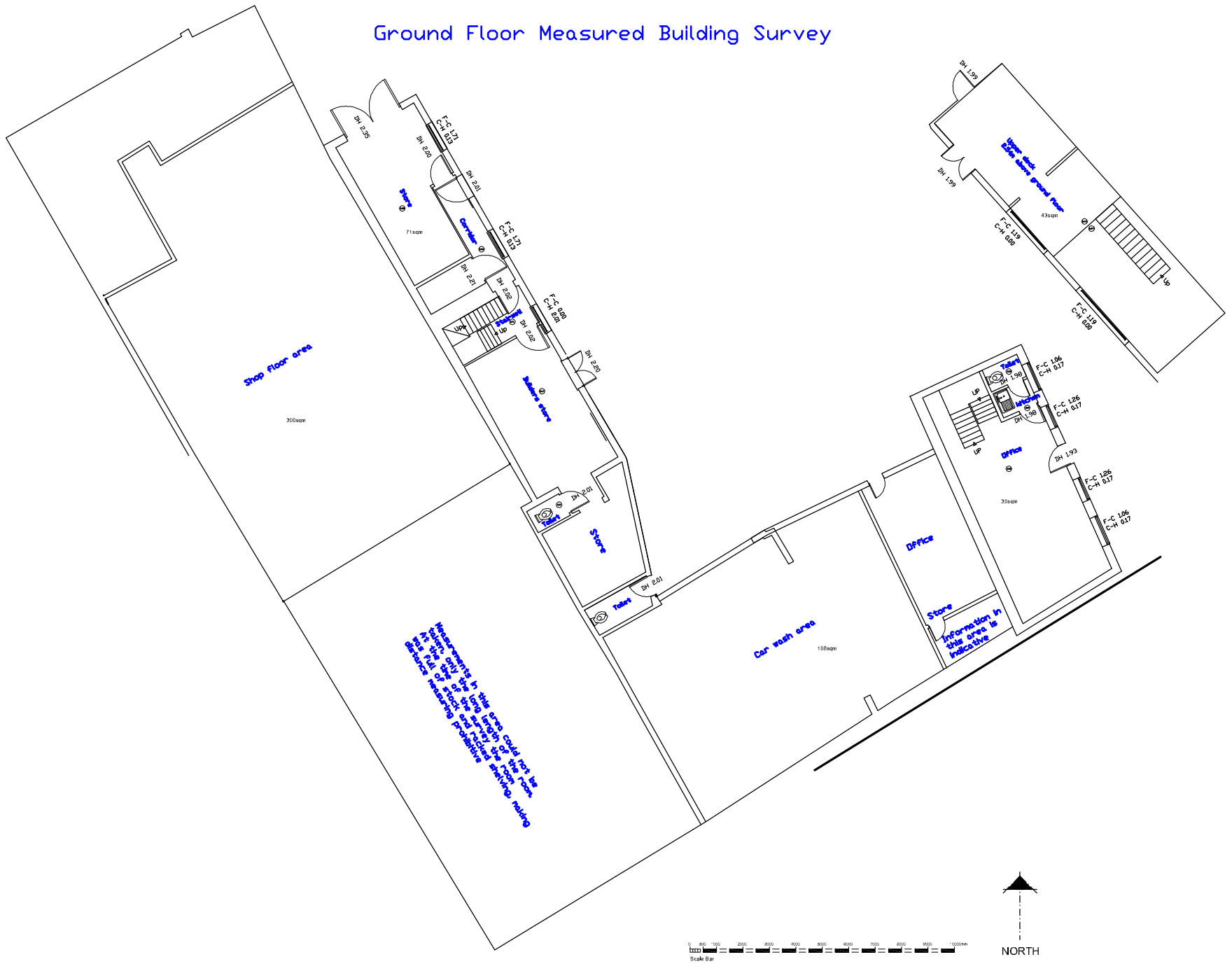
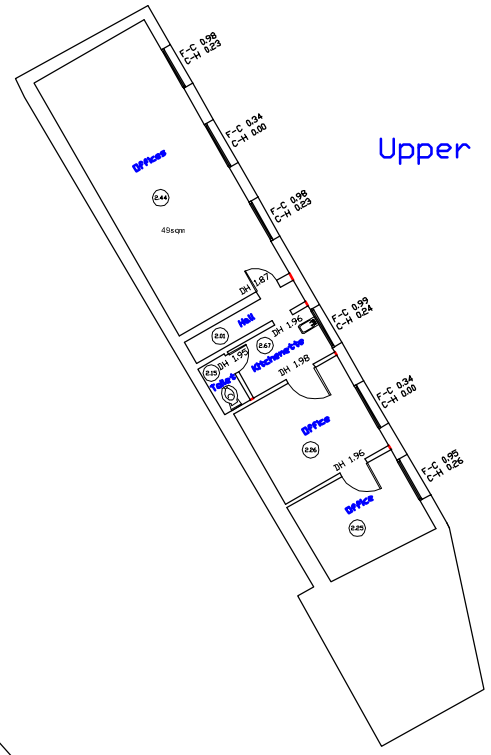
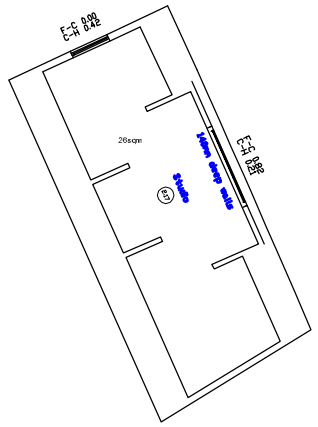
Ground Floor Measured Building Survey



Upper Floor Measured Building Survey





client :

ROUNDLISTIC LTD

drawing title :

EXISTING FLOOR PLANS

property :

LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

AVIS APPLETON & ASSOCIATES
11 Barmouth Road
Wandsworth
London SW18 2DT
t: 0208 877 9170
e: post@avisappleton.com

scale	:	A1 @ 1.100 A3 @ 1.200
date	:	5.08.2014
drawing number	:	14.8355.03
drawn by	:	MJA / MB

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NORTH

Refuse Store

Vehicle Turning Point

Bicycle Storage Area for Commercial units 9no

Bicycle Storage Area for Residential units 18no

Lift

Entrance Lobby Common Parts

Up

LANDSCAPED COURTYARD

Close board Fence 1.8m High

Panel Fence 1.6m high

Fire Escape

Ground Floor Unit G1
173sqm
11862sqf

Ground Floor Unit G2
151sqm
1625sqf

Ground Floor Unit G3
109sqm
1173sqf

Common Parts Entrance Lobby

Scale Bar 0 500 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000mm

SITE LAYOUT GENERAL ARRANGEMENT PLAN

B	Design revisions	16.08.16	M

client :

ROUNDLISTIC LTD

drawing title :

PROPOSED SITE LAYOUT

property :

LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

AVIS APPLETON & ASSOCIATES
11 Barmouth Road
Wandsworth
London SW18 2DT
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scale : A1 @ 1.100 A3 @ 1.20
date : 5.08.2014
drawing number : 14.8355.05B
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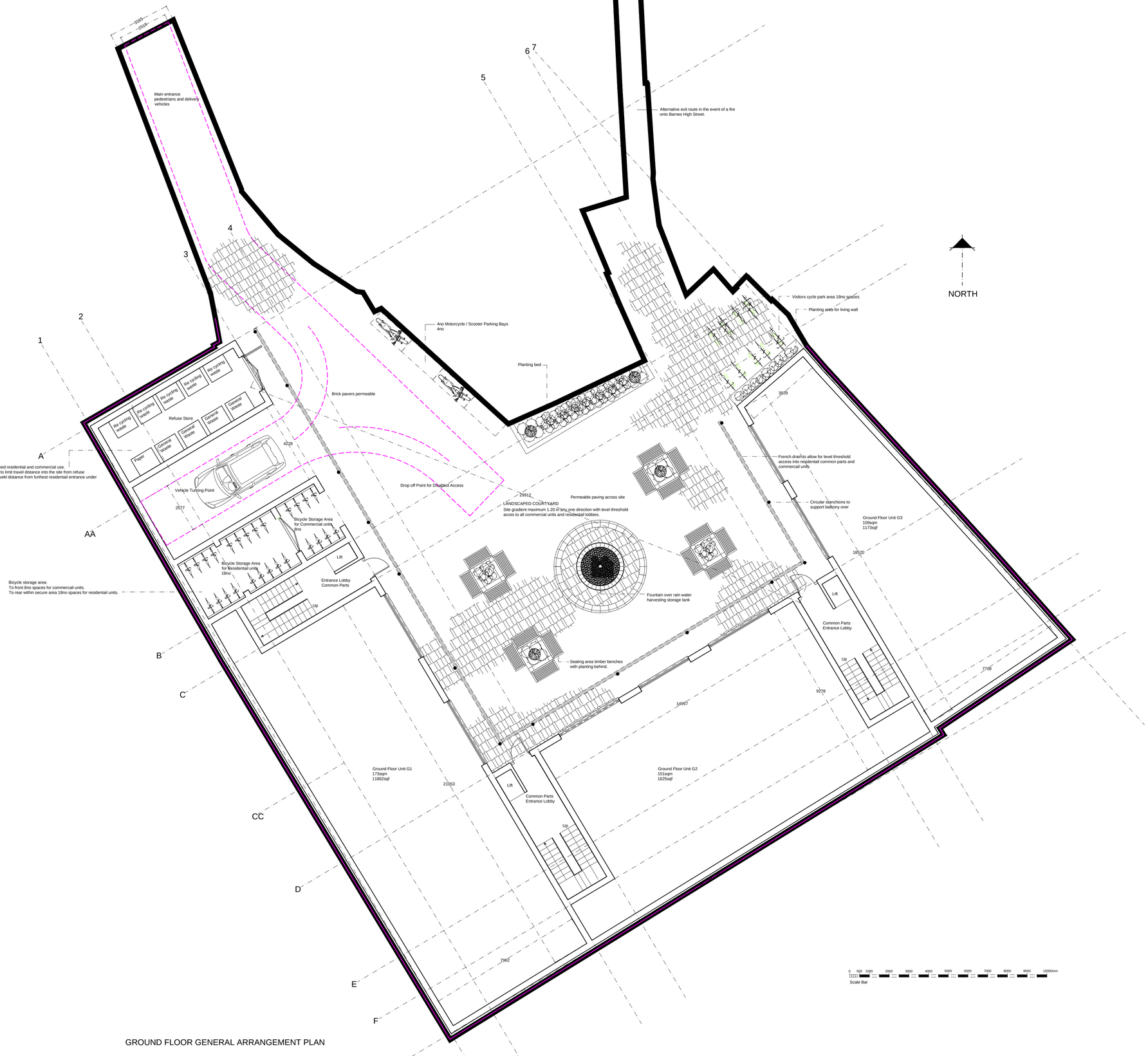

GROUND FLOOR GENERAL ARRANGEMENT PLAN

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B	Design revisions	16.08.16	MJA
C	Areas revisions	23.08.16	MJA

client :

ROUNDLISTIC LTD

drawing title :

PROPOSED GROUND FLOOR PLAN

property :

LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

AVIS APPLETON & ASSOCIATES
11 Barmouth Road
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scale : A1 @ 1.100 A3 @ 1.200
date : 5.08.2014
drawing number : 14.8355.06C
drawn by : MJA / MB

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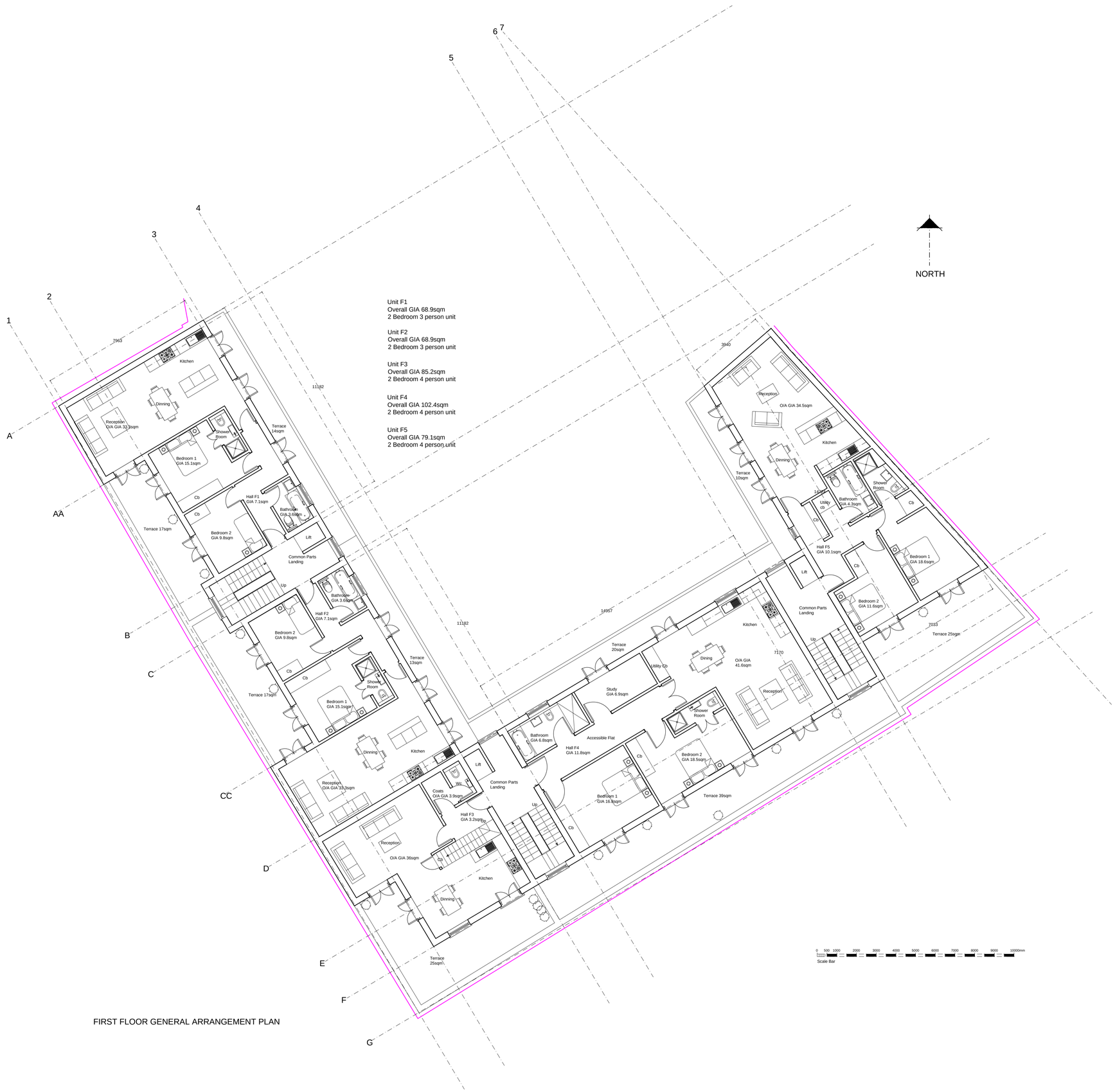

Unit F1
Overall GIA 68.9sqm
2 Bedroom 3 person unit

Unit F2
Overall GIA 68.9sqm
2 Bedroom 3 person unit

Unit F3
Overall GIA 85.2sqm
2 Bedroom 4 person unit

Unit F4
Overall GIA 102.4sqm
2 Bedroom 4 person unit

Unit F5
Overall GIA 79.1sqm
2 Bedroom 4 person unit

FIRST FLOOR GENERAL ARRANGEMENT PLAN

B	Design revisions	16.08.16	MJA

client :

ROUNDLISTIC LTD

drawing title :

PROPOSED FIRST FLOOR PLAN

property :

LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

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scale : A1 @ 1.100 A3 @ 1.200
date : 5.08.2014
drawing number : 14.8355.07B
drawn by : MJA / MB

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SECOND FLOOR GENERAL ARRANGEMENT PLAN

B	Design revisions	16.08.16	MJA

client :

ROUNDLISTIC LTD

drawing title :

PROPOSED SECOND FLOOR PLAN

property :

LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

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scale : A1 @ 1.100 A3 @ 1.200
date : 5.08.2014
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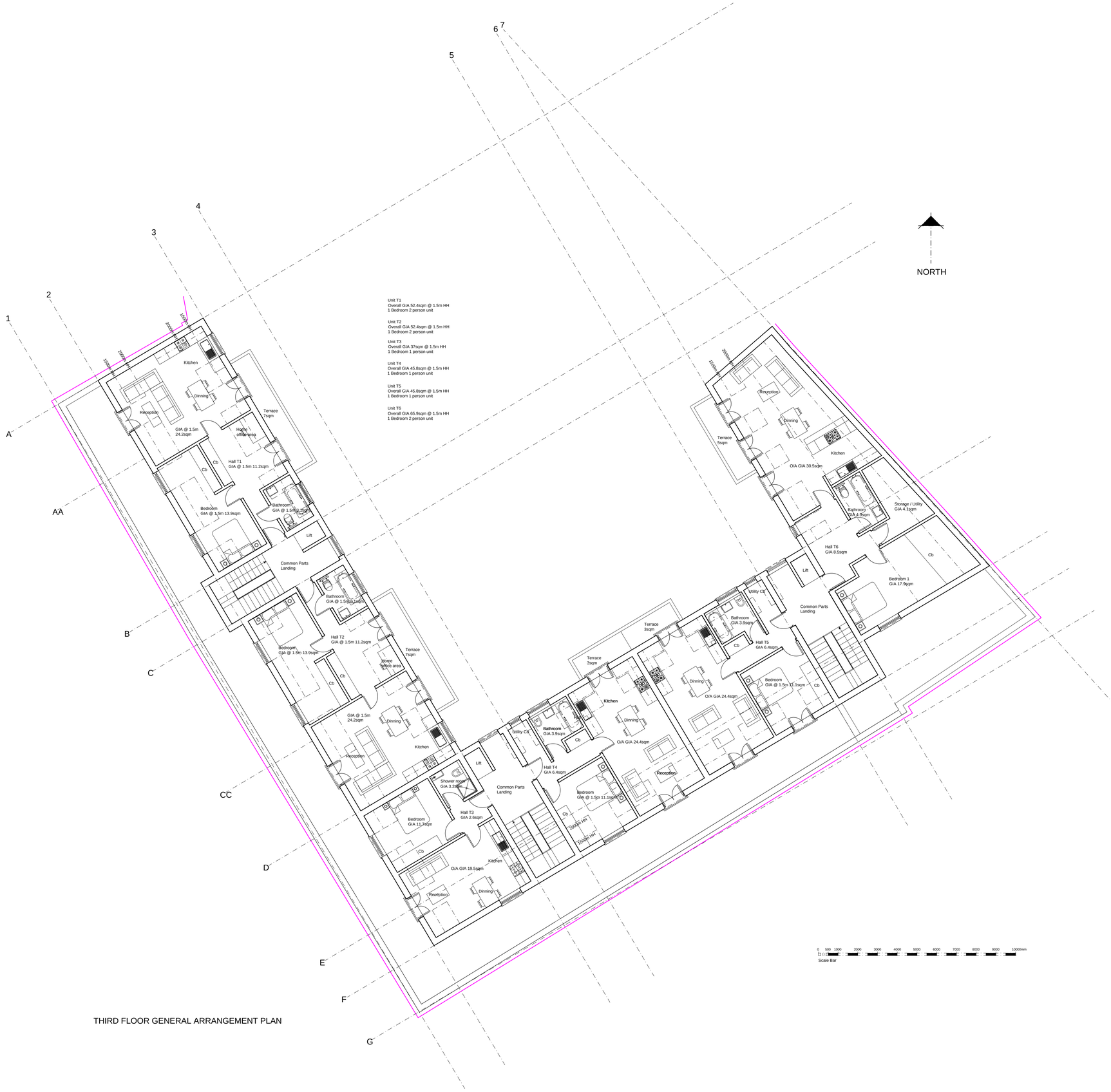

THIRD FLOOR GENERAL ARRANGEMENT PLAN

B	Design revisions	16.08.16	MJA

client :

ROUNDLISTIC LTD

drawing title :

PROPOSED THIRD FLOOR PLAN

property :

LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

AVIS APPLETON & ASSOCIATES
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Wandsworth
London SW18 2DT
t: 0208 877 9170
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scale	:	A1 @ 1.100 A3 @ 1.200
date	:	5.08.2014
drawing number	:	14.8355.09B
drawn by	:	MJA / MB

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APPENDIX B- ENVIRONMENT AGENCY CORRESPONDENCE

Product 4 (Detailed Flood Risk) for: 1-4 Liffords Place, Barnes High Street, London SW13 9LR
Requested by: Asha Saeed, Nimbus Engineering Consultants LTD
Reference: KSL 22097 SD
Date: 07 September 2016

Contents

The information provided is based on the best data available as of the date of this letter.

You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements to the data for this location have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Customer services line: 01732 223 202
Email: kslenquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Flood Map for Planning (Rivers and Sea)

The Flood Map:

Our Flood Map shows the natural floodplain for areas at risk from river and tidal flooding. The floodplain is specifically mapped ignoring the presence and effect of defences. Although flood defences reduce the risk of flooding they cannot completely remove that risk as they may be over topped or breached during a flood event.

The Flood Map indicates areas with a 1% (0.5% in tidal areas), Annual Exceedance Probability (AEP) - the probability of a flood of a particular magnitude, or greater, occurring in any given year, and a 0.1% AEP of flooding from rivers and/or the sea in any given year. In addition, the map also shows the location of some flood defences and the areas that benefit from them.

The Flood Map is intended to act as a guide to indicate the potential risk of flooding. When producing it we use the best data available to us at the time and also take into account historic flooding and local knowledge. The Flood Map is updated on a quarterly basis to account for any amendments required. These amendments are then displayed on the internet at

https://www.gov.uk/government/organisations/environment-agency.

At this Site:

The Flood Map shows that this site lies within the outline of Flood Zone 3 **OR** Flood Zone 2. This zone comprises land assessed as having a 0.5% (1 in 200) or greater annual probability of tidal flooding **OR** between a 0.5% (1 in 200) and 0.1% (1 in 1000) annual probability of tidal flooding.

OR

is not within the current 'Extreme Flood Outline'. According to the Flood Map, which provides a general estimate of the likelihood of flooding across England & Wales, this site is shown to have less than 0.1% (1 in 1000) chance of flooding in any year from rivers and/or the sea.

Enclosed is an extract of our Flood Map which shows this information for your area.

Method of production

The Flood Map at this location has been derived using detailed modelling of the Thames Tidal Defences Study completed in 2006 by Halcrow Ltd.

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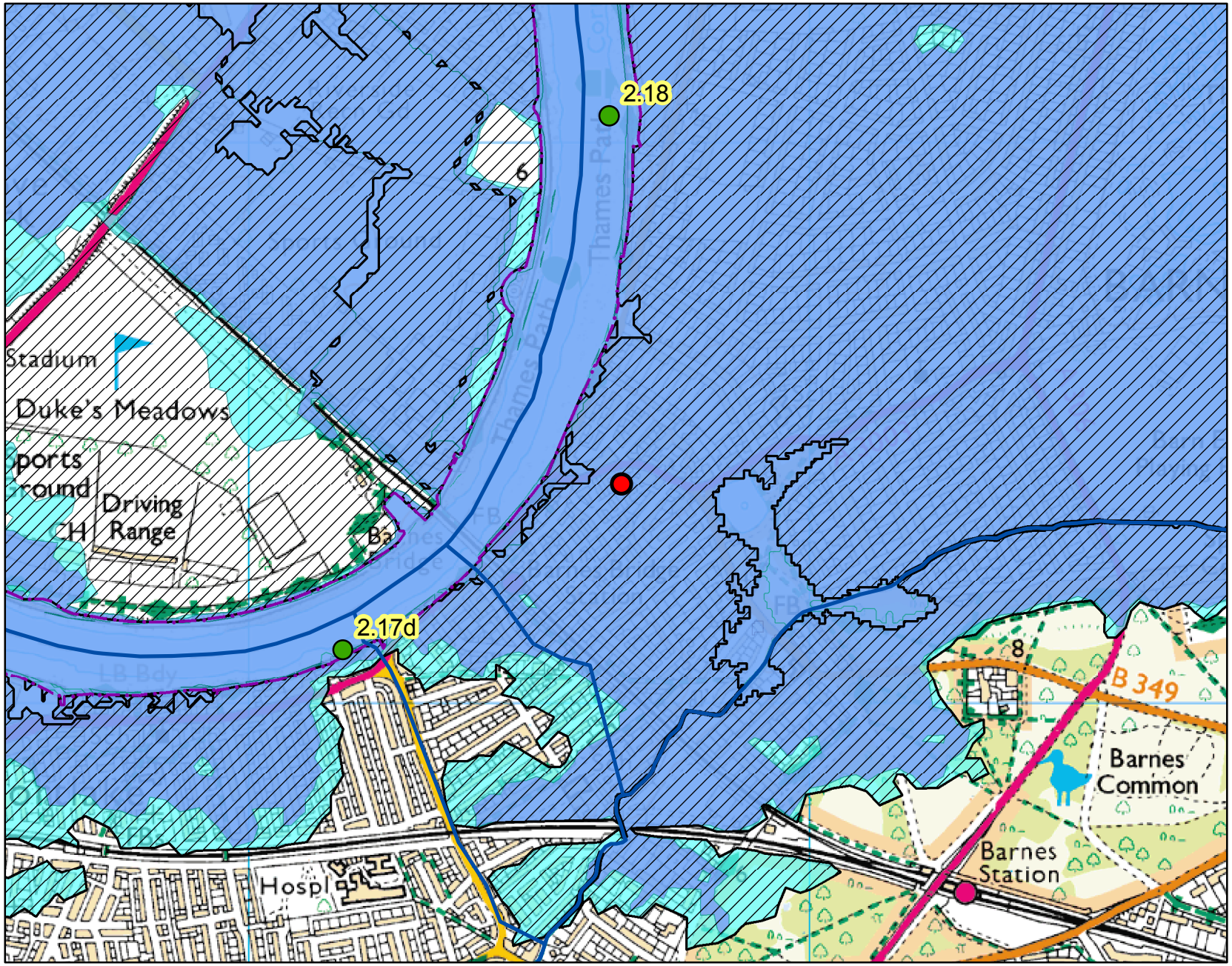
Detailed FRA Map centred on SW13 9LR created 07 September 2016 [Ref: KSL 22097 SD]



Environment Agency

Scale 1: 10,000

Legend

- Main Rivers
- Site
- TE2100 Model Nodes
- Flood Map - Defences
- Jan 1928 Flood Outline
- Areas Benefitting from Flood Defences
- Flood Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

Flood Map for Planning (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of occuring each year
- or from a river with a 1% or greater chance of occuring each year

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 0.1% chance of occuring each year.

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Thames Estuary 2100 (TE2100)

You have requested in-channel flood levels for the tidal river Thames. These have been taken from the Thames Estuary 2100 study completed by HR Wallingford in 2008. The modelled node closest to your site is 2.17d; the locations of nearby nodes are also shown on the enclosed map.

Details about the TE2100 plan

The TE2100 plan is now live and within it are a set of levels on which the flood risk management strategy is based. The plan is the overarching flood management strategy for the Thames Estuary and therefore any development planning should be based on the same underlying data.

Details about the TE2100 in-channel levels

The TE2100 in-channel levels take into account operation of the Thames Barrier when considering future levels. The Thames Barrier requires regular maintenance and with additional closures the opportunity for maintenance will be reduced. When this happens, river levels – for which the Barrier would normally shut for the 2008 epoch – will have to be allowed through to ensure that the barrier is not shut too often. For this reason, levels upriver of the barrier will increase and the tidal walls will need to be heightened to match.

Why is there no return period for levels upriver of the barrier?

The levels upriver of the barrier are the highest levels permitted by the operation of the Thames Barrier. If levels and flows are forecast to be any higher, the Thames Barrier would shut, ensuring that the tide is blocked and the river maintained to a low level. For this reason the probability of any given water level upriver of the Barrier is controlled and therefore any associated return period becomes irrelevant. The Thames Barrier and associated defence system has a 1 in 1000 year standard which means it ensures that flood risk is managed up to an event that has a 0.1% annual probability. The probability of water levels upriver is ultimately controlled by the staff at the Thames Barrier.

For further information about the Thames Barrier please visit our website at:

https://www.gov.uk/the-thames-barrier

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Customer services line: 01732 223 202
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Website: https://www.gov.uk/government/organisations/environment-agency

TE2100 2008 levels:

Levels downriver of the Thames Barrier are 0.1% AEP (1 in 1000) and levels upriver are the highest levels permitted by the Thames Barrier, described as the Maximum Likely Water Levels (MLWLs). The defence levels (left defence, right defence) are the minimum levels to which the defences should be built.

Location	Node	Easting	Northing	Extreme water level (m)	Left defence (m)	Right defence (m)	Allow for future defence raising to a level of...	
							Left Bank (m)	Right Bank (m)
	2.17d	521099	176083	5.17	5.94	5.94	6.70	6.70
	2.18	521644	177047	5.04	5.54	5.94	6.40	6.40
	2.18a	521776	177707	5.04	5.54	5.94	6.40	6.40
	2.19	522080	177994	5.03	5.54	5.94	6.40	6.40

TE2100 climate change levels:

The water levels in west London are lower than the current day extreme levels because they do not take into account extreme fluvial events; they are tidal only levels.

				2065 to 2100		**2100**	
Location	Node	Easting	Northing	Design water level	Defence level (both banks)	Design water level	Defence level (both banks)
	2.17d	521099	176083	5.55	6.25	6.00	6.70
	2.18	521644	177047	5.50	6.25	5.94	6.70
	2.18a	521776	177707	5.50	5.95	5.94	6.40
	2.19	522080	177994	5.49	5.95	5.93	6.40

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Email: kslenquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Thames Tidal Breach Modelling

The table below displays site-specific modelled flood levels at your site. These have been taken from the Thames Tidal Breach Modelling Study 2015 completed by CH2M HILL in March 2015. The exact location of the given site-specific levels and the extent of the breach are shown on the enclosed map.

This modelling simulates tidal breaches along the Thames from Teddington to the Mar Dyke and River Darent. A series of 113 tidal models were developed for the Environment Agency at pre-determined breach locations. These were chosen using a risk-based approach by examining critical locations based on low floodplain topography. For hard and composite defences breaches are set at 20 m wide; for soft defences, breaches are 50 m wide. In both cases, the defence breach scour distance was assumed to extend into the floodplain by the same distance as the breach width.

Based on the 2008 TE2100 in-channel levels, the 0.5% (1 in 200 year) and 0.1% (1 in 1000 year) annual probability of exceedance tidal events were modelled for all breach locations downriver of the Thames Barrier. These were modelled for the 2014 year epoch, as well as a 2065 and 2100 epoch which include allowances for climate change.

For breaches upriver of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closures. The levels used are referred to as Maximum Likely Water Levels (MLWLs). Therefore 2014, 2065 and 2100 epochs were modelled on that basis.

The modelled levels shown assume that the Thames defences have been breached at locations Barn01, Barn02 and Barn 03. The most critical breach is at 'Barn01' (NGR TQ2154176396).

			Barn01		
	National Grid Reference		Modelled levels in mAODN		
Node	Easting	Northing	2014	2065	2100
1	521591	176402	5.17	5.69	5.91
2	521628	176416	5.17	5.69	5.89
3	521669	176430	Nil return	5.67	5.86
4	521706	176424	Nil return	5.66	5.86
5	521705	176385	Nil return	5.25	5.47
6	521681	176363	Nil return	5.25	5.47
7	521671	176398	Nil return	Nil return	Nil return
8	521643	176396	Nil return	Nil return	Nil return
9	521664	176359	Nil return	5.22	5.47
10	521679	176345	Nil return	5.25	5.47

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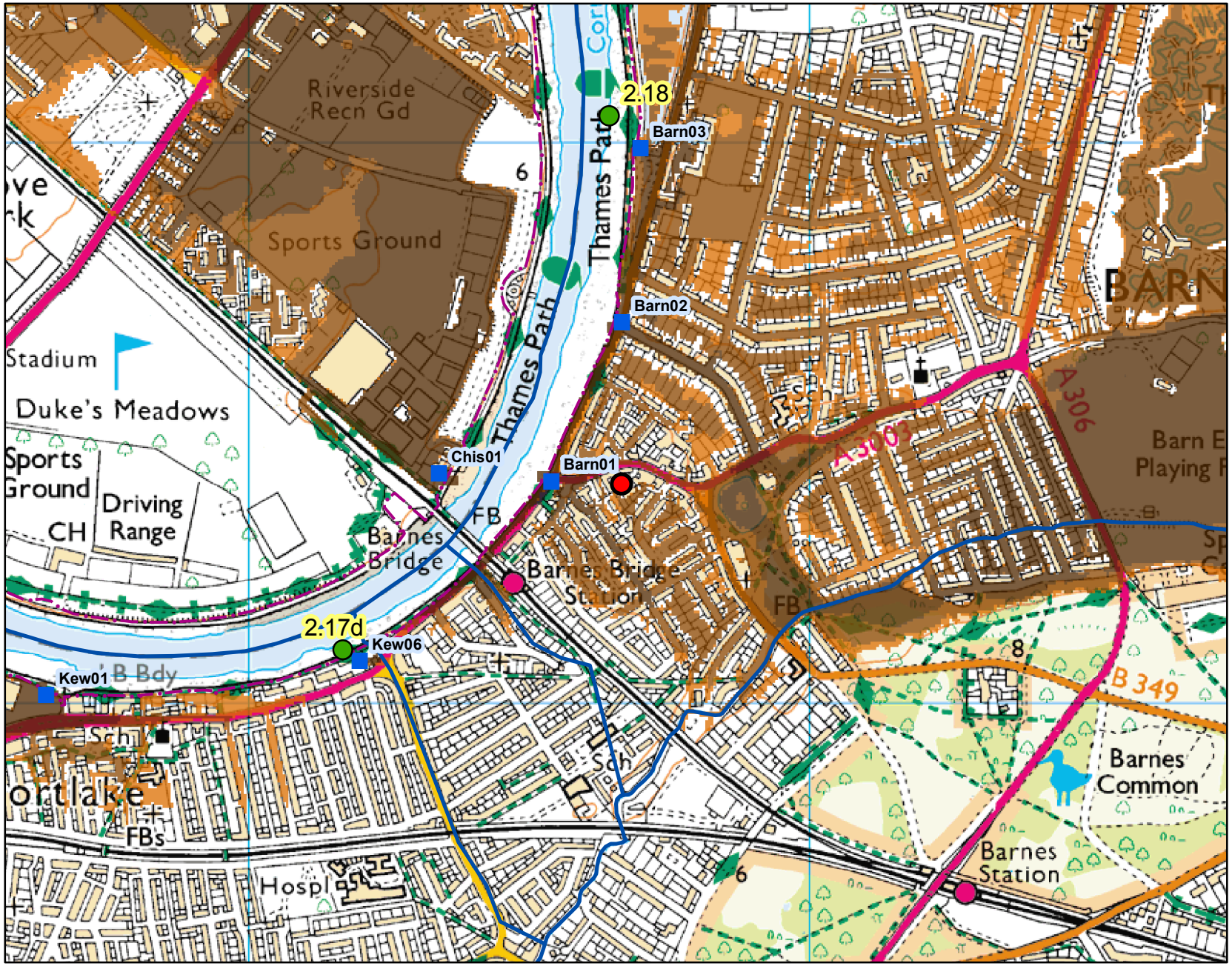
Email: kslenquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Breach Modelling Map centred on SW13 9LR created 07 September 2016 [Ref: KSL 22097 SD]



Environment Agency

Scale 1: 10,000

Legend

- Main Rivers
- Site
- TE2100 Model Nodes
- Breach Locations
- Flood Map - Defences

Upriver MLWL Outlines

Epoch

- 2014
- 2065
- 2100

Thames Tidal Breach Modelling 2015

A modelled representation of tidal breaches along the Thames from Teddington to the Mar Dyke and River Darent, based on low floodplain topography. For hard and composite defences breaches are set at 20 m wide; for soft defences, breaches are 50 m wide. In both cases, the defence breach scour distance was assumed to extend into the floodplain by the same distance as the breach width.
The modelling is based on the 2008 TE2100 in-channel levels, with an allowance for climate change for epochs 2065 and 2100.

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Thames Tidal Upstream Inundation Modelling

The enclosed map shows results for the Thames Tidal Upstream Inundation Modelling Study 2015 completed by CH2M HILL in March 2015.

Upriver of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closures. Therefore 2014, 2065 and 2100 epochs were modelled on that basis.

Using the domains updated as part of the Thames Tidal Breach Modelling Study 2015 completed by CH2M HILL in March 2015, the project generated outputs for water depths, velocity, levels and hazard. However the scenario modelled is that the Thames Barrier is operational but all linear defences have been removed. It uses the TE2100 in-channel levels calculated in 2008 and only provides data for embayments upriver of the Thames Barrier.

	National Grid Reference		Modelled levels in mAODN		
Point	**Easting**	**Northing**	**2014**	**2065**	**2100**
1	521591	176402	5.17	5.69	5.93
2	521628	176416	5.17	5.67	5.89
3	521669	176430	5.17	5.65	5.86
4	521706	176424	Nil return	5.61	5.82
5	521705	176385	Nil return	5.40	5.66
6	521681	176363	Nil return	5.44	5.70
7	521671	176398	Nil return	5.61	5.83
8	521643	176396	5.17	5.65	5.88
9	521664	176359	Nil return	5.50	5.76
10	521679	176345	Nil return	5.45	5.71

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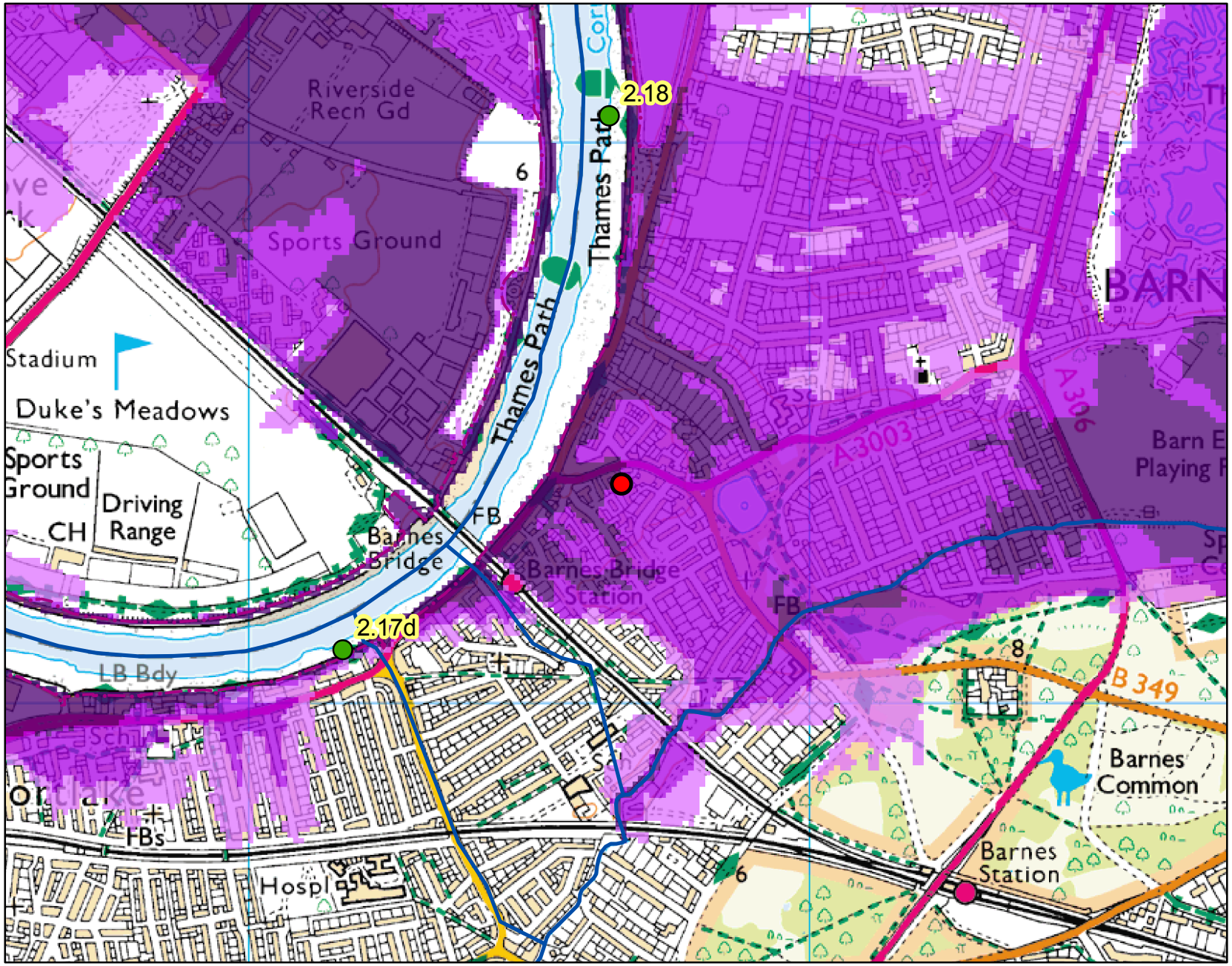
Upstream Inundation Modelling Map centred on SW13 9LR created 07 September 2016 [Ref: KSL 22097 SD]



Environment Agency

Scale 1: 10,000

Legend

- Main Rivers
- Site
- TE2100 Model Nodes
- Flood Map - Defences

Upriver MLWL Outlines

Epoch

- 2014
- 2065
- 2100

Upstream Inundation Modelling 2015

The modelled scenario is that the Thames Barrier is operational but all linear defences have been removed. The modelling is based on the 2008 TE2100 in-channel levels including an allowance for climate change.

Upstream of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closeres. Therefore 2014, 2065 and 2100 epochs were modelled using Maximum Likley Water Levels (MLWLs).

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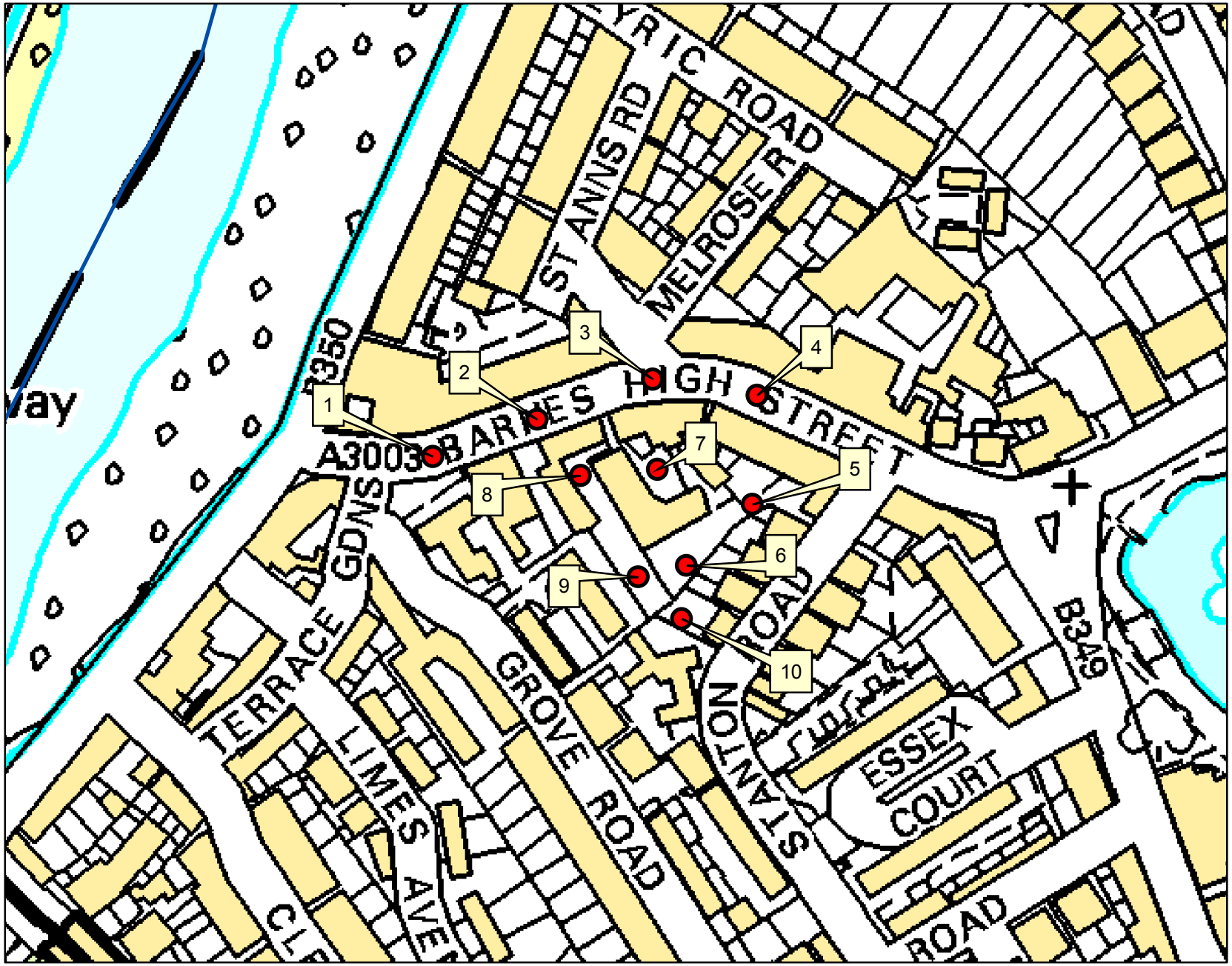
2D Node Location Map centred on SW13 9LR created 07 September 2016 [Ref: KSL 22097 SD]



Environment Agency

Scale 1: 2,000

Legend

- Main Rivers
- Nodes

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Defence Details

The design standard of protection of the flood defences in this area of the Thames is 0.1% AEP; they are designed to defend London up to a 1 in 1000 year **tidal** flood event. The defences are all raised, man-made and privately owned. It is the riparian owners' responsibility to ensure that they are maintained to a crest level of 5.94m AODN (the Statutory Flood Defence Level in this reach of the Thames). We inspect them twice a year to ensure that they remain fit for purpose. The current condition grade for defences in the area is 2 (good), on a scale of 1 (very good) to 5 (very poor). For more information on your rights and responsibilities as a riparian owner, please see our document 'Living on the edge' found on our website at:

https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities

There are no planned improvements in this area. Please see the 'Thames Estuary 2100' document on our website for the short, medium and long term Flood Risk Management strategy for London:

https://www.gov.uk/government/publications/flooding-thames-estuary-2100-te2100-plan

Areas Benefiting from Flood Defences

This site is within an area benefiting from flood defences, as shown on the enclosed extract of our Flood Map. Areas benefiting from flood defences are defined as those areas which benefit from formal flood defences specifically in the event of flooding from rivers with a 1% (1 in 100) chance in any given year, or flooding from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would be flooded. An area of land may benefit from the presence of a flood defence even if the defence has overtopped, if the presence of the defence means that the flood water does not extend as far as it would if the defence were not there.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Customer services line: 01732 223 202
Email: kslenquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Recorded Flood Events Data

We hold records of historic flood events from rivers and the sea. Information on the floods that may have affected the area local to your site is provided below and in the enclosed map (if relevant).

Flood Event Data

We do not hold records of historic flood events from rivers and/or the sea affecting the area local to this site. However, please be aware that this does not necessarily mean that flooding has not occurred here in the past, as our records are not comprehensive.

Due to the fact that our records are not comprehensive, we would advise that you make further enquiries locally with specific reference to flooding at this location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage undertaker for the area.

We map flooding to land, not individual properties. Our historic flood event record outlines are an indication of the geographical extent of an observed flood event. Our historic flood event outlines do not give any indication of flood levels for individual properties. They also do not imply that any property within the outline has flooded internally.

Please be aware that flooding can come from different sources. Examples of these are:

- from rivers or the sea;
- surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system);
- overflowing or backing up of sewer or drainage systems which have been overwhelmed,
- groundwater rising up from underground aquifers

Currently the Environment Agency can only supply flood risk data relating to the chance of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding and drainage systems that have been overwhelmed.

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Additional Information

Use of Environment Agency Information for Flood Risk/Flood Consequence Assessments

Important

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

https://www.gov.uk/flood-risk-standing-advice-frsa-for-local-planning-authorities

https://www.gov.uk/government/publications/national-planning-policy-framework-technical-guidance

https://www.gov.uk/government/publications/development-and-flood-risk-practice-guide-planning-policy-statement-25

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk/Consequence Assessment (FRA/FCA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA/FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

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Surface Water

We have provided two national Surface Water maps, under our Strategic Overview for flooding, to your Lead Local Flood Authority – London Borough of Richmond upon Thames – who are responsible for local flood risk (i.e. surface runoff, ground water and ordinary watercourse), which alongside their existing local information will help them in determining what best represents surface water flood risk in your area.

The London Borough of Richmond upon Thames have reviewed these and determined what it believes best represents surface water flood risk. You should therefore contact this authority so they can provide you with the most up to date information about surface water flood risk in your area.

You may also wish to consider contacting the appropriate relevant Local Planning Authority and/or water/sewerage undertaker for the area. They may be able to provide some knowledge on the risk of flooding from other sources. We are working with these organisations to improve knowledge and understanding of surface water flooding.

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APPENDIX C- TOPOGRAPHIC SURVEY

CO-ORDINATE TABLE

Reference	East	North	Elevation
Stn 1	521670.284	176399.750	5.349
Stn 2	521655.797	176406.336	5.045

Figured dimensions only to be taken from this drawing.
Any errors or omissions to be reported to the architect.

client :
ROUNDLISTIC LTD

drawing title :
SITE PLAN

property :
LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

AVIS APPLETON & ASSOCIATES
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scale : A1 @ 1.100 A3 @ 1.200
date : 5.08.2014
drawing number : 14.8355.02
drawn by : MJA / MB

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APPENDIX D- SURFACE WATER CALCULATIONS

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Job No.	C-1458
Sheet no.	1
Date	17/04/15

MasterDrain
HY 8.7

Project	Liffords Place	By	Checked	Reviewed
Title	Pre and post SW devt calculations	S.L		

Data:-

Hydrology:-

Location = LONDON (SOUTH)		WRAP	= 4
Long reference = 540175		Grid reference	= TQ4075
M5-60 (mm)	= 20.1	SAAR (mm/yr)	= 600
r	= 0.44	Soil	=0.47
Hyd. area	= 6	Hyd. zone	= 8
Hydrograph	= Summer	Area = England and Wales	

Site values used in design:-

Total site area	= 0.1238 ha	Climate change factor	= 30%
Pre-dev area drained	= 0.0000 ha	Post-dev area drained	= 0.0760 ha
Imperm runoff factor	= 98%	Perm runoff factor	= 20%

Pre-development

Area to soakaways	= 0.0000 ha	Area to other SUDS	= 0.0000 ha
Perv. area to SUDS	= 0.0000 ha	Pre-dev flow to drain	= 0.00 l/s

Post-development

Area to soakaways	= 0.0000 ha	Area to other SUDS	= 0.0000 ha
Perv. area to SUDS	= 0.0000 ha	Post-dev flow to drain	= 0.00 l/s

Calculations:-

Revised Post-dev Imperm. area = 0.076 ha
Equiv. Post-dev Imperm. area = 0.074 ha
Equiv. Post-dev Perm. area = 0.010 ha
Total Pre-dev equiv. area ha = 0.025 ha
Total Post-dev equiv. area ha = 0.084 ha
100 yr 6 hour mean intensity = 10.08mm/hr

Results:-

Pre-dev peakflow runoff (l/s) (m^3/s)

R.P.	15	30	60	120	240	360	480	600	Max	CCF	Final	R.P.
1	8.7	5.7	3.6	2.1	1.3	1.0	0.8	0.7	8.7	N/A	8.7	1
30	21.3	13.6	8.3	5.0	2.9	2.1	1.7	1.4	21.3	N/A	21.3	30
100	27.7	17.9	11.0	6.5	3.8	2.7	2.2	1.8	27.7	N/A	27.7	100

Post-dev peakflow runoff (l/s)

R.P.	15	30	60	120	240	360	480	600	Max	CCF	Final	R.P.
1	29.6	19.3	12.1	7.2	4.4	3.3	2.6	2.2	29.6	30	38.5	1
30	72.2	46.3	28.3	16.8	9.8	7.1	5.6	4.7	72.2	30	93.9	30
100	93.9	60.6	37.3	22.1	12.8	9.2	7.3	6.1	93.9	30	122.0	100

100 year 6 hour (x Climate Change Factor) storm gives:-
Pre-dev runoff volume m^3 = 15.0m^3
Post-dev rainfall volume = 66.1m^3
Post-dev volume m^3 (excess above SUDS) = 66.1m^3
100 yr 6 hour mean intensity = 10.08mm/hr
Pre-dev volume to drain at 0 l/s = 0.0 m^3
Post-dev volume to drain at 0 l/s = 0.0 m^3
Post-dev storage volume = 66.1m^3
Post-dev 5mm imperm volume = 3.8 m^3
Post-dev 5mm perm volume = 2.4 m^3

$Q_{BAR(rural)}$ = 0.499 l/s or 4.031 l/s/ha or 0.000 cumecs - from IoH 124.

The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.

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Job No.	Sheet no.	Date
C-1458	2	17/04/15

MasterDrain
HY 8.7

Project	By	Checked	Reviewed
Liffords Place	S.L		
Title: Pre and post SW devt calculations			

Data summary.

Use the data below for the SUR1 form

Site areas:-

Total site area = 0.1238 ha ;1238.0 m² [3A]
Pre-development impermeable area = 0.0000 ha [3B]
Pre-development permeable area = 0.1238 ha
Post-development impermeable area = 0.0760 ha [3C]
Post-development permeable area = 0.0478 ha

Peak runoff:-

Pre-development 1 year storm (15min) = 8.7 l/s [6A]
Pre-development 100 year storm (15min) = 27.7 l/s [6C]
Post-development 1 year storm (15min) = 29.6 l/s [6B]
Post-development 100 year storm (15min)= 93.9 l/s [6D]

Greenfield runoff:-

$Q_{BAR(rural)}$ = 0.499 l/s or 4.031 l/s/ha or 0.000 cumecs - from IoH 124.

Climate change factor:-

CCF = 30%

Volumes:-

Pre-development 100 yr/6hr storm [12A]= 19.5m³
Post-development 100 yr/6hr storm (add. volume with no SUDS) [12B]= 66.1m³
Post-development 100 yr/6hr storm (add. volume with SUDS) = 66.1m³
Post-development add. predicted volume (No SUDS) [12C] = 46.6m³

You may also require

Data relating to the infiltration test calculations (if applicable)
Evidence to show runoff reduction (if applicable)
Information on calculation methods (if applicable see next sheet)

Note

Numbers in square brackets relate to the
Nov. 2010 v1.1 / issued 11/02/10 copy of SUR1

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Job No.	C-1458
Sheet no.	3
Date	17/04/15

MasterDrain
HY 8.7

Project	Liffords Place	By	S.L
Title	Pre and post SW devt calculations	Checked	
		Reviewed	

Definitions and methods

Hydrology

The hydrological constants are derived from the Wallingford maps. They are used to calculate location specific rainfall figures.

Site values and factors

Areas of the site should be entered in hectares (10000 m²). If the Pre-development site is a green field, this box is blank.
Climate Change Factor is initially set at 20% - this may be changed as required.
Greenfield runoff is calculated using the method described in IoH 124.
Runoff factors

The impermeable runoff factor is initially set at 98%
The permeable runoff factor is initially set at 20%

Note: the CCF and the runoff factors may be changed by the user to suit the development
The areas draining to soakaways and other SUDS are entered in the appropriate box (in hectares)

Calculations

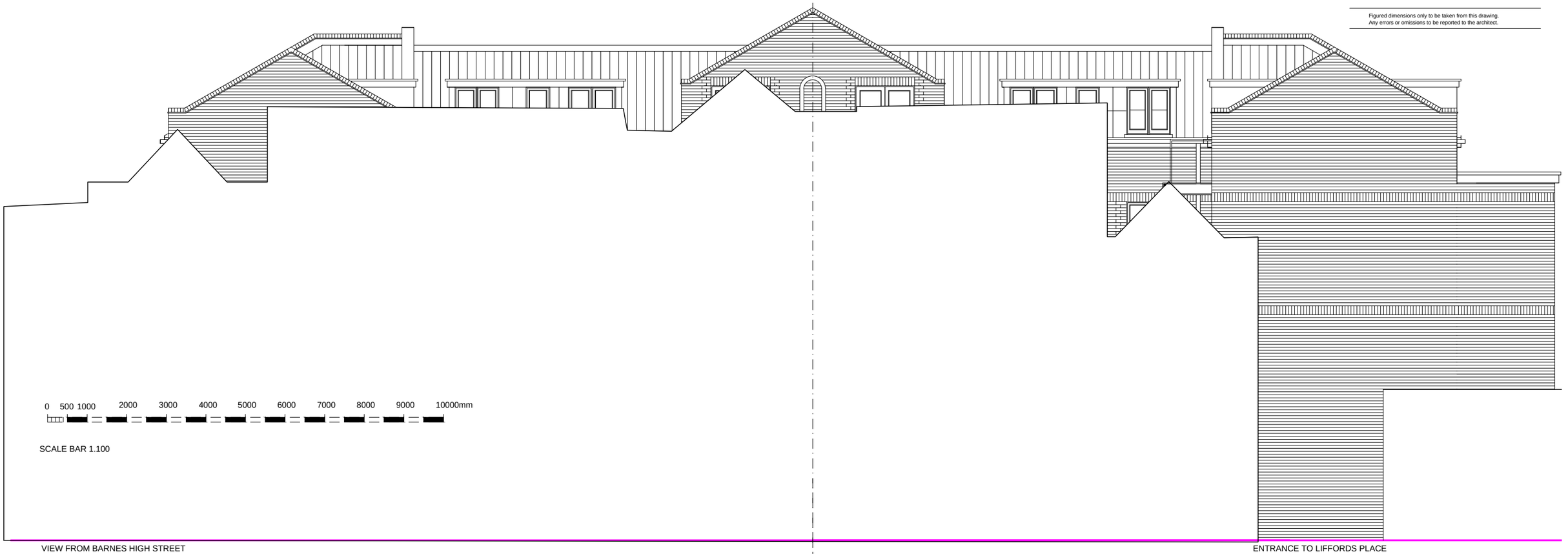
The post-development area is reduced by subtracting the areas that drain to soakaways or other SUDS, to give a revised figure.
All areas are then multiplied by the appropriate runoff factor to give an equivalent area with 100% runoff.
These are then summated.
This gives a total pre-development equivalent area, and a similar figure for the post-development area.
The 'Post-dev volume to drain (no SUDS)' gives the total runoff to drain if no SUDS were used.

Results

The pre- and post-development areas are subjected to 1,30 and 100 year return period storms with a duration of 15 to 600 minutes.
The Revised Post-dev Imperm. area is the area (in ha) that is not going to SUDS x impervious runoff factor.
The runoff rates are calculated for the chosen hydrograph (Summer or Winter) as l/s. Figures in red indicate m³/s
The peak value is measured, multiplied by the CCF and the total maximum rate is shown.
The pre- and post-development volumes for a 100 year / 6 hour storm are calculated from the area under the hydrograph curve.
Post-dev volume (i.e. excess above SUDS) is that volume produced by the drained area that does not go to SUDS.
Qbar(rural) is calculated in accordance with the procedure laid down in IoH 124

APPENDIX E- BUILDING ELEVATIONS

Figured dimensions only to be taken from this drawing.
Any errors or omissions to be reported to the architect.



SCALE BAR 1.100

VIEW FROM BARNES HIGH STREET

ENTRANCE TO LIFFORDS PLACE

CUT THROUGH VIEW FROM BARNES HIGH STREET

B	DESIGN REVISIONS	16.08.16	MJA

client :

ROUNDLISTIC

drawing title :

ELEVATION FROM BARNES HIGH STREET
SHOWING OUTLINE OF EXISTING
BUILDINGS / WALLS

property :

LIFFORDS PLACE
BARNES HIGH STREET
LONDON SW13

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scale : A3 @ 1:100
date : 13.09.13
drawing number : 13:8355:16B
drawn by : MJA

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