St. George's Hill Lawn Tennis Club, Weybridge

6793

Drainage Strategy & Flood Risk Assessment

December 2022

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London
20 Britton Street, London, EC1M 5TX
www.furnesspartnership.com

Bradford
The Paper Hall, Anne Gate, Bradford BD1 4EQ
info@furnesspartnership.com

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1 Introduction

This document comprises a Flood Risk Assessment in accordance with the National Planning Policy Framework (NPPF) including its technical guidance in support of a planning application for the redevelopment of an existing car park within the tennis club grounds at St. George's Hill Lawn Tennis Club (HLTC), into a new fitness centre.

Furness Partnership have been commissioned to identify and set out the principles of approaching and managing flood risk pertaining to the proposed development at St George's HLTC.

The objective of this FRA is to:

1) Collect and review available information to make a qualitative assessment of all sources of flooding to the development including drainage infrastructure; fluvial and tidal sources; groundwater sources and artificial sources.
2) Assess the flood risk to the application site under existing and post-development conditions; and
3) Outline any mitigating measures needed to meet the requirement of the NPPF.

1.1 Data Sources / References

Data collected during the course of this assessment is presented in Table 1 below:

Purpose	Source	Data
Identification of Existing Flood Risk	Elmbridge Borough Council Level 1 Strategic Flood Risk Assessment (SFRA), March 2018	Strategic assessment of flood risk across the Borough of Elmbridge
	Surrey County Council Local Flood Risk Management Strategy	Details of Country wide flood risk and mitigation measures
	Environment Agency	Site specific flood risk mapping
Identification of Historical Flooding	Surrey County Council Local Flood Risk Management Strategy	Details of Historic flooding
	Environment Agency	Historic flood risk mapping
Identification of Existing Drainage	Thames Water Sewer records	Identification of the publicly owned drainage system near the application site
	CCTV Survey	Identification of the private drainage system within the application site

Table 1 Sources of Data Reviewed

2 Site Description and Location

2.1 Location

The site (see Figure 1 below) is located at St. George's Hill Lawn Tennis Club, Weybridge, KT13 0LL. The site is bounded by residential properties on all sides. Further afield, St. George's Hill is found to the south, Burhill Golf Clubs to the East, and Weybridge to the North and West, and the M25 Motorway Orbital to the West. The proposed area of development is located to the eastern end of the Lawn Tennis Club plot. It can be accessed from both East Road to the east and Warreners Lane to the west.

Figure 1 Site Location

2.2 Existing Development

The site is rectangular in shape, comprising an area of approximately 1,165m^2. The site is comprised of a car park, i.e., it is mostly hard surfacing and a couple of long, thin strips of soft landscaping. The sites operations fall within the leisure category. There is also a cottage at the northern end of the site, which is currently vacant, and a small shed to the west of this.

2.3 Proposed Development

The scheme proposes to demolish the existing car park, and all existing structures, to make way for a new two-storey fitness centre, which includes a number of studios, a large gym, a male and female changing room, physio rooms, and a small plant room. Access to the site will remain the same. The proposed finished floor level of the ground floor of the fitness centre has been set at +48.80m AOD.

2.4 Topography

Site levels are currently fairly flat, with an average ground level of +49m AOD, ranging from +49.34m to +48.27m within the site boundary.

2.5 Hydrology

There are no watercourses located within the site boundary. A lake, Warren Pond, is located approximately 60m southwest of the proposed site. To the east, the River Mole is located about 113m away, which is a tributary of the River Thames. A small water feature / ditch is located to the east of the site, running behind the gardens of the homes on East Road.

The current drainage flow paths follow a south-west to north-east direction, which can be seen in Figure 2 below. Any overland flow will follow this route, being intercepted by the existing channel drains and gullies where possible, and going around the cottage, before flowing into the area of heavy trees and vegetation to the north-east. It is assumed the runoff that does not infiltrate into the ground due to oversaturation during heavy storms will eventually discharge into the Thames tributary River Mole.

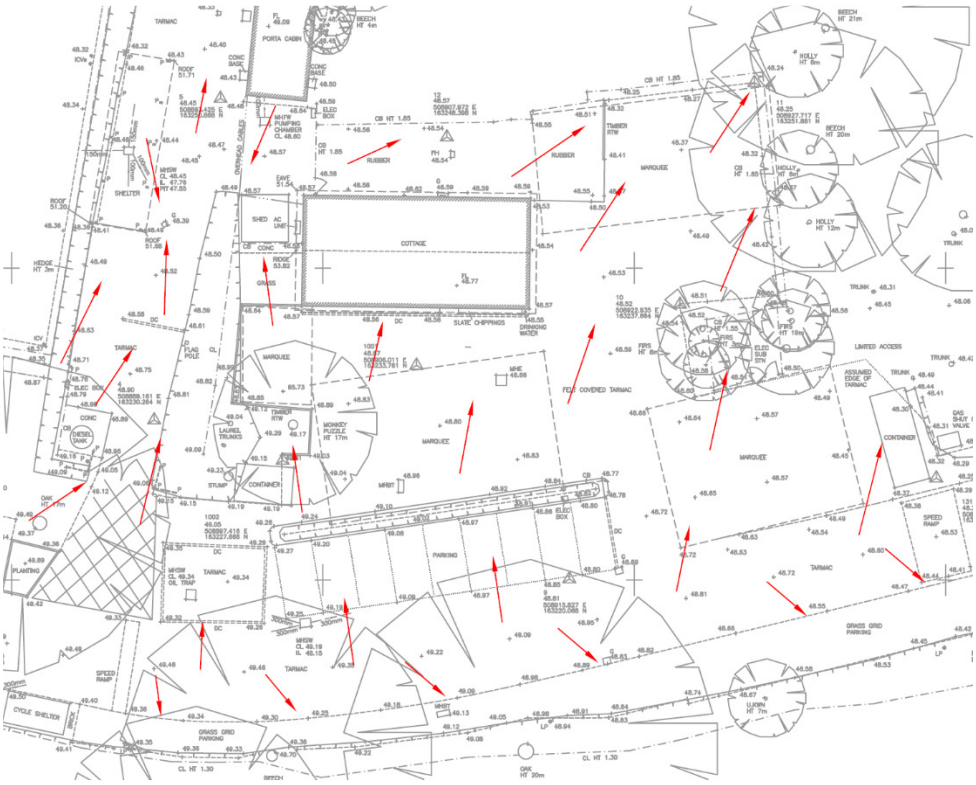


Figure 2 Existing Drainage Flow Paths

2.6 Geology

According to the British Geological Survey 'Geology' viewer tool, the site has a bedrock geology of 'Bagshot Formation – Sand', which is mostly composed of composed of fine to coarse-grained sand that is frequently micaceous and locally clayey, with sparse glauconite and sparse seams of gravel. BGS also confirms the site is not likely to be underlain by superficial deposits.

A Phase 1 desk study undertaken by arc environmental in July 2022, advises that limited depths of made ground is likely to be present considering the current and historical uses of the site, and is expected to comprise disturbed natural strata with man-made debris e.g., brick, concrete etc.

The desk study also finds a borehole log from close by to the site, (approx. 160m southeast), which found orange/brown to yellow slightly gravelly slightly clayey fine to medium sand to depths of circa 3.50m overlying stiff fissured dark grey slightly sandy clay to depths of circa 10.0m.
An intrusive site investigation has not yet been undertaken.

Figure 3 BGS Site Geology Map

2.6.1 Groundwater

Groundwater levels are not currently known.

According to the Landmark data obtained for the desk study, the bedrock of the site lies above a Secondary A Aquifer and the superficial strata is listed as unproductive. The site is not within a Source Protection Zone.

3 Policy Context

3.1 National Planning Policy Framework

The National Planning Policy Framework (latest version issued in July 2021) Section 14 paragraphs 159 – 169, outline the latest guidance on Planning and Flood Risk. The policy outlines:

- The need to avoid inappropriate development in areas at risk of flooding and direct development instead to low-risk areas.
- The use of the Sequential Test and Exception Test as appropriate, consideration of all flood risks and consideration of safeguarding land for current or future flood management.
- A site-specific Flood Risk Assessment should be produced as appropriate.

The NPPF retains a risk-based approach to planning and defines 3 zones: zone 1, zone 2 and zone 3 (further split into zone 3a and zone 3b), as the basis for applying the Sequential Test to proposed developments. The purpose of the Sequential Test is to guide development to those areas at less risk of flooding, as it is expected that the extent of these areas will grow with climate change. For the purpose of applying the Sequential Test and quantifying flood risk from fluvial and tidal source, flood zones are defined as per Figure 4 below:

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.(Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Figure 4 Classification of Flood Zones

3.1.1 Sequential Test

The existing site is used for leisure purposes, and is located in flood zone 1. As there is not a proposed change of use, the site is categorised as 'Less Vulnerable'.

Figure 5 shows the classification of flood risk vulnerability and flood zone compatibility according to the Technical Guidance of NPPF i.e., the Sequential Test required for all planned development. The scheme is considered appropriate within the designated flood zone for the site, therefore, based on this classification, the Exception Test is not required.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Figure 5 Sequential Test

3.2 Flood and Water Management Act

The Flood and Water Management Act (FWMA) 2010 outlines roles and responsibilities for the implementation of Sustainable Drainage Systems (SuDs) in developments. Drainage systems must comply with national standards. Surrey County Council is the Lead Local Flood Authority (LLFA) for the development area and in accordance with the FWMA are responsible for coordinating the management of flood risk from surface, groundwater, and ordinary watercourses. The LLFA acts a statutory consultee on Surface Water and SuDs proposals.

3.3 Surrey Local Flood Risk Management Strategy 2017-2032

Surrey is a County at high risk of flooding with a high number of properties at risk from fluvial and surface water sources. It has experienced several major flood incidents in the last ten years, with much of this occurring in the floodplain of the lower River Thames and its tributaries. The Surrey Flood Risk Management Strategy sets out core objectives that will be required to be undertaken and outlines specific actions to try to reduce the flood risk to the people inhabiting and working in Surrey.

3.4 Elmbridge Borough Council Level 1 Strategic Flood Risk Assessment

The Strategic Flood Risk Assessment (SFRA) report for Elmbridge was carried out by AECOM in 2015. The SFRA provides an overview of the Borough in terms of overall flood risk, identifying areas at risk of flooding from all sources (including groundwater, surface water, foul sewer flooding, main fluvial and tidal flooding) whilst assessing the variation in flood risk across the Borough.

3.5 Surrey County Council Preliminary Flood Risk Assessment

The Preliminary Flood Risk Assessment (PFRA) was published in June 2011 for Surrey County Council. The aim of the PFRA was to provide an extensive overview of historic and potential future flooding over the administrative area of Surrey (includes Elmbridge, Epsom and Ewell, Guildford, Runnymede, Reigate & Banstead, Waverly and Woking Borough Councils, and Mole Valley and Tandridge District Councils) so that along with data from other County Councils, a national picture of flooding could be developed by the Environment Agency. The PFRA also address the identification and mapping of possible future flood risk sites for the County.

4 Definitions of Types of Flood Hazard

4.1 Fluvial and Tidal Flood Risk

River (fluvial) flooding takes place when a river's capacity is exceeded and it bursts its banks, forcing the overtopping water onto surrounding land.

The application site lies within Flood Zone 1, as identified within the Environment Agency's online flood zone mapping (Figure 6 and Appendix C). This indicates that the application site has been assessed as having less than a 0.1% annual probability (1 in 1000-year chance) of river or sea flooding, i.e., a low probability of flooding.

The closest watercourse to the site is the River Mole, located approximately 1.5km away to the East. The site is not in the floodplain of the River Mole, and hence, is at very low risk of flooding from this source or any other fluvial source.

The site is not at risk of tidal flooding.

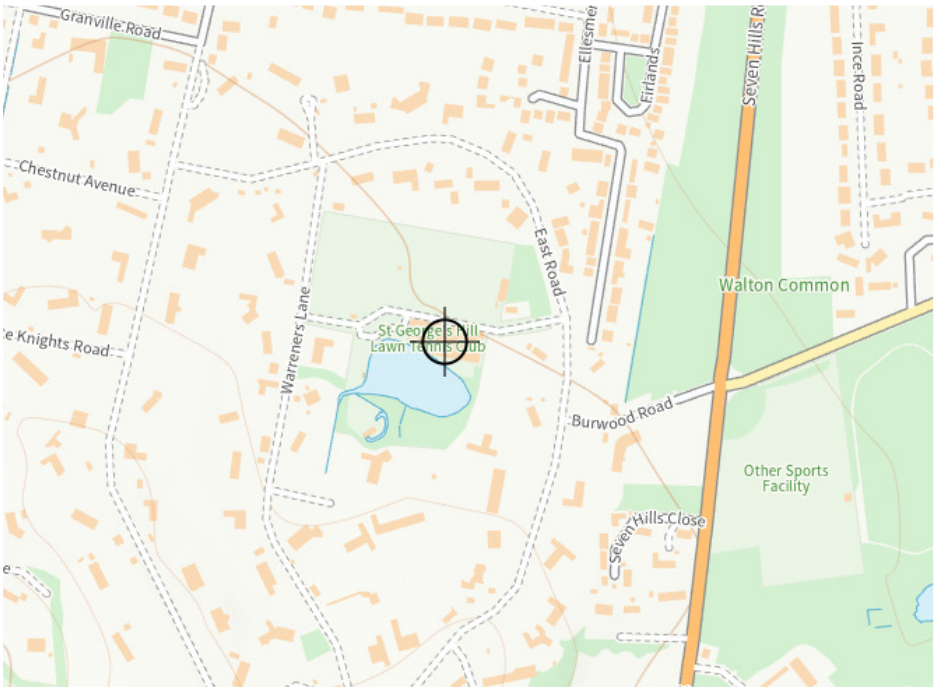


Figure 6 Flooding from Rivers and the Sea

4.2 Flooding from Artificial Sources

Artificial flood sources include raised channels such as canals or storage features such as ponds and reservoirs.

The largest storage feature is to the southwest of the site, Warren Pond, which is at high risk of flooding from surface water, which means there is a greater than 3.3% chance of flooding here each year; although this is expected as it is a dedicated storage feature, built at a lower level than its surroundings.

The EA flood mapping also confirms that the site is not at risk of flooding from reservoirs.

4.3 Groundwater Flooding

The desk study cites groundwater flooding maps produced by the British Geological Survey for the area, and identifies the central/southwest area of the site may have the potential to undergo groundwater flooding, both below ground and at surface level. The property to the northwest and east also may be prone to groundwater flooding below ground level.

The Elmbridge SFRA notes that most of the settlement area is within a low groundwater flooding risk category, and that the majority of the area has a groundwater table that is more than 5m below ground level. However, this reduced to less than 3m in the central Weybridge area.

4.4 Sewer Flooding

There are no public surface water sewers within the site boundary, and it is assumed that the private surface water sewers are owned and maintained by the current property owner. As noted in the Elmbridge Borough Council Level 1 SFRA, the TWUL Register has recorded 1-5 properties as experiencing internal sewer flooding in the St George's Hill area, and 1-7 properties with external sewer flooding.

The likelihood of sewer flooding may change over time due to increases in development, changing the extent of impermeable areas draining to a sewer, and climate change affecting rainfall patterns. As a result, sewer flooding may become more frequent in the future.

4.5 Overland Flooding

Overland flooding is caused when water does not penetrate into the ground due to the surface being impermeable (not porous). It also occurs when the ground is already saturated or because drains are not functional or overwhelmed, for example, during short, intense storms. This leaves the water with nowhere to go to and as a result, it will remain or flow on the surface.

The EA has produced a flood map for Surface Water for the application site and surrounding area, as shown in Figure 7 below, which shows that the site is a low-risk area when considering surface water flooding, and hence, overland flooding.

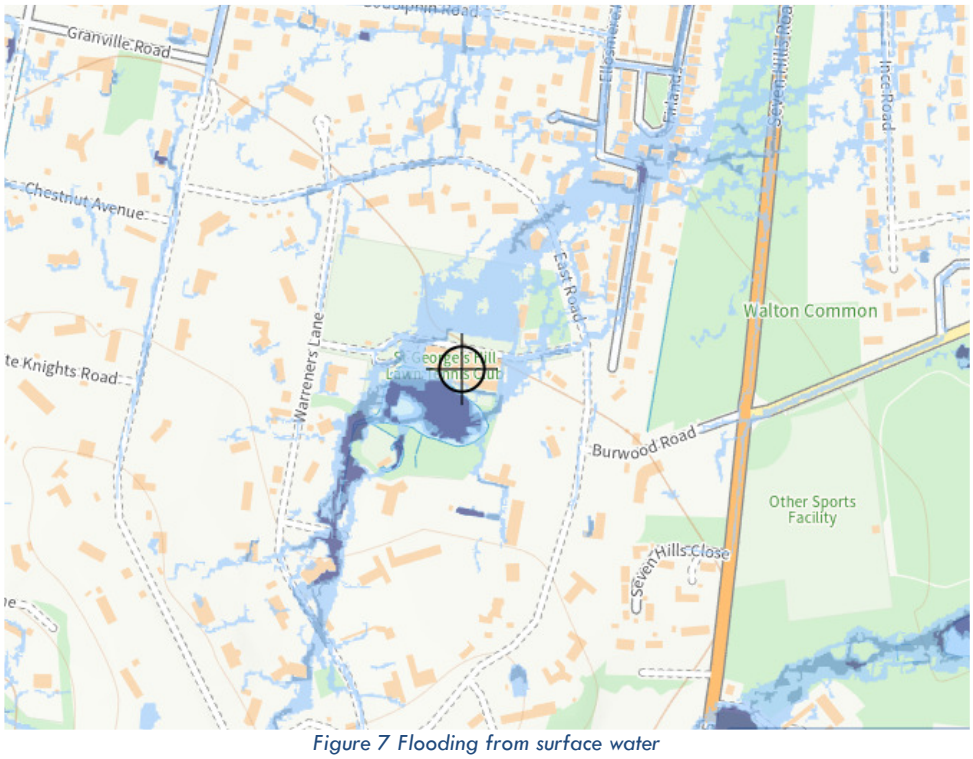


Figure 7 Flooding from surface water

4.6 Climate Change

Climate change can affect flood risk in several ways e.g., impact on river flows, sea levels, rainfall intensity, wave height and wind speed. Therefore, the risk of flooding is likely to increase in the future. Climate change allowances are predictions of anticipated change for:

- peak river flow
- peak rainfall intensity
- sea level rise
- offshore wind speed and extreme wave height.

Although the development will likely have a life of over fifty years, is in Flood Zone 1 and classified as 'less vulnerable', the 'Mole Management Catchment' peak rainfall upper allowance of 40% has been applied for the proposed drainage strategy design, in line with requirements from the LLFA and the Resident's Association.

5 Surface Water Management and SuDS

5.1 Existing Surface Water Drainage

According to the Thames Water asset plans (Appendix D), the closest public sewers are located on East Road and Warreners Lane. On East Road a 225mm diameter surface water sewer runs south to north and then discharges to an unknown outfall just south of the entrance to St. George's Hill LTC. To the north of the site access, a 150mm diameter surface water sewer runs along East Road, and then connects into a 225mm diameter sewer coming round from Warreners Lane. It is assumed that the

existing site surface water drainage discharges into this 150mm diameter sewer, via Thames Water manhole 9251.

There are several gullies and channel drains within the site boundary, and these all discharge into a 300mm diameter surface water sewer running west to east across the site. The drainage for the adjacent tennis courts is kept separate from the car park drainage and it is assumed that this discharges in to a sewer to the northern end of the site via a 175mm diameter sewer (according to the topographical survey undertaken).

A combined topographical / CCTV survey has been commissioned and the plans can be found in Appendix E.

The existing site comprises the following areas, which has been compared with the proposed development areas:

	Existing (m^2)	Proposed (m^2)
Roofs	0	656
Hardstanding	1,146.5	509
Soft landscaping	18.5	0
TOTAL	**1,165**	**1,165**

Table 2 Comparison of Existing and Proposed Site Areas

The greenfield runoff rates for the site have been obtained from the UK SuDS 'Greenfield Runoff Rate Estimation' tool, and are presented in Table 3 below, and Appendix F.

Return Period	Greenfield Runoff Rate (l/s)
1 in 1 year	0.16
1 in 30-year	0.43
1 in 100-year	0.59
1 in 200-year	0.7

Table 3 Greenfield Runoff Rates

A rainfall intensity of 77.5mm/hr (0.022l/s/ha) has been obtained from FEH13 data, and the resulting existing brownfield peak runoff rate is shown in Table 4 below.

	Area (m^2)	Rainfall Intensity (77.5mm/hr)	Q, Peak Discharge Rate (l/s)
Hard Landscape	1,146.5	77.5	24.68
Soft Landscape	18.5	0	0
Total	**1,165**		**24.68**

Table 4 - Brownfield Runoff Rates based on FEH13 data

5.2 Evaluation of Sustainable Drainage Systems

In accordance with best practice and requirements set out in the NPPF, and guidance from the Environment Agency, and DEFRA, SuDS should be utilised where possible within the planned development. It is proposed to utilise SuDS as is deemed feasible, following the hierarchy for disposal and treatment as outlined below in Table 5. A summary of comments has been provided for each method with regards to this specific development:

SuDS Hierarchy (most to least preferred)	
METHOD	**COMMENTS**
Discharge into the ground	Not feasible due to deep areas of made ground and silty clay below made ground; low infiltration rates likely
Discharge into a surface water body	No surface water bodies around site, Warren Pond at higher level than site
Discharge into a surface water sewer	Feasible due to presence of private drains within site, which connect to Thames Water sewers
Discharge into a combined sewer	Not required

Table 5 SuDS Hierarchy Summary

A trial pit was excavated within the adjacent tennis court, which confirmed the existing ground as clay. Recent rainfall had filled the excavation, and demonstrated a very poor rate of infiltration within the trial pit, the water was not percolating at an adequate rate into the ground. A picture of the excavation can be found in Appendix H. For this reason, infiltration SuDS, including soakaways and permeable paving, will not be feasible at this site. However, lined permeable paving will be provided at the car parking bays to allow runoff to be treated prior to attenuation.

Green roofs were considered, however, were ultimately ruled out due to the scope of the project. Rain gardens, downpipe planters were not considered feasible to due space constraints. No new trees are being installed, hence, attenuating tree pits is not achievable.

5.3 Proposed Surface Water Drainage Strategy

When designing the surface water drainage strategy, the following assumptions and design points have been considered.

- The existing site is categorised as brownfield in nature;
- Existing drainage infrastructure will be re-used, where possible;
- Based on the existing site geology (to be confirmed by site specific intrusive investigation), and the scale/nature of the site, it is not expected that infiltration will be possible;
- The proposed drainage network has been designed to ensure no flooding for the 1 in 100-year plus 40% climate change event, in line with the LLFA's requirements;
- Strategy based on guidance provided in Building Regulations Part H, The SuDS Manual (CIRIA C753), BS EN 752 and Sewerage Sector Guidance Appendix C.

The 1 in 100-year greenfield runoff rate (Table 3) for the site area is very low, however, several low-flow control devices exist in the industry. Hence, the restricted discharge rate for the site will be set as 0.6L/s, which presents a 95% betterment to the existing brownfield rate.

The Modified Rational Method was also employed to determine the likely peak brownfield runoff rates for a range of return periods and durations, which can be found in Table 6 below.

	1yr	2yr	5yr	30yr	100yr
15min	12.67	16.41	21.40	29.50	40.72
30min	7.93	10.23	13.17	19.56	25.57
60min	5.11	6.47	8.23	12.31	16.22

6hr	1.45	1.77	2.19	3.24	4.16

Table 6 - Brownfield Runoff Rates using Modified Rational Method

The Residents' Association has expressed concern about the existing sewers and gullies on East Road being at capacity, and that any additional flow will exacerbate and even worsen the issue. The scheme does not increase the area of roofs/hard landscaping to more than the existing, and the proposed strategy will utilise a Hydrobrake to further restrict the discharge into the sewers, to a rate of 0.6L/s. This 95% betterment on the existing surface water runoff rate should result in the East Road sewers having more capacity than they currently do, and undergoing less stress during heavy rainfall events. Therefore, an increase in surface water runoff is not expected.

The proposed surface water drainage strategy will comprise a series of new rainwater pipes for the fitness centre roof runoff, and channel drains and gullies which will pick up surface water runoff from the external hard surfaces. The surface water will then discharge into the proposed attenuation tank, and then flow through a new SDS Aqua-Filter, prior to discharging at a restricted rate of 0.6L/s into the existing 300mm diameter sewer. This existing 300mm diameter sewer will need be diverted to the south by approximately 1-2m to provide enough clearance from the proposed building and foundations, and to make space for the attenuation tank required under the parking bays.

The eastern side of the site is constrained by tree canopy areas, and hence, new drain runs are not permissible in this area. It is expected that the ground level will fall away from the fitness centre and towards the permeable surfacing to the back of the site, as per existing ground slope.

This has been modelled in InfoDrainage, for all storms up to and including the 1 in 100 year +40% climate change durations, using the values listed below.

- Developable Area (whole site): 0.1165 ha
- SAAR: 625 mm
- Soil Percentage Runoff (SPR): 0.3
- Hydrological Region: 6
- Hydro-brake flow rate: 0.6L/s

The model produces no flooding for any storm analysed. The final minimum attenuation volume required is 68m^3. The proposed strategy can be found in Appendix I, and InfoDrainage model results in Appendix J.

The LLFA requires all proposed developments to limit the site runoff rate to as close as possible to greenfield rate as possible for both the 1 in 1 year rainfall event and the 1 in 100-year event. However, as this is a brownfield site, the strategy has been assessed against the rates in Table 6 above, and it can be concluded that the restricted rate of 0.6L/s is a much lower peak runoff rate for both storm events and, hence, complies with Technical Standard S3.

In case of exceedance flows i.e., greater than the critical 1 in 100-year plus climate change storm, it is expected that any surface flooding that occurs, will simply sit within the kerbed areas of the car parking spaces and the existing hard landscaping areas, until the gullies have drained down enough to accommodate the additional rainfall. Considering the wider area around the tennis club, the topography of the land generally falls in a north-easterly direction, eventually finding its way to the River Thames tributary, River Mole. Although the detailed external levels strategy has yet to be

concluded, it is expected that it will follow the existing patterns i.e., the proposed strategy will continue to implement the existing overland flow route, with surface water runoff flowing around the fitness centre to the north-east corner of the site.

It is expected that exceedance flows will occur as per Figure 8 below. The building does slightly impede the current flow path of any exceedance runoff; however, the levels will still mostly fall to the north-east of the site. Additionally, through use of permeable surfaces covering the parking bays and the athletics running track, flow will be slowed down enough so as not to adversely impact neighbouring land, not more than in the existing situation.

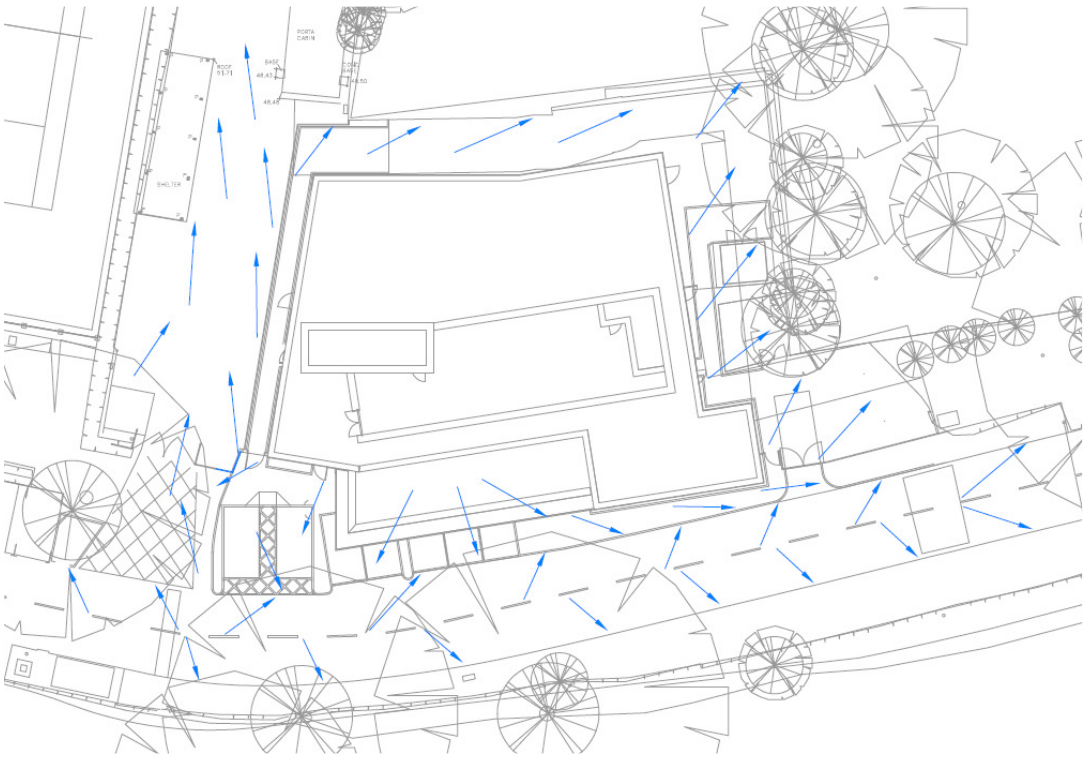


Figure 8 Post-development overland flow routes

A hydrology assessment is deemed unnecessary as this scheme does not propose any below ground structures, i.e., a basement, therefore a change in hydrological profiles is not anticipated.

During construction of the fitness centre, it is anticipated that a phased approach is implemented and necessary allowance will be made to accommodate the site's surface runoff. Installing one of the tanks first and providing a temporary drainage strategy may be a prudent solution considering the capacity issues on East Road, however, this will need further assessment.

It should be noted that the drainage proposals in this report are outline only and further refinement and assessment may be necessary as part of the detailed design stage.

5.3.1 Stormwater Treatment Management Train and Runoff Quality

The Surface Water treatment provided by the SuDS features will ensure that the runoff is of sufficient quality so as not to impact the receiving system.

In keeping with the CIRIA SuDS Manual philosophy, the drainage strategy proposed aims to reduce any potential pollution risk to the receiving surface water sewers. In terms of designing for amenity

and biodiversity, due to the nature of the site, there is little opportunity or value in proposing any methods to enhance either criterion, and hence, they will not be considered further.

As per Section 26 of the SuDS Manual:

'*The risk posed by surface water runoff to the receiving environment is a function of:*

- *The pollution hazard at a particular site (i.e., the pollutant source)*
- *The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels, and/or the effectiveness of underlying soil layers in protecting the receiving groundwater (i.e., the pollutant pathway)*
- *The sensitivity of the receiving environment (i.e., the environmental receptor).'*

To ensure the design complies with the required pollution mitigation, adequate treatment of the contributing areas will need to be provided.

The following equation needs to be complied with, for each SuDS type used:

Total SuDS mitigation index ≥ Pollution hazard index

To ensure the stormwater quality is as high as possible prior to entering the sewer network, we propose to utilise gullies and channel drains with appropriate sump units that will collect/manage any debris or silt falling into the system. Following this, attenuation of the stormwater will occur, which then gets pulled through into the Hydro-brake flow control chamber and then the proposed SDS Aqua -Filter which will filter out over 80% of suspended solids, silt, hydrocarbons, nutrients and heavy metals that may have contaminated the site.

The Simple Index Approach has been used to assess the pollution risk for this site's SuDS strategy. According to Table 26.2 'Pollution hazard indices for different land use classifications' of the SuDS Manual, the site can be classified within the following categories:

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
1 Residential roofs	Very low	0.2	0.2	0.05
2 Other roofs	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from roof)	0.05
3 Individual property driveways, residential car parks, low traffic roads, and non-residential car parking with infrequent change i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4
4 Commercial yard and delivery areas, non-residential car parking with frequent change, all roads	Medium	0.7	0.6	0.7

	except low traffic roads and trunk roads/motorways				
5	Sites with heavy pollution, sites where chemicals and fuels are to be delivered, handled, stored, used or manufactured, industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Table 7 Pollution Hazard Indices

The roofs of the site would fall under category 1 - 'other roofs', and the site parking and access roads would fall under category 4. Category 4 figures will be used for this check as it encompasses a higher level of pollution risk.

The following mitigation indices data will be used for the proprietary Aqua-Filter system installed prior to the surface water from the site discharging to local surface waters. This has been obtained from the manufacturer, SDS:

	Mitigation indices		
Type of SuDS component	***TSS***	***Metals***	***Hydrocarbons***
Proprietary treatment systems - SDS Aqua-Filter	0.8	0.8	0.7

Table 8 SDS Aqua-Filter Mitigation Indices

Therefore, the following mitigation indices will apply for the car parking spaces:

Permeable Paving > Attenuation Tank > SDS Aqua Filter > Existing Sewer Network

	Pollution hazard indices	**SuDS mitigation indices – Permeable Paving**	**Total SuDS Mitigation indices**	**Mitigation ≥ Pollution hazard?**
TSS	0.7	0.7	0.7	Yes
Metals	0.6	0.6	0.6	Yes
Hydrocarbons	0.7	0.7	0.7	Yes

Table 9 Permeable Paving Treatment Train Pollution Mitigation Indices

For the rest of the drainage strategy, the following mitigation indices will apply:

RWP/gully/channel drain > Attenuation Tank > SDS Aqua Filter > Existing Sewer Network

	Pollution hazard indices	**SuDS mitigation indices – SDS Aqua-Filter**	**Total SuDS Mitigation indices**	**Mitigation ≥ Pollution hazard?**
TSS	0.7	0.8	0.8	Yes
Metals	0.6	0.8	0.8	Yes
Hydrocarbons	0.7	0.7	0.7	Yes

Table 10 Treatment Train Pollution Mitigation Indices

Therefore, both the proposed treatment trains are considered acceptable.

5.3.2 SuDS Maintenance Regime

The maintenance and management schedule required for the proposed SuDS on site should follow the below guidelines, to ensure the risk of flooding i.e., failure of the system, is reduced and even eliminated for the lifetime of the system.

Maintenance will be in accordance with Sewerage Sector Guidance Appendix C document (May 2021), the guidance of CIRIA SuDS Manual C753 and other established best practices.

The SuDS and drainage infrastructure on site will be maintained by the developer for the maintenance period after completion and handover. Long term, the owner or a site management company will be responsible for the ongoing maintenance of the SuDS infrastructure. Table 11 outlines the Maintenance Schedule required for the site; however, it should be noted that for the first 3 months post practical completion and handover, maintenance should be carried out every month at a minimum. Regular maintenance schedule reviewing may be required to keep up with best practice and ensure the SuDS are remaining effective.

The developer is responsible for providing the SuDS Maintenance Plan and O&M Manual to the site Management team. The O&M manual shall be handed over to each subsequent owner of the site, and within that pack should be included any relevant engineering drawings for ease.

Drainage Infrastructure Item	General maintenance	Responsibility
Drainage pipework	Jet and clean as necessary	Site owner/Management Company
Manholes/silt traps/catchpits/gullies/ channel drains	Remove cover annually to check for any sign of blockage and (jet) clean as necessary. Empty sumps as required.	Site owner/Management Company
Permeable Paving	Monthly visual inspection, bi-annual sweeping of surface debris and contamination.	Site owner/Management Company
SDS Aqua-filter	Bi-annual visual inspection, remove any significant large debris/litter. Servicing as per manufacturer recommendations.	Site owner/Management Company
Hydro-brake flow control	Monthly visual inspection; Servicing as per manufacturer recommendations.	Site owner/Management Company

Table 11 Maintenance Schedule

6 Impact of the scheme on Flood Risk and Mitigation Measures

6.1 Proposed Development Impact

Through the use of SuDS compliant design philosophies, with regards to runoff and volume control, and stormwater treatment for adequate water quality, the proposed development adequately reduces the flood risk to the receiving surface water drainage network, and also ensures the water quality being discharged is to the required standards so as not to negatively affect downstream water environments. Below is a breakdown of how the proposed development may affect the existing flood risk to the site, and any mitigation measures that may be required will be discussed.

Mitigation against Tidal and Fluvial Flooding

The site is considered to be at low risk of tidal and fluvial flooding. The introduction of new SUDs features - surface water attenuation and near to source flow control devices will have a positive impact on the local storm water network by providing betterment to the runoff rate from the site.

Mitigation against Groundwater Flooding

As the proposed drainage strategy does not incorporate any infiltration or groundwater recharge, the level of groundwater is not expected to rise due to the development, and hence, flood risk will not increase.

Mitigation against Pluvial and Sewer Flooding

The proposed site drainage will better the existing surface water runoff rate, by reducing the total discharge rate from the site, and hence, it is not expected that the risk of sewer flooding will increase.

7 Foul Water Strategy

There is an existing 150mm diameter foul sewer running through the proposed fitness centre footprint. It is proposed that this will be diverted around the southern extent of the building, and any foul flows from inside the centre will discharge to a number of new external manholes.

Overall, the strategy proposes that the foul water flows from the site will be collected through a gravity system and connect to an existing sewer via a new manhole, which then connects to a foul/combined sewer in East Road. The new foul drainage will pick up waste from a number of WC's, showers and handwash basins from inside the fitness centre.

All foul drainage will be designed to Building Regulations Part H, and BS 752 standards.

8 Conclusions

The redevelopment proposes to demolish the existing car park and small building structures, and replace these with a new fitness centre, which includes a number of studios, a male and female changing room, and a small plant room. Access to the site will remain the same.

Environment Agency mapping shows that majority of site lies in Flood Zone 1 (Low Risk). It was also found that the site has a low risk of flooding from all other sources.

The site is considered 'less vulnerable' with respect to flood risk in line with NPPF guidelines. The proposed development is not required to undertake the exception test as less vulnerable uses are deemed 'appropriate development' in Flood Zone 1.

A below ground attenuation tank of minimum volume 68m^3 is proposed to attenuate surface water flows from the site, which will then flow at a restricted rate of 0.6L/s into the existing 300mm diameter surface water sewer to the east of the site. This is a greater than 90% bettered flow rate in comparison to the existing brownfield runoff rate ensuring that any existing sewer capacity issues on East Road are alleviated.

The existing 300mm diameter surface water sewer will need to be slightly diverted to provide clearance from the proposed fitness centre footprint and to allow space for the new drainage, and attenuation tanks. The existing 150mm diameter foul sewer running across the development site will also be diverted around the western, southern and eastern sides of the fitness centre and a number of new chambers are proposed to pick up foul flows from the centre.

Through the implementation of the tank, permeable surfaces, and other proprietary systems, the flood risk assessment has concluded that the proposed development neither increases the site footprint nor the potential for flood risk or flooding from the site, whilst also improving the quality of water entering the sewer system.

APPENDIX A – Existing Site Plan

Existing Site Plan

1 : 200

1:200 0 5 10 15 20 m

Rev	Date	Description	By	Chk
P01	07.07.22	SGHRA Submission	GL	JM

SGHRA SUBMISSION

DB3

LEEDS
10 South Parade, Leeds, LS1 5QS
Tel: 0113 244 2931 www.darntonb3.com

CLIENT
ST. GEORGE'S HILL LAWN TENNIS CLUB

PROJECT
FITNESS BUILDING

TITLE
EXISTING SITE PLAN

CREATION DATE	SCALE @ A1	DRN	CHK	STATUS
06/24/22	1 : 200	GL	JM	S0

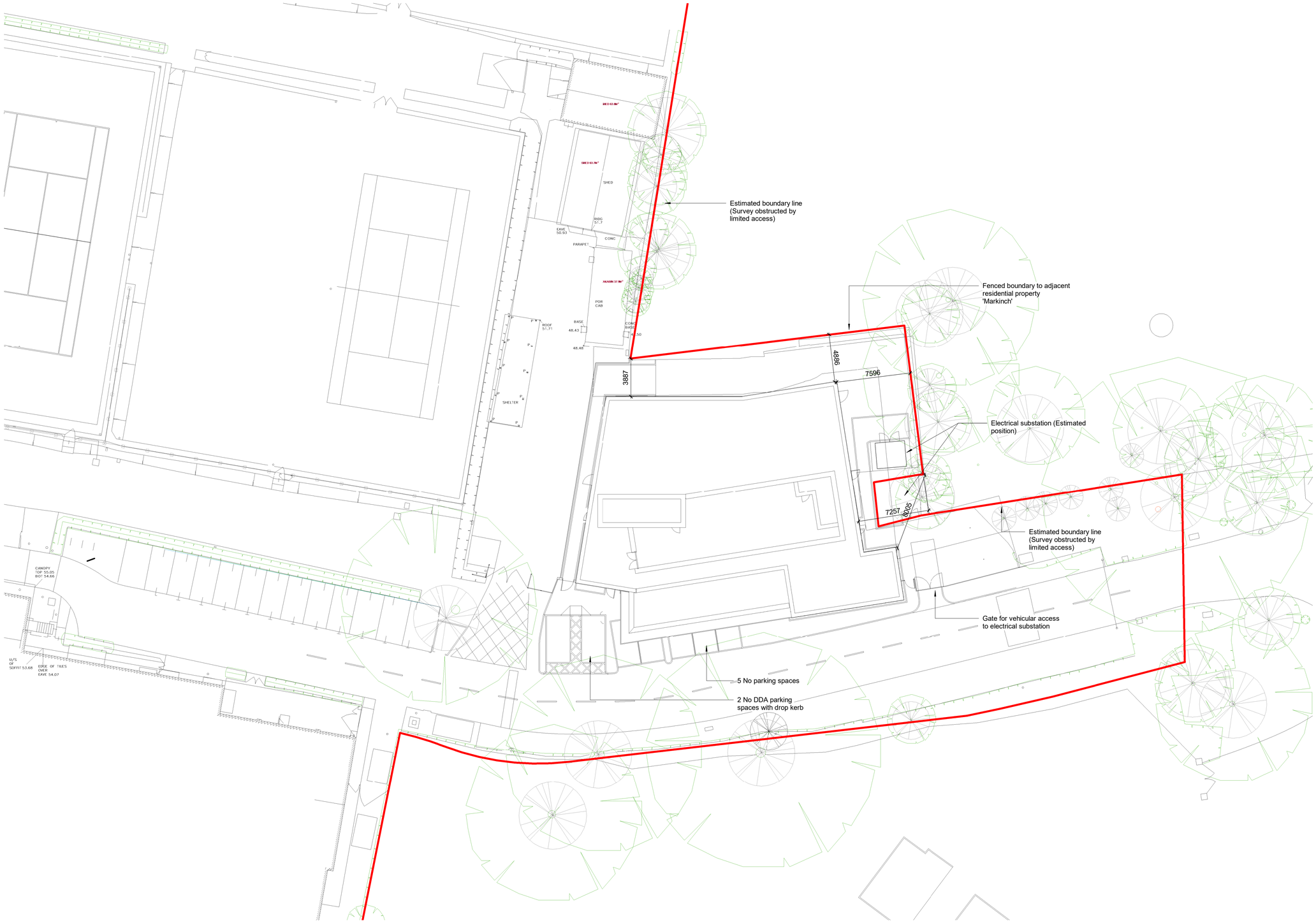
SHEET NO.
15764 - DB3 - B01 - ZZ - DR - A - 90001

REVISION
P01

PROJECT NO|ORIGINATOR|ZONE|LEVEL|TYPE|ROLE|NUMBER

PLOT DATE|07/07/2022 14:17:15

APPENDIX B – Proposed Site Plan



Key legend:

Site boundary line

Proposed Site Plan

1 : 200

1:200 0 5 10 15 20 m

Rev	Date	Description	By	Chk
P05	28.02.23	Issued for planning	VG	JM
P04	09.12.22	Revsied boundary line as per 08/12/2022 email	VG	JM
P03	31.10.22	Additional external equipment omitted	JK	JM
P02	28.10.22	Running track omitted	JK	JM
P01	07.07.22	SGHRA Submission	GL	JM

PLANNING

DB3

LEEDS

10 South Parade, Leeds, LS1 5QS
Tel: 0113 244 2931 www.darntonb3.com

CLIENT
ST. GEORGE'S HILL LAWN TENNIS CLUB

PROJECT
FITNESS BUILDING

TITLE
PROPOSED SITE PLAN - FITNESS BUILDING

CREATION DATE	SCALE @ A1	DRN	CHK	STATUS
06/24/22	As indicated	GL	JM	S0

SHEET NO.
15764 - DB3 - B01 - ZZ - DR - A - 90100

REVISION
P05

PROJECT NO|ORIGINATOR|ZONE|LEVEL|TYPE|ROLE|NUMBER

PLOT DATE:05/03/2023 11:28:24

APPENDIX C – EA Flood Map for Planning

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**508823/163202**	**25 May 2022 16:21**

Your selected location is in flood zone 1, an area with a low probability of flooding.

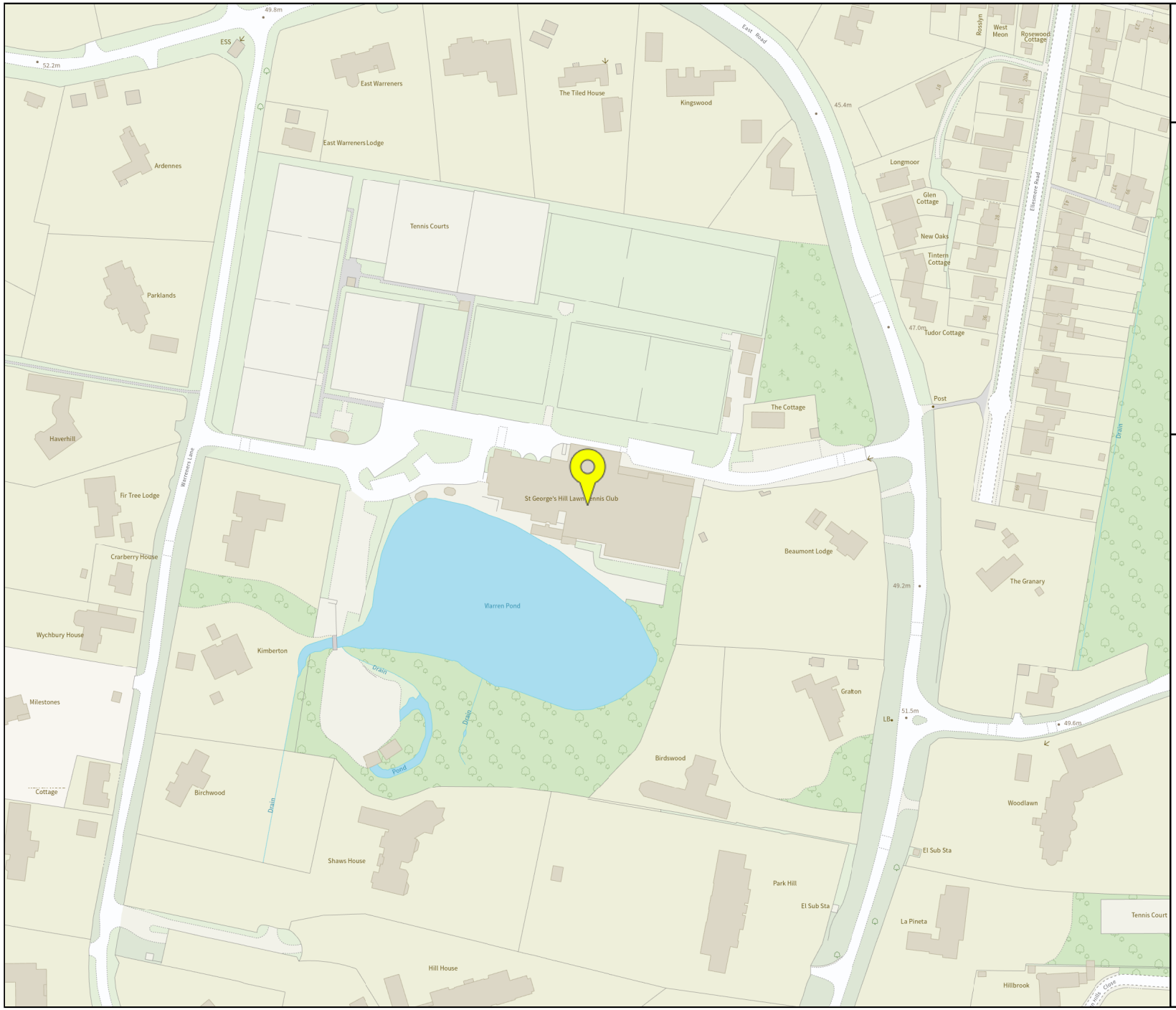
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
508823/163202

Scale
1:2500

Created
25 May 2022 16:21

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

APPENDIX D – Thames Water Asset Plan

Asset location search

Property Searches

CHECKED

Atkins Ltd
Stats Enquiries Team The Hub
500Park Avenue
BRISTOL
BS32 4RZ

Search address supplied Site at East Road, Warreners Lane, Weybridge
KT13 0LL

Your reference 114442

Our reference ALS/ALS Standard/2022_4747541

Search date 9 November 2022

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

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

0800 009 4540

Asset location search

Property Searches

Search address supplied: Site at East Road, Warreners Lane, Weybridge, KT13 0LL

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the address below:

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

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset location search

Thames Water Property Searches

Waste Water Services

Please provide a copy extract from the public sewer map.

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

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

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

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

For your guidance:

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

Clean Water Services

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

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

Affinity Water Ltd
Tamblin Way
Hatfield
AL10 9EZ
Tel: 0345 3572401

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

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

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

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

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

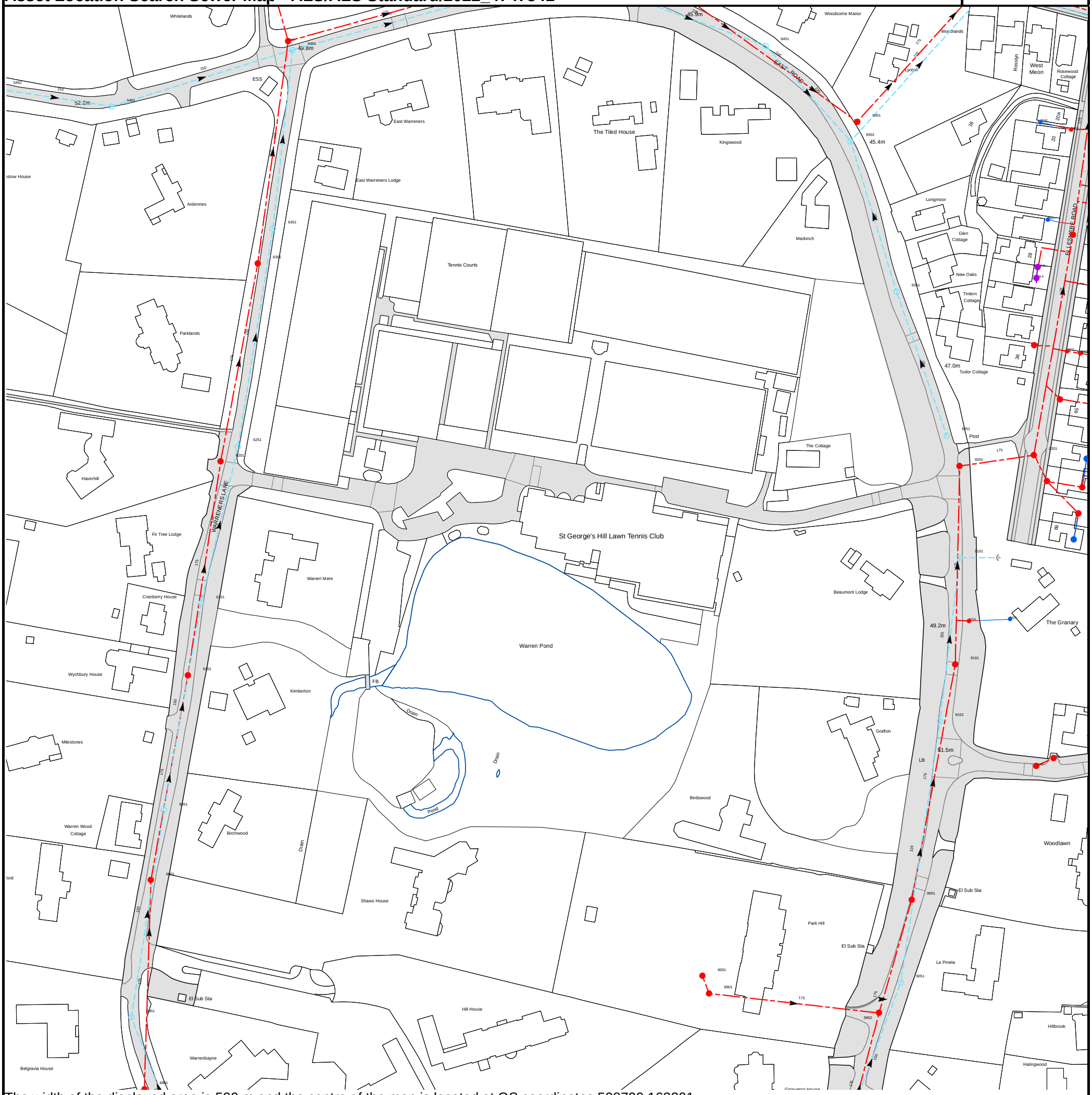
Clean Water queries

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

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

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2022_4747541



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 508790,163201

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

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
02YQ	n/a	n/a
031A	n/a	n/a
031B	n/a	n/a
031E	n/a	n/a
031C	n/a	n/a
021C	n/a	n/a
031D	n/a	n/a
0301	43.9	41.09
021B	n/a	n/a
021A	n/a	n/a
9051	56.64	55.37
8001	n/a	n/a
9001	53.82	52.52
6001	58.39	55.73
6051	57.61	56.59
011C	n/a	n/a
011B	n/a	n/a
9152	50.32	49.1
6101	56.54	53.87
9101	n/a	n/a
911A	n/a	n/a
011A	n/a	n/a
6151	55.96	54.97
9151	48.4	47.46
02YT	n/a	n/a
02YR	n/a	n/a
02ZP	n/a	n/a
02ZT	n/a	n/a
9201	47.52	45.75
6201	54.99	52.5
02ZR	n/a	n/a
0201	46.57	44.84
6251	54.51	53.31
9251	47.35	46.17
02YZ	n/a	n/a
02YW	n/a	n/a
6301	n/a	n/a
6351	51.5	50.44
6401	49.61	46.36
6451	49.6	48.41
8451	45.61	44.51
9352	45.32	42.96
9301	43.31	40.96
9351	46.45	45.25
5451	51.91	50.74
6901	59.52	56.68
5951	59.11	58.15
9902	57.38	54.23
8901	n/a	n/a

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

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
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

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

- Ancillary
- Drop Pipe
- Control Valve
- 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.

- Inlet
- Outfall
- Undefined End

Other Symbols

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

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement

Ducts may contain high voltage cables. Please check with Thames Water.

- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the 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 indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. 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, please contact Property Searches on 0800 009 4540.

Terms and Conditions

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

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

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

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

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

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

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0800 009 4540** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

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

APPENDIX E – Topographical/CCTV Survey Plans

Court no. G4

Court no. G3

Court no. G2

Court no. G1

Murphy Surveys Ltd. Disclaimer

The survey aims to map all existing utilities and sub surface structures and provide information with respect to pipe size, material type and drainage connectivity. However GPR surveying is limited by the following guidelines and it may not be possible to accurately survey, define and locate all services and sub surface features.

- Locational accuracy is determined by referring to the manufacturers guidelines for the detectors used.
- Existing record information showing underground services is often incomplete and unknown accuracy; therefore it should be regarded only as an indication.
- In ideal conditions these spatial accuracies for the underground utilities are +/- 5% for the RD4000 and +/- 10% of depth for the GPR to 2.5m deep. However, variations within the subsurface may alter this estimated accuracy.
- Although all reasonable steps have been taken to locate all features, there is no guarantee that all will be shown on the drawing as some above ground features may have obstructed the survey.
- GPR surveying operates best within high resistivity material. Clay overburden can impair GPR surveying.
- Due to the attenuation of the radar signal with depth, resolution is restricted, hence making identification of anomalies difficult with increasing depth.
- The depth penetration and quality of the data depends on the ground conditions on the site. Poor data may be a result of areas with high conductivity. Also, high reflective materials close to the surface i.e. rebar may hide deeper anomalies.
- It is not always possible to trace the entire length of each underground service.
- It is always our intention to use the Utility providers' details, if supplied prior to survey commencement as a guide for location purposes. However, should we not be able to locate those guided services we shall not be held responsible for the accuracy, or otherwise, of the location of that service, as issued by the utility provider and therefore shown "Taken from Records" on the drawing and we are not liable for any loss that may arise due to the lack of accuracy in the guided information.
- Unless otherwise stated, all services and sub surface structures shown on Murphy Surveys Limited plan drawings have been surveyed using approved detectors and the connections between manholes, if not traced, are assumed to run straight.
- Plan accuracies of the order of + or - 150mm may be achieved but this figure will depend on the depth of the service below ground level. Where similar services run on close proximity, separation may be impossible. Successful tracing of non metallic pipes may be limited.
- Please note that not all buried pipes, cables and ducts can be detected and mapped in consideration of their depth, location, material type, geology and proximity to other utilities. Even an appropriate and professionally executed survey may not be able to achieve a 100% detection rate.
- Services which have been untraceable are shown from Records where possible.
- DP represents distance from the surface level to the top of the service/ radar.

No allowance has been made within our quotation, unless otherwise stated, for the location and mapping of undeclared services. Failure to detect or fully map any declared service will be recorded within the notes accompanying our final drawings.
Where technically possible, depth indications will be given. These should be used for guidance only and wherever critical accuracy is required these should be confirmed by the Client by undertaking trial excavations or similar. Bends, lateral service connections, or the close proximity of other services and local magnetic, atmospheric or ground conditions, could in certain situations influence the accuracy of the plan and depth indication facility. Depths will not be provided unless we are reasonably confident of their validity.
Where Murphy Surveys Limited issues a CAD drawn utility service plan, this should be read in conjunction with all available public utility records etc. As part of our exhaustive Quality Control procedures, Murphy Surveys Limited Endeavour to add relevant Public Utility record information onto the final issue drawing. An allowance should be made for the width of services, particularly where these are laid in bands or are of significant size etc. For clarification or appropriate easement bands, we would recommend that direct contact is made with the Asset Owner or Statutory Undertaker.
We exclude the following, except where otherwise specified and possible to do so;

- All private service connections, (including water or gas fittings where no through flow of applied signal is possible.
- Pot ended or disconnected cables or terminated short lengths of pipe.
- Internal building services
- Fibre optic cables (except where laid with a standard communications cable or built in tracer wire or similar conductor system) or can be clearly located using ground penetrating radar.
- Small diameter cables less than 17mm diameter, or pipes less than 38mm diameter.
- Above ground services unless specifically requested.
- Lifting manhole covers which require longer than 10 minute effort using standard heavy duty lifting apparatus.
- Services positioned directly below other pipes or cables etc (i.e. masking signal) - intrusive verification options available on request.
- Deep non metallic pipes, ducts or culverts (unless probing or Pipe Track 3d is specified as part of the fully invasive survey option).
- Passing through defective pipework (displaced joints etc) or acute bends between access points.

Please note that our Quotation does not allow for location of individual service feeds to properties unless reasonable to do so, as access would be required into each property to apply direct connections to inlet points and this would significantly increase the scope of work, survey cost and also cause possible disruption to occupants.
Client supplied utility drawings may not be up to date or give sufficient coverage of all areas surveyed, as such extra precaution should be taken when excavation works are carried out on site.
All BT services marked on site as a guide only, as it is a requirement to inform BT via their 'Dial before you Dig' scheme prior to commencement of excavation works. For on site assistance contact - 0800 9173993 dbyd@openreach.co.uk
All work carried out by Murphy Surveys Limited (MSL) conforms to the guidelines set out by The Survey Association (TSA).

Underground Utilities

- Gas Pipe
- Gas Pipe - Low Pressure
- Gas Pipe - Medium Pressure
- Gas Pipe - Intermediate Pressure
- Gas Pipe - High Pressure
- BT
- Cable Activated TV
- Fibre Optic
- Telecom
- Telecom - Colt
- Telecom - Energis
- Telecom - FibreNet
- Telecom - Level 3
- Telecom - Mercury
- Telecom - MFSC
- Telecom - Tanet
- Telecom - Verizon
- Telecom - Virgin
- Telecom - Vodafone
- Telecom - WCOM
- Electrical Cable
- Electrical Cable - Extra High Volt
- Electrical Cable - High Voltage
- Electrical Cable - Low Voltage
- Street Lighting Cable
- Combined Water
- Foul Water
- Surface Water Drainage
- Vent Pipe
- Water Main
- Hot Water
- CCTV
- Control Cable
- Traffic Control Signal Cable
- Empty Ducts
- Unknown Service
- Unidentified GPR Anomaly
- Chamber
- Survey Station
- Direction of flow
- GPR Slab
- GPR Survey Area

AR	Assumed Route
CL	Cover Level
DP = 0.55	Depth from ground level to Top of Pipe/GPR Target (m)
EOT	End Of Trace
IL	Invert Level
MH	Manhole
NT	No Trace
TFR	Taken From Record Drawings
UTO	Unable To Open
UTS	Unable To Survey

Site Location

Surveyed by :	PI/SA	Date: 13/03/2015	Datum : OSGB
Drawn by :	PI/SA	Date: 20/04/2015	Grid System: OSGB
Checked by :	TMD	Date: 21/04/2015	

Revisions

No.	Date	Description
A	21/04/2015	First Issue
B	11/06/2015	RevB - Court Numbers Added

No. 318

THE SURVEY ASSOCIATION FULL MEMBER

EUROPEAN GPR ASSOCIATION

murphy SURVEYS
GLOBAL CONSULTING SURVEYORS

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

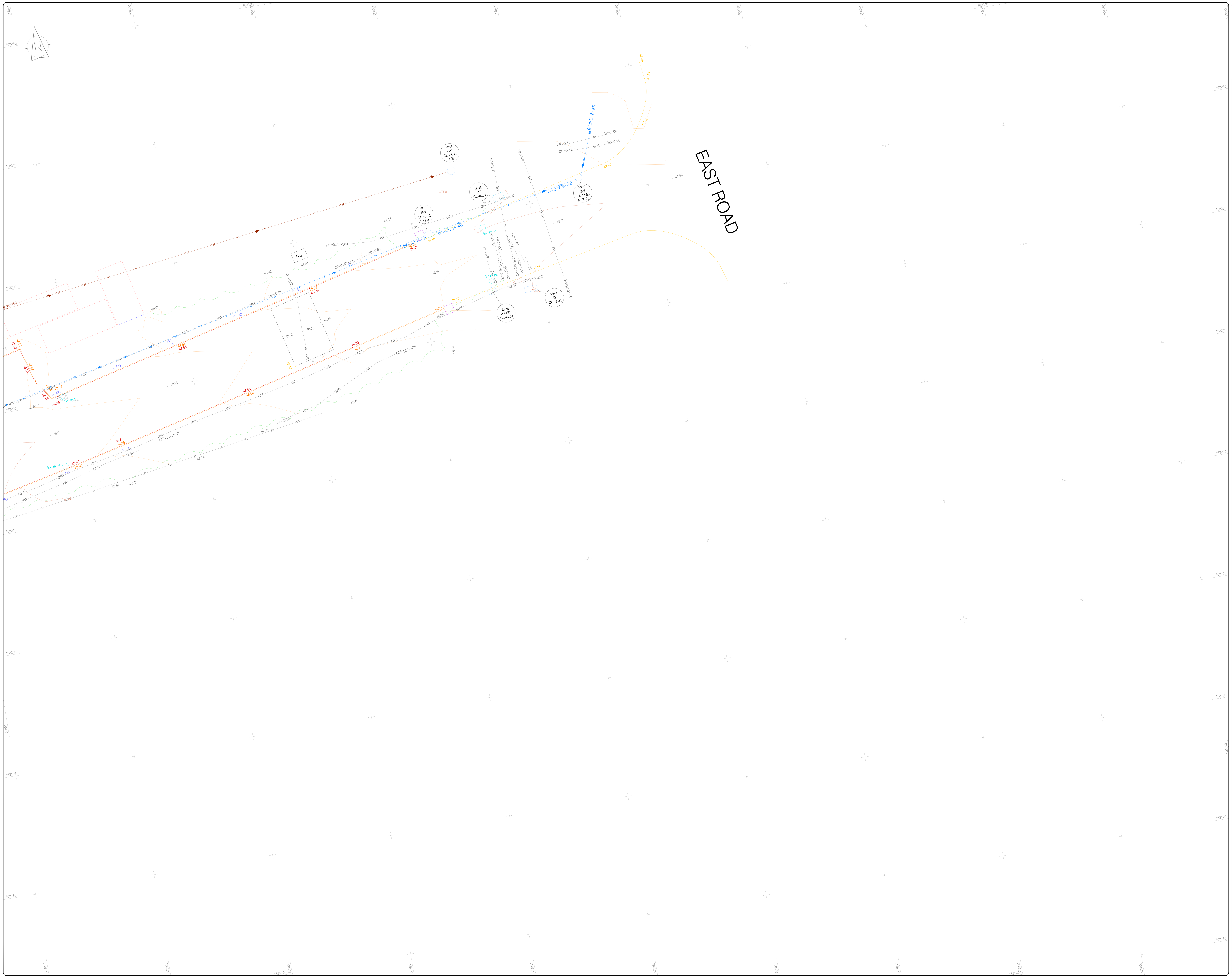
London Glasgow Belfast Cork Kildare

UK Head Office
9 Devonshire Square
London
EC2M 4YF

Phone: (+44) 020 3178 6644
Email:london@murphysurveys.co.uk

www.murphysurveys.co.uk

Client :	St. George's Hill Lawn Tennis Club
Project :	Topo of St. George's Hill Lawn Tennis Club Site.
Date : 11/06/2015	**Scale :** 1:100@A0
Description :	Utility Services Survey Drainage Services
Drawing Number :	**MSL11735-U-RevB-06-06**



Murphy Surveys Ltd. Disclaimer

The survey aims to map all existing utilities and sub surface structures and provide information with respect to pipe size, material type and drainage connectivity. However GPR surveying is limited by the following guidelines and it may not be possible to accurately survey, define and locate all services and sub surface features.

- Locational accuracy is determined by referring to the manufacturers guidelines for the detectors used.
- Existing record information showing underground services is often incomplete and unknown accuracy; therefore it should be regarded only as an indication.
- In ideal conditions these spatial accuracies for the underground utilities are +/- 5% for the RD4000 and +/- 10% of depth for the GPR to 2.5m deep. However, variations within the subsurface may alter this estimated accuracy.
- Although all reasonable steps have been taken to locate all features, there is no guarantee that all will be shown on the drawing as some above ground features may have obstructed the survey.
- GPR surveying operates best within high resistivity material. Clay overburden can impair GPR surveying.
- Due to the attenuation of the radar signal with depth, resolution is restricted, hence making identification of anomalies difficult with increasing depth.
- The depth penetration and quality of the data depends on the ground conditions on the site. Poor data may be a result of areas with high conductivity. Also, high reflective materials close to the surface i.e. rebar may hide deeper anomalies.
- It is not always possible to trace the entire length of each underground service.
- It is always our intention to use the Utility providers' details, if supplied prior to survey commencement as a guide for location purposes. However, should we not be able to locate those guided services we shall not be held responsible for the accuracy, or otherwise, of the location of that service, as issued by the utility provider and therefore shown "Taken from Records" on the drawing and we are not liable for any loss that may arise due to the lack of accuracy in the guided information.
- Unless otherwise stated, all services and sub surface structures shown on Murphy Surveys Limited plan drawings have been surveyed using approved detectors and the connections between manholes, if not traced, are assumed to run straight.
- Plan accuracies of the order of + or - 150mm may be achieved but this figure will depend on the depth of the service below ground level. Where similar services run on close proximity, separation may be impossible. Successful tracing of non metallic pipes may be limited.
- Please note that not all buried pipes, cables and ducts can be detected and mapped in consideration of their depth, location, material type, geology and proximity to other utilities. Even an appropriate and professionally executed survey may not be able to achieve a 100% detection rate.
- Services which have been untraceable are shown from Records where possible.
- DP represents distance from the surface level to the top of the service/ radar.

No allowance has been made within our quotation, unless otherwise stated, for the location and mapping of undeclared services. Failure to detect or fully map any declared service will be recorded within the notes accompanying our final drawings.
Where technically possible, depth indications will be given. These should be used for guidance only and wherever critical accuracy is required these should be confirmed by the Client by undertaking trial excavations or similar. Bends, lateral service connections, or the close proximity of other services and local magnetic, atmospheric or ground conditions, could in certain situations influence the accuracy of the plan and depth indication facility. Depths will not be provided unless we are reasonably confident of their validity.
Where Murphy Surveys Limited issues a CAD drawn utility service plan, this should be read in conjunction with all available public utility records etc. As part of our exhaustive Quality Control procedures, Murphy Surveys Limited Endeavour to add relevant Public Utility record information onto the final issue drawing. An allowance should be made for the width of services, particularly where these are laid in bands or are of significant size etc. For clarification or appropriate easement bands, we would recommend that direct contact is made with the Asset Owner or Statutory Undertaker.
We exclude the following, except where otherwise specified and possible to do so;

- All private service connections, (including water or gas fittings where no through flow of applied signal is possible.
- Pot ended or disconnected cables or terminated short lengths of pipe.
- Internal building services
- Fibre optic cables (except where laid with a standard communications cable or built in tracer wire or similar conductor system) or can be clearly located using ground penetrating radar.
- Small diameter cables less than 17mm diameter, or pipes less than 38mm diameter.
- Above ground services unless specifically requested.
- Lifting manhole covers which require longer than 10 minute effort using standard heavy duty lifting apparatus.
- Services positioned directly below other pipes or cables etc (i.e. masking signal) - intrusive verification options available on request.
- Deep non metallic pipes, ducts or culverts (unless probing or Pipe Track 3d is specified as part of the fully invasive survey option).
- Passing through defective pipework (displaced joints etc) or acute bends between access points.

Please note that our Quotation does not allow for location of individual service feeds to properties unless reasonable to do so, as access would be required into each property to apply direct connections to inlet points and this would significantly increase the scope of work, survey cost and also cause possible disruption to occupants.
Client supplied utility drawings may not be up to date or give sufficient coverage of all areas surveyed, as such extra precaution should be taken when excavation works are carried out on site.
All BT services marked on site as a guide only, as it is a requirement to inform BT via their "Dial before you Dig" scheme prior to commencement of excavation works. For on site assistance contact - 0800 9173993 dbyd@openreach.co.uk
All work carried out by Murphy Surveys Limited (MSL) conforms to the guidelines set out by The Survey Association (TSA).

Underground Utilities

GAS	Gas Pipe
GAS LP	Gas Pipe - Low Pressure
GAS MP	Gas Pipe - Medium Pressure
GAS IP	Gas Pipe - Intermediate Pressure
GAS HP	Gas Pipe - High Pressure
BT	BT
CATV	Cable Activated TV
FIBRE	Fibre Optic
TELECOM	Telecom
COLT	Telecom - Colt
ENERGIS	Telecom - Energis
FIBERNET	Telecom - FibreNet
LEVEL3	Telecom - Level 3
MERCURY	Telecom - Mercury
MFSC	Telecom - MFSC
TANET	Telecom - Tanet
VERIZON	Telecom - Verzion
VIRGIN	Telecom - Virgin
VODAFONE	Telecom - Vodafone
WCOM	Telecom - WCOM
E	Electrical Cable
EHV	Electrical Cable - Extra High Volt
HV	Electrical Cable - High Voltage
LV	Electrical Cable - Low Voltage
SL	Street Lighting Cable
CW	Combined Water
FW	Foul Water
SW	Surface Water Drainage
VP	Vent Pipe
	Water Main
HW	Hot Water
CCTV	CCTV
Ctrl C	Control Cable
TCSU	Traffic Control Signal Cable
ED	Empty Ducts
UNID	Unknown Service
	Unidentified GPR Anomaly
	Chamber

S1 1000.000 1000.000 100.00 Survey Station

Direction of flow

GPR Slab

GPR Survey Area

AR	Assumed Route
CL	Cover Level
DP = 0.55	Depth from ground level to Top of Pipe/GPR Target (m)
EOT	End Of Trace
IL	Invert Level
MH	Manhole
NT	No Trace
TFR	Taken From Record Drawings
UTO	Unable To Open
UTS	Unable To Survey

Site Location

Surveyed by : PY/SA Date: 13/03/2015 Datum : OSGB
Drawn by : PY/SA Date: 20/04/2015 Grid System: OSGB
Checked by : TMD Date: 21/04/2015

Revisions

No.	Date	Description
A	21/04/2015	First Issue
B	11/06/2015	RevB - Court Numbers Added

No. 318

THE SURVEY ASSOCIATION FULL MEMBER

EUROPEAN GPR ASSOCIATION

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GLOBAL CONSULTING SURVEYORS

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London Glasgow Belfast Cork Kildare

UK Head Office
9 Devonshire Square
London
EC2M 4YF
Phone: (+44) 020 3178 6644
Email:london@murphysurveys.co.uk

www.murphysurveys.co.uk

Client : St. George's Hill Lawn Tennis Club

Project : Topo of St. George's Hill Lawn Tennis Club Site.

Date : 11/06/2015 **Scale :** 1:100@A0

Description : Utility Services Survey
Drainage Services

Drawing Number : **MSL11735-U-RevB-07-06**

APPENDIX F – UK SuDS Greenfield Runoff Rate Calculation

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Heeta Patel
Site name:	St. George's Tennis Club
Site location:	Weybridge

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

Site Details

Latitude:	51.35778° N
Longitude:	0.4373° W
Reference:	2095159424
Date:	Nov 15 2022 13:09

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.12

Methodology

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

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	625	625
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	0.19	0.19
1 in 1 year (l/s):	0.16	0.16
1 in 30 years (l/s):	0.44	0.44
1 in 100 year (l/s):	0.61	0.61
1 in 200 years (l/s):	0.72	0.72

APPENDIX G – UK SuDS Storage Volume Estimate

Print Close Report

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Heeta Patel
Site name:	St. George's Tennis Club
Site location:	Weybridge

This is an estimation of the storage volume requirements that are needed to meet normal
best practice criteria in line with Environment Agency guidance "Rainfall runoff management
for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and
the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design
of drainage systems. It is recommended that hydraulic modelling software is used to calculate
volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.35776° N
Longitude:	0.43719° W
Reference:	1633541055
Date:	Apr 13 2023 17:51

Site characteristics

Total site area (ha):	0.1165
Significant public open space (ha):	0
Area positively drained (ha):	0.1165
Impermeable area (ha):	0.1165
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.12
Net impermable area for storage volume design (ha):	0.12
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	0.6

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
SPR:	0.3	0.3

Hydrological characteristics	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	97.79
FEH / FSR conversion factor:	1.27	1.27
SAAR (mm):	625	625
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	0.19	0.19
Q_{BAR} for net site area (l/s):	0.19	0.19

Site discharge rates	Default	Edited
1 in 1 year (l/s):	0.6	0.6
1 in 30 years (l/s):	0.6	0.6
1 in 100 year (l/s):	0.6	0.6

Estimated storage volumes	Default	Edited
Attenuation storage 1/100 years (m^3):	114	114
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	114	114

APPENDIX H – Trial Pit Photo

APPENDIX I - Proposed Drainage Strategy

KEY

- PROPOSED SURFACE WATER DRAIN
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED SURFACE WATER CHANNEL DRAIN
- PROPOSED SURFACE WATER RAINWATER PIPE
- PROPOSED SURFACE WATER GULLY
- PROPOSED CELLULAR ATTENUATION TANK
- PROPOSED FOUL WATER DRAIN
- PROPOSED FOUL WATER MANHOLE
- EXISTING SURFACE WATER DRAINAGE
- EXISTING FOUL WATER DRAINAGE
- SEWER TO BE ABANDONED/GRUBBED OUT
- PROPOSED LINED PERMEABLE SURFACING
- PROPOSED SURFACE WATER DRAIN DIVERSION
- SITE APPLICATION BOUNDARY

PORTAKABIN 37.9M²
PORTA CABIN
BASE 48.43
CONC BASE 48.50
48.48
ROOF 51.71
SHELTER
150mm
100mm
100mm

SWMH.02
CL: 48.75
IL: 47.772
150Ø @ 1:100
RWP
SWMH.01
CL: 48.75
IL: 48.24
RWP
1000 @ 1:80
3750 @ 1:100
RWP

PROPOSED FOUL MANHOLE TO BE CONSTRUCTED ON EXISTING FOUL SEWER LINE. EXACT IL OF CONNECTION TO BE DETERMINED ON SITE; CONTRACTOR TO CONSULT WITH ENGINEER ABOUT FINAL FOUL STRATEGY.

FWMH.6A
CL: 48.80
IL: 47.80

EXISTING 150mmØ FOUL WATER SEWER TO BE ABANDONED / GRUBBED OUT, AND DIVERTED AS PROPOSED FOUL STRATEGY

EXISTING FOUL MANHOLE TO BE REMOVED / INFILLED WITH CONCRETE / ABANDONED

EXFWMH.8
CL: 46.78
IL: 47.48

RE

FWMH.8
CL: 48.70
IL: 47.18

150mm
150mm
SWMH.08
CL: 48.70
IL: 46.96

SEE INSET A

150Ø @ 1:140
300mm
EXSWMH.6
CL: 48.12
IL: 47.41

SWMH.07
CL: 48.75
IL: 47.09

150Ø @ 1:60

FWMH.1
CL: 48.75
IL: 48.02
RWP

FWMH.2
CL: 48.80
IL: 47.93

FWMH.3
CL: 48.80
IL: 47.81

FWMH.4
CL: 48.80
IL: 47.72

SWMH.23
SILT TRAP
CL: 48.80
IL: 47.93

SWMH.22
CL: 48.80
IL: 47.98

FWMH.5
CL: 48.80
IL: 47.65

FWMH.6
CL: 48.80
IL: 47.50

SWMH.21
CL: 48.80
IL: 48.10

FWMH.7
CL: 48.70
IL: 47.31

150Ø @ 1:65
150Ø @ 1:125
150Ø @ 1:100
150Ø @ 1:100
300Ø @ 1:76

ATT-TANK.01
CL: 49.00
IL: 47.45; SOFFIT OF TANK: 48.50
5m x 4m x 1.05m
TOTAL STORAGE VOLUME ~20m³

SWMH.03
CATCHPIT
CL: 49.00
IL: 47.55

3750 @ 1:100

EXISTING 300mm DIAMETER SURFACE WATER SEWER TO BE GRUBBED OUT AND DIVERTED

300Ø @ 1:235
DIV.SWMH.1
CL: 49.20
IL: 48.43
3000 @ 1:48
EXSWMH.7
CL: 49.32
IL: 48.40
3750
300mm
300mm
300Ø @ 1:48
300Ø @ 1:76
SWMH.06
CL: 48.75
IL: 47.28
SDS AQUA-FILTER FOR TREATMENT OF WATER PRIOR TO DISCHARGE INTO EXISTING SEWER NETWORK.
DIV.SWMH.3
CL: 48.70
IL: 47.84
SWMH.05 - HYDRO-BRAKE MANHOLE
FLOW RATE 0.6L/s
CL: 48.80
IL: 47.35
DIV.SWMH.2
CL: 49.20
IL: 48.32
EXSWMH.11
CL: 49.21
IL: 48.11
ATT-TANK.02
CL: 49.00
IL: 47.40; SOFFIT OF TANK: 48.45
12m x 4m x 1.05m
TOTAL STORAGE VOLUME ~48m³
300mm

The Residents' Association has expressed concern about the existing sewers and gullies on East Road being at capacity, and that any additional flow will exacerbate and even worsen the issue. The scheme does not increase the area of roofs/hard landscaping to more than the existing, and the proposed strategy will utilise a Hydrobrake to further restrict the flow going into the sewers, to a rate of 2L/s. This is a greater than 85% betterment on the existing surface water runoff rate (brownfield rate: 16.3L/s), and hence, this should result in the East Road sewers actually having more capacity than they currently do. Therefore, an increase in surface water runoff is not expected. Existing sewers within the site boundary and under East Road should be fully surveyed prior to construction and jetted.

DRAINAGE STRATEGY SUBJECT TO THE APPROVAL OF THE LLFA

PROPOSED SURFACE WATER CONNECTION TO EXISTING MANHOLE 150Ø IL: 46.91
150mm
SWMH.08
CL: 48.70
IL: 46.96
150Ø @ 1:106
300mm
300mm
EXSWMH.2
CL: 47.83
IL: 46.76

INSET A
SCALE 1:100

Rev	Date	Comment	By	Check
P02	14.04.22	ISSUED FOR PLANNING FOLLOWING RA & LLFA COMMENTS	HP	LF
P01	19.12.22	ISSUED FOR PLANNING	HP	LF

Status Code: S2
Drawing Status: PRELIMINARY
This drawing may only be used for construction/manufacture if status is CONSTRUCTION

FURNESS Consulting Engineers
London
20 Britton Street, London, EC1M 5TX
tel: 020 7490 4353 fax: 020 7490 4354
info@furnesspartnership.com
Bradford
The Paper Hall, Anne Gate, Bradford, BD1 4EQ
tel: 01274 392092
mail@furnesspartnership.com

Project
ST GEORGE'S HILL LAWN TENNIS CLUB

Drawing Title
PROPOSED DRAINAGE STRATEGY

FP Job No.	Drawn	Date	Checked	Scale @ A1
6793	HP	DEC '22	LF	1:100

PROJECT	OPERATOR	ZONE / VOLUME	LEVEL / LOCATION	FILE TYPE	ROLE	SHEET No.	Rev.
/	FUR	XX	ZZ	DR	D	0910	P02

APPENDIX J – InfoDrainage Model Results Summary

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Junctions Storm Phase: Phase	Company Address:		

Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)	Invert Level (m)	Chamber Shape	Diameter (m)
SW1	Manhole	508922.721	163237.943	48.750	0.400	48.350	Circular	0.300
SW2	Manhole	508921.173	163248.515	48.750	0.507	48.243	Circular	0.600
SW3	Manhole	508896.646	163246.557	48.750	0.978	47.772	Circular	0.900
SW4	Manhole	508893.312	163224.179	49.000	1.454	47.546	Circular	1.200
SW7	Manhole	508913.973	163220.711	48.800	1.400	47.400	Circular	1.200
SW8	Manhole	508920.926	163221.958	48.700	1.371	47.329	Circular	0.450
SW9	Manhole	508938.463	163225.942	48.700	1.551	47.149	Circular	0.450
SW10	Manhole	508958.842	163232.406	48.700	1.736	46.964	Circular	0.450
SW11	Manhole	508964.335	163231.582	47.830	0.918	46.912	Circular	1.200
Manhole	Manhole	508908.876	163247.533	48.750	0.743	48.007	Circular	0.450

Name	Lock
SW1	Levels
SW2	Levels
SW3	Levels
SW4	None
SW7	Levels
SW8	Levels
SW9	None
SW10	None
SW11	All
Manhole	None

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

Porous Paving

Type : Porous Paving

Dimensions

Exceedence Level (m)	49.000
Depth (m)	0.700
Base Level (m)	48.300
Paving Layer Depth (mm)	130
Membrane Percolation (m/hr)	1.0
Porosity (%)	30
Length (m)	6.000
Long. Slope (1:x)	500.00
Width (m)	5.599
Total Volume (m³)	5.819

Under Drain

Height Above Base (m)	0.050
Diameter (mm)	150
No. of Barrels	1
Release Height (m)	0.400
Friction Scheme	Manning's n
n	0.015

Advanced

Conductivity (m/hr)	0.1

Porous Paving (1)

Type : Porous Paving

Dimensions

Exceedence Level (m)	49.000
Depth (m)	0.700
Base Level (m)	48.300
Paving Layer Depth (mm)	130
Membrane Percolation (m/hr)	1.0
Porosity (%)	30
Length (m)	12.780
Long. Slope (1:x)	500.00
Width (m)	4.910
Total Volume (m³)	10.888

Under Drain

Height Above Base (m)	0.050
Diameter (mm)	150
No. of Barrels	1
Release Height (m)	0.400
Friction Scheme	Manning's n
n	0.015

Advanced

Conductivity (m/hr)	0.1

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

Porous Paving (2)

Type : Porous Paving

Dimensions

Exceedence Level (m)	48.800
Depth (m)	0.700
Base Level (m)	48.100
Paving Layer Depth (mm)	130
Membrane Percolation (m/hr)	1.0
Porosity (%)	30
Length (m)	31.095
Long. Slope (1:x)	1000.00
Width (m)	3.919
Total Volume (m^3)	21.224

Under Drain

Height Above Base (m)	0.050
Diameter (mm)	150
No. of Barrels	1
Release Height (m)	0.400
Friction Scheme	Manning's n
n	0.015

Advanced

Conductivity (m/hr)	0.1

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

Tank

Type : Cellular Storage

Dimensions

Exceedence Level (m)	49.000
Depth (m)	1.050
Base Level (m)	47.450
Number of Crates Long	34
Number of Crates Wide	8
Number of Crates High	7
Porosity (%)	95
Crate Length (m)	0.5
Crate Width (m)	0.5
Crate Height (m)	0.15
Total Volume (m³)	68.330

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Network Design Criteria Storm Phase: Phase	Company Address:		

Flow Options

Peak Flow Calculation	(UK) Modified Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

Pipe Options

Lock Slope Options	None
Design Level	Level Soffits
Min. Cover Depth (m)	1.200
Min. Slope (1:x)	500.00
Max. Slope (1:x)	40.00
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☐
Reduce Channel Depths	☐

Manhole Options

Apply Offset	☐
Synchronise Manhole Invert Levels	☑

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Outfall Details Storm Phase: Phase	Company Address:		

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
SW11	Free Discharge		

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address:		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	☐

Rainfall

FEH

Type: FEH

Site Location	GB 508909 163231 TQ 08909 63231
Rainfall Version	2013
Data Type	Point
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
2.0	0
30.0	0
100.0	0
100.0	40

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:		

FEH: 2 years: Increase Rainfall (%): +0: Critical Storm Per Item

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow (m^3)
Catchment Area	FEH: 2 years: +0 %: 15 mins: Winter	0.02	2.6	1.210
Catchment Area (1)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	1.3	0.614
Catchment Area (2)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	2.0	0.943
Catchment Area (3)	FEH: 2 years: +0 %: 15 mins: Winter	0.02	3.6	1.692
Catchment Area (5)	FEH: 2 years: +0 %: 15 mins: Winter	0.02	3.2	1.488
Catchment Area (7)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	1.1	0.494
Catchment Area (8)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	2.1	0.961
Catchment Area (4)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	1.2	0.545
Catchment Area (6)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	1.3	0.587

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:		

FEH: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow (m^3)
Catchment Area	FEH: 30 years: +0 %: 15 mins: Winter	0.02	6.5	3.015
Catchment Area (1)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	3.3	1.525
Catchment Area (2)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	5.1	2.361
Catchment Area (3)	FEH: 30 years: +0 %: 15 mins: Winter	0.02	9.0	4.213
Catchment Area (5)	FEH: 30 years: +0 %: 15 mins: Winter	0.02	7.9	3.704
Catchment Area (7)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	2.6	1.232
Catchment Area (8)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	5.2	2.400
Catchment Area (4)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	2.9	1.352
Catchment Area (6)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	3.2	1.471

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:		

FEH: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow (m^3)
Catchment Area	FEH: 100 years: +0 %: 15 mins: Winter	0.02	8.5	3.937
Catchment Area (1)	FEH: 100 years: +0 %: 15 mins: Winter	0.01	4.3	1.990
Catchment Area (2)	FEH: 100 years: +0 %: 15 mins: Winter	0.01	6.6	3.080
Catchment Area (3)	FEH: 100 years: +0 %: 15 mins: Winter	0.02	11.8	5.499
Catchment Area (5)	FEH: 100 years: +0 %: 15 mins: Winter	0.02	10.4	4.833
Catchment Area (7)	FEH: 100 years: +0 %: 15 mins: Winter	0.01	3.4	1.606
Catchment Area (8)	FEH: 100 years: +0 %: 15 mins: Winter	0.01	6.7	3.131
Catchment Area (4)	FEH: 100 years: +0 %: 15 mins: Winter	0.01	3.8	1.765
Catchment Area (6)	FEH: 100 years: +0 %: 15 mins: Winter	0.01	4.1	1.921

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:		

FEH: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow (m^3)
Catchment Area	FEH: 100 years: +40 %: 15 mins: Winter	0.02	11.9	5.506
Catchment Area (1)	FEH: 100 years: +40 %: 15 mins: Winter	0.01	6.0	2.787
Catchment Area (2)	FEH: 100 years: +40 %: 15 mins: Winter	0.01	9.3	4.308
Catchment Area (3)	FEH: 100 years: +40 %: 15 mins: Winter	0.02	16.7	7.695
Catchment Area (5)	FEH: 100 years: +40 %: 15 mins: Winter	0.02	14.6	6.763
Catchment Area (7)	FEH: 100 years: +40 %: 15 mins: Winter	0.01	4.9	2.242
Catchment Area (8)	FEH: 100 years: +40 %: 15 mins: Winter	0.01	9.5	4.380
Catchment Area (4)	FEH: 100 years: +40 %: 15 mins: Winter	0.01	5.3	2.467
Catchment Area (6)	FEH: 100 years: +40 %: 15 mins: Winter	0.01	5.8	2.686

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		

FEH: 2 years: Increase Rainfall (%): +0: Critical Storm Per Item

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
SW1	FEH: 2 years: +0 %: 15 mins: Winter	48.750	48.350	48.390	0.040	2.6	0.003	0.000	2.5	1.209	OK
SW2	FEH: 2 years: +0 %: 15 mins: Winter	48.750	48.243	48.284	0.041	3.8	0.012	0.000	3.7	1.820	OK
SW3	FEH: 2 years: +0 %: 15 mins: Winter	48.750	47.772	47.814	0.042	5.7	0.027	0.000	5.4	2.756	OK
SW4	FEH: 2 years: +0 %: 360 mins: Winter	49.000	47.546	47.681	0.135	1.9	0.153	0.000	1.9	16.398	OK
SW7	FEH: 2 years: +0 %: 360 mins: Winter	48.800	47.400	47.681	0.281	0.6	0.318	0.000	0.5	18.324	Surcharged
SW8	FEH: 2 years: +0 %: 720 mins: Summer	48.700	47.329	47.346	0.017	0.5	0.003	0.000	0.5	25.840	OK
SW9	FEH: 2 years: +0 %: 30 mins: Summer	48.700	47.149	47.167	0.018	0.5	0.003	0.000	0.5	1.250	OK
SW10	FEH: 2 years: +0 %: 30 mins: Winter	48.700	46.964	46.982	0.018	0.5	0.003	0.000	0.5	1.252	OK
SW11	FEH: 2 years: +0 %: 30 mins: Winter	47.830	46.912	46.928	0.017	0.5	0.000	0.000	0.5	1.252	OK
Manhole	FEH: 2 years: +0 %: 15 mins: Winter	48.750	48.007	48.047	0.040	3.7	0.006	0.000	3.6	1.817	OK

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		

FEH: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
SW1	FEH: 30 years: +0 %: 15 mins: Winter	48.750	48.350	48.416	0.066	6.5	0.005	0.000	6.4	3.014	OK
SW2	FEH: 30 years: +0 %: 15 mins: Winter	48.750	48.243	48.311	0.068	9.6	0.019	0.000	9.4	4.537	OK
SW3	FEH: 30 years: +0 %: 360 mins: Winter	48.750	47.772	47.995	0.223	2.1	0.142	0.000	2.1	17.979	OK
SW4	FEH: 30 years: +0 %: 360 mins: Winter	49.000	47.546	47.994	0.449	3.8	0.507	0.000	3.3	30.476	Surcharged
SW7	FEH: 30 years: +0 %: 360 mins: Winter	48.800	47.400	47.995	0.595	0.6	0.673	0.000	0.5	19.337	Surcharged
SW8	FEH: 30 years: +0 %: 360 mins: Winter	48.700	47.329	47.346	0.017	0.5	0.003	0.000	0.5	19.298	OK
SW9	FEH: 30 years: +0 %: 360 mins: Winter	48.700	47.149	47.167	0.018	0.5	0.003	0.000	0.5	19.271	OK
SW10	FEH: 30 years: +0 %: 360 mins: Winter	48.700	46.964	46.982	0.018	0.5	0.003	0.000	0.5	19.250	OK
SW11	FEH: 30 years: +0 %: 360 mins: Winter	47.830	46.912	46.929	0.017	0.5	0.000	0.000	0.5	19.250	OK
Manhole	FEH: 30 years: +0 %: 15 mins: Winter	48.750	48.007	48.074	0.067	9.4	0.011	0.000	9.2	4.532	OK

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		

FEH: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
SW1	FEH: 100 years: +0 %: 15 mins: Winter	48.750	48.350	48.428	0.078	8.5	0.006	0.000	8.3	3.936	OK
SW2	FEH: 100 years: +0 %: 15 mins: Winter	48.750	48.243	48.323	0.080	12.6	0.023	0.000	12.3	5.923	OK
SW3	FEH: 100 years: +0 %: 600 mins: Winter	48.750	47.772	48.213	0.441	1.9	0.281	0.000	1.8	26.168	Surcharged
SW4	FEH: 100 years: +0 %: 600 mins: Winter	49.000	47.546	48.213	0.667	3.2	0.755	0.000	2.8	45.068	Surcharged
SW7	FEH: 100 years: +0 %: 600 mins: Winter	48.800	47.400	48.213	0.813	0.6	0.920	0.000	0.6	35.855	Surcharged
SW8	FEH: 100 years: +0 %: 720 mins: Winter	48.700	47.329	47.348	0.019	0.6	0.003	0.000	0.6	42.426	OK
SW9	FEH: 100 years: +0 %: 600 mins: Winter	48.700	47.149	47.168	0.019	0.6	0.003	0.000	0.6	35.787	OK
SW10	FEH: 100 years: +0 %: 480 mins: Winter	48.700	46.964	46.983	0.020	0.6	0.003	0.000	0.6	28.808	OK
SW11	FEH: 100 years: +0 %: 480 mins: Winter	47.830	46.912	46.930	0.019	0.6	0.000	0.000	0.6	28.808	OK
Manhole	FEH: 100 years: +0 %: 600 mins: Winter	48.750	48.007	48.213	0.206	1.2	0.033	0.000	1.3	17.909	Surcharged

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		

FEH: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
SW1	FEH: 100 years: +40 %: 720 mins: Winter	48.750	48.350	48.466	0.116	1.0	0.008	0.000	1.0	17.093	Flood Risk
SW2	FEH: 100 years: +40 %: 720 mins: Winter	48.750	48.243	48.466	0.223	1.5	0.063	0.000	1.5	25.754	Flood Risk
SW3	FEH: 100 years: +40 %: 720 mins: Winter	48.750	47.772	48.466	0.694	2.3	0.441	0.000	2.0	37.555	Flood Risk
SW4	FEH: 100 years: +40 %: 720 mins: Winter	49.000	47.546	48.465	0.920	3.8	1.040	0.000	3.6	65.578	Surcharged
SW7	FEH: 100 years: +40 %: 720 mins: Winter	48.800	47.400	48.466	1.066	0.7	1.205	0.000	0.6	48.578	Surcharged
SW8	FEH: 100 years: +40 %: 360 mins: Winter	48.700	47.329	47.349	0.020	0.6	0.003	0.000	0.7	24.387	OK
SW9	FEH: 100 years: +40 %: 360 mins: Winter	48.700	47.149	47.170	0.021	0.7	0.003	0.000	0.6	24.355	OK
SW10	FEH: 100 years: +40 %: 360 mins: Winter	48.700	46.964	46.985	0.021	0.6	0.003	0.000	0.6	24.330	OK
SW11	FEH: 100 years: +40 %: 720 mins: Winter	47.830	46.912	46.931	0.020	0.7	0.000	0.000	0.7	48.479	OK
Manhole	FEH: 100 years: +40 %: 720 mins: Winter	48.750	48.007	48.465	0.459	1.5	0.073	0.000	1.5	26.083	Flood Risk

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

FEH: 2 years: Increase Rainfall (%): +0: Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Tank	FEH: 2 years: +0 %: 360 mins: Winter	47.681	47.681	0.231	0.231	2.8	14.954	0.000	0.000	0.6	18.652	78	OK
Porous Paving	FEH: 2 years: +0 %: 15 mins: Summer	48.312	48.300	0.000	0.000	0.0	0.000	0.000	0.000	0.0	0.000	100	OK
Porous Paving (1)	FEH: 2 years: +0 %: 15 mins: Summer	48.326	48.300	0.000	0.000	0.0	0.000	0.000	0.000	0.0	0.000	100	OK
Porous Paving (2)	FEH: 2 years: +0 %: 5760 mins: Summer	48.552	48.552	0.421	0.452	0.1	15.938	0.000	0.000	0.0	0.672	25	OK

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

FEH: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Tank	FEH: 30 years: +0 %: 360 mins: Winter	47.995	47.995	0.545	0.545	5.2	35.183	0.000	0.000	0.6	20.412	49	OK
Porous Paving	FEH: 30 years: +0 %: 15 mins: Summer	48.312	48.300	0.000	0.000	0.0	0.000	0.000	0.000	0.0	0.000	100	OK
Porous Paving (1)	FEH: 30 years: +0 %: 15 mins: Summer	48.326	48.300	0.000	0.000	0.0	0.000	0.000	0.000	0.0	0.000	100	OK
Porous Paving (2)	FEH: 30 years: +0 %: 4320 mins: Winter	48.552	48.552	0.421	0.452	0.1	15.944	0.000	0.000	0.0	1.192	25	OK

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

FEH: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Tank	FEH: 100 years: +0 %: 600 mins: Winter	48.213	48.213	0.763	0.763	4.4	49.300	0.000	0.000	0.6	37.040	28	OK
Porous Paving	FEH: 100 years: +0 %: 15 mins: Summer	48.312	48.300	0.000	0.000	0.0	0.000	0.000	0.000	0.0	0.000	100	OK
Porous Paving (1)	FEH: 100 years: +0 %: 15 mins: Summer	48.326	48.300	0.000	0.000	0.0	0.000	0.000	0.000	0.0	0.000	100	OK
Porous Paving (2)	FEH: 100 years: +0 %: 4320 mins: Winter	48.552	48.552	0.421	0.452	0.1	15.946	0.000	0.000	0.0	1.979	25	OK

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

FEH: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Tank	FEH: 100 years: +40 %: 720 mins: Winter	48.466	48.466	1.016	1.016	5.7	65.602	0.000	0.000	0.7	58.839	4	OK
Porous Paving	FEH: 100 years: +40 %: 720 mins: Winter	48.466	48.466	0.154	0.166	1.0	1.608	0.000	0.000	0.1	1.348	72	OK
Porous Paving (1)	FEH: 100 years: +40 %: 720 mins: Winter	48.465	48.466	0.140	0.166	1.6	2.871	0.000	0.000	0.1	2.229	74	OK
Porous Paving (2)	FEH: 100 years: +40 %: 960 mins: Winter	48.557	48.557	0.426	0.457	0.7	16.125	0.000	0.000	0.1	0.928	24	OK

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

FEH: 2 years: Increase Rainfall (%): +0: Critical Storm Per Item

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.007	FEH: 2 years: +0 %: 480 mins: Summer	Pipe	SW8	SW9	48.7	47.346	0.017	23.152	0.4	0.03	0.5	OK
1.008	FEH: 2 years: +0 %: 30 mins: Summer	Pipe	SW9	SW10	48.7	47.167	0.018	1.250	0.4	0.03	0.5	OK
1.009	FEH: 2 years: +0 %: 30 mins: Winter	Pipe	SW10	SW11	48.7	46.982	0.017	1.252	0.4	0.03	0.5	OK
Pipe	FEH: 2 years: +0 %: 15 mins: Winter	Pipe	SW1	SW2	48.8	48.390	0.040	1.209	0.7	0.14	2.5	OK
Pipe (2)	FEH: 2 years: +0 %: 15 mins: Winter	Pipe	SW3	SW4	48.8	47.814	0.052	2.756	0.6	0.03	5.4	OK
Pipe (5)	FEH: 2 years: +0 %: 15 mins: Summer	Pipe	Tank	SW7	49.0	47.541	0.116	0.920	0.1	0.01	1.7	OK
Pipe (6)	FEH: 2 years: +0 %: 120 mins: Winter	Pipe	SW7	SW8	48.8	47.646	0.017	5.941	0.4	0.03	0.5	Surcharged
Pipe (3)	FEH: 2 years: +0 %: 15 mins: Winter	Pipe	SW4	Tank	49.0	47.608	0.065	4.952	1.0	0.05	9.7	OK
Pipe (4)	FEH: 2 years: +0 %: 15 mins: Summer	Pipe	Porous Paving	Tank	49.0	48.300	0.045	0.000	0.0	0	0.0	OK
Pipe (7)	FEH: 2 years: +0 %: 15 mins: Summer	Pipe	Porous Paving (1)	Tank	49.0	48.300	0.045	0.000	0.0	0	0.0	OK
Pipe (1)	FEH: 2 years: +0 %: 15 mins: Winter	Pipe	SW2	Manhole	48.8	48.284	0.040	1.820	1.0	0.15	3.7	OK
Pipe (1) (1)	FEH: 2 years: +0 %: 15 mins: Winter	Pipe	Manhole	SW3	48.8	48.047	0.041	1.817	0.9	0.15	3.6	OK
Pipe (8)	FEH: 2 years: +0 %: 5760 mins: Summer	Pipe	Porous Paving (2)	Manhole	48.8	48.536	0.004	0.670	0.0	0	0.0	Surcharged

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

FEH: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.007	FEH: 30 years: +0 %: 360 mins: Winter	Pipe	SW8	SW9	48.7	47.346	0.018	19.298	0.4	0.03	0.5	OK
1.008	FEH: 30 years: +0 %: 360 mins: Winter	Pipe	SW9	SW10	48.7	47.167	0.018	19.271	0.4	0.03	0.5	OK
1.009	FEH: 30 years: +0 %: 360 mins: Winter	Pipe	SW10	SW11	48.7	46.982	0.018	19.250	0.4	0.03	0.5	OK
Pipe	FEH: 30 years: +0 %: 15 mins: Winter	Pipe	SW1	SW2	48.8	48.416	0.067	3.014	0.8	0.36	6.4	OK
Pipe (2)	FEH: 30 years: +0 %: 15 mins: Winter	Pipe	SW3	SW4	48.8	47.838	0.087	6.917	0.7	0.07	13.9	OK
Pipe (5)	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	Tank	SW7	49.0	47.676	0.251	1.366	0.3	0.02	2.2	OK
Pipe (6)	FEH: 30 years: +0 %: 360 mins: Winter	Pipe	SW7	SW8	48.8	47.995	0.018	19.317	0.4	0.03	0.5	Surcharged
Pipe (3)	FEH: 30 years: +0 %: 15 mins: Winter	Pipe	SW4	Tank	49.0	47.702	0.204	11.492	1.2	0.13	24.0	OK
Pipe (4)	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	Porous Paving	Tank	49.0	48.300	0.100	0.000	0.0	0	0.0	OK
Pipe (7)	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	Porous Paving (1)	Tank	49.0	48.300	0.100	0.000	0.0	0	0.0	OK
Pipe (1)	FEH: 30 years: +0 %: 15 mins: Winter	Pipe	SW2	Manhole	48.8	48.311	0.068	4.537	1.2	0.38	9.4	OK
Pipe (1) (1)	FEH: 30 years: +0 %: 15 mins: Winter	Pipe	Manhole	SW3	48.8	48.074	0.067	4.532	1.2	0.37	9.2	OK
Pipe (8)	FEH: 30 years: +0 %: 5760 mins: Winter	Pipe	Porous Paving (2)	Manhole	48.8	48.536	0.004	2.357	0.0	0	0.0	Surcharged

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

FEH: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.007	FEH: 100 years: +0 %: 720 mins: Winter	Pipe	SW8	SW9	48.7	47.348	0.019	42.426	0.4	0.03	0.6	OK
1.008	FEH: 100 years: +0 %: 600 mins: Winter	Pipe	SW9	SW10	48.7	47.168	0.019	35.787	0.4	0.04	0.6	OK
1.009	FEH: 100 years: +0 %: 480 mins: Winter	Pipe	SW10	SW11	48.7	46.983	0.019	28.808	0.4	0.03	0.6	OK
Pipe	FEH: 100 years: +0 %: 15 mins: Winter	Pipe	SW1	SW2	48.8	48.428	0.079	3.936	0.9	0.47	8.3	OK
Pipe (2)	FEH: 100 years: +0 %: 15 mins: Winter	Pipe	SW3	SW4	48.8	47.848	0.125	9.032	0.8	0.09	18.2	OK
Pipe (5)	FEH: 100 years: +0 %: 15 mins: Summer	Pipe	Tank	SW7	49.0	47.744	0.319	1.503	0.4	0.02	2.5	OK
Pipe (6)	FEH: 100 years: +0 %: 720 mins: Winter	Pipe	SW7	SW8	48.8	48.204	0.019	42.446	0.4	0.03	0.6	Surcharged
Pipe (3)	FEH: 100 years: +0 %: 15 mins: Winter	Pipe	SW4	Tank	49.0	47.778	0.280	14.711	1.3	0.18	32.1	OK
Pipe (4)	FEH: 100 years: +0 %: 15 mins: Summer	Pipe	Porous Paving	Tank	49.0	48.300	0.100	0.000	0.0	0	0.0	OK
Pipe (7)	FEH: 100 years: +0 %: 15 mins: Summer	Pipe	Porous Paving (1)	Tank	49.0	48.300	0.100	0.000	0.0	0	0.0	OK
Pipe (1)	FEH: 100 years: +0 %: 15 mins: Winter	Pipe	SW2	Manhole	48.8	48.323	0.080	5.923	1.3	0.5	12.3	OK
Pipe (1) (1)	FEH: 100 years: +0 %: 15 mins: Winter	Pipe	Manhole	SW3	48.8	48.086	0.078	5.919	1.3	0.49	12.1	OK
Pipe (8)	FEH: 100 years: +0 %: 480 mins: Winter	Pipe	Porous Paving (2)	Manhole	48.8	48.406	0.100	0.002	0.0	0	0.0	Surcharged

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

FEH: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item

Project:	Date: 18/12/2022		
	Designed by: h.patel	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.007	FEH: 100 years: +40 %: 360 mins: Winter	Pipe	SW8	SW9	48.7	47.349	0.020	24.387	0.5	0.04	0.7	OK
1.008	FEH: 100 years: +40 %: 360 mins: Winter	Pipe	SW9	SW10	48.7	47.170	0.021	24.355	0.4	0.04	0.6	OK
1.009	FEH: 100 years: +40 %: 720 mins: Winter	Pipe	SW10	SW11	48.7	46.985	0.020	48.479	0.5	0.04	0.7	OK
Pipe	FEH: 100 years: +40 %: 15 mins: Winter	Pipe	SW1	SW2	48.8	48.449	0.100	5.505	0.9	0.66	11.7	OK
Pipe (2)	FEH: 100 years: +40 %: 15 mins: Winter	Pipe	SW3	SW4	48.8	47.901	0.242	12.026	0.8	0.13	25.6	OK
Pipe (5)	FEH: 100 years: +40 %: 15 mins: Summer	Pipe	Tank	SW7	49.0	47.856	0.375	1.739	0.4	0.02	3.3	Surcharged
Pipe (6)	FEH: 100 years: +40 %: 360 mins: Winter	Pipe	SW7	SW8	48.8	48.441	0.020	24.410	0.5	0.04	0.6	Surcharged
Pipe (3)	FEH: 100 years: +40 %: 15 mins: Winter	Pipe	SW4	Tank	49.0	47.901	0.375	19.745	1.3	0.25	44.8	OK
Pipe (4)	FEH: 100 years: +40 %: 180 mins: Winter	Pipe	Porous Paving	Tank	49.0	48.373	0.100	0.000	0.0	0.01	0.1	OK
Pipe (7)	FEH: 100 years: +40 %: 360 mins: Winter	Pipe	Porous Paving (1)	Tank	49.0	48.428	0.100	0.000	0.0	0	0.1	Surcharged
Pipe (1)	FEH: 100 years: +40 %: 15 mins: Winter	Pipe	SW2	Manhole	48.8	48.345	0.101	8.289	1.4	0.7	17.4	OK
Pipe (1) (1)	FEH: 100 years: +40 %: 15 mins: Winter	Pipe	Manhole	SW3	48.8	48.107	0.095	8.284	1.4	0.68	16.9	OK
Pipe (8)	FEH: 100 years: +40 %: 960 mins: Winter	Pipe	Porous Paving (2)	Manhole	48.8	48.541	0.100	0.926	0.0	0.01	0.1	Surcharged

Prepared by: Heeta Patel	Signed: Heeta Patel	Date: 14.04.23
Reviewed by: Leon Furness	Signed: Leon Furness	Date: 14.04.23