Bridgewater Retail Park

Uxbridge Road

Hayes

UB4 0RH

Flood Risk Assessment
& Drainage Strategy Report

for

OXW Hayes S.à.r.l

Ref: 21093-BGL-XX-XX-RP-D-0001

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Uxbridge Road
Hayes
UB4 0RH

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Burrows Graham Limited has prepared this report in accordance with the instructions of the above named Client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

CONTENTS

1.0 EXECUTIVE SUMMARY

The development proposal is for the demolition of existing retail buildings and the development of a single Class E(g)ii, E(g)iii, B2 and B8 use employment unit with ancillary office accommodation, including new vehicular access, associated external yard areas, HGV and car parking, servicing, external lighting, landscaping, infrastructure and associated works at a site known as Bridgewater Retail Park, Uxbridge Road, Hayes, UB4 0RH.

An initial review of the site topographical and GPR survey indicates that the surface water drainage currently outfalls unrestricted to the adjacent Yeading Brook immediately to the east of the site.

In accordance with the NPPF and local strategic flood risk assessment, this report has studied and assessed the flood risk to the site by all sources. A review of the EA indicative Flood Maps shows that the majority of the site is located within Flood Zone 2, i.e. land defined as having less than 1 in 100 but greater than a 1 in 1000 annual probability of flooding from river or sea in any year. However, a review of the EA Product 4 detailed flood model levels for the adjacent Yeading Brook has identified that this map is incorrect and the majority of the site is in fact located in low risk Flood Zone 1, except for a small area in the south east corner away from the proposed building. The site is defined as 'less vulnerable' such that the development can be considered 'appropriate' in accordance with NPPF guidelines. As the majority of the site is located within Flood Zone 1, the sequential and exception tests are not required by the local authority. Further to this, the site is considered to be at 'low risk' from all sources of flooding; tidal, fluvial, pluvial, sewer, groundwater and artificial sources.

The surface drainage strategy as outlined below is to restrict the proposed flow rate to ensure that the flood risk to the site and surrounding catchment is reduced by the new development. The drainage hierarchy has been considered in the drainage strategy discussed in Section 5. The surface water runoff will be collected from the impermeable areas and directed via the underground network towards the existing surface water drainage that outfalls to Yeading Brook. Although the existing site is largely impermeable, the runoff rates will be restricted to Greenfield Rates for the respective storm events in line with Hillingdon Council policy. This incorporates a minimum 98% reduction in predevelopment discharge rates. Due to the restriction in flow rates, the surface water will be attenuated within below ground geocellular attenuation tanks. The SuDS hierarchal approach will also be considered with permeable paving incorporated in the design. A detailed Drainage layout with hydraulic calculations has been prepared to support this approach and can be found in the Appendices.

There is no residual flood risk from the development site to the surrounding district due to the reduction in storm water flow rates. The development does not therefore increase the risk of flooding to other adjacent neighbourhoods. Out of chamber or gully flooding for the extreme 100 year plus climate change event may occur within the development site and is classed as exceedance flows. Flood water from this event will be contained within the development site and directed away from the unit to the external yards and hard landscaped areas.

Foul flows will be collected by a new gravity network and discharge to the existing Thames Water foul water sewer network in Uxbridge Road via an existing connection.

2.0 DEVELOPMENT DETAILS

2.1 CONTEXT

This Flood Risk Assessment & Drainage Strategy report has been prepared by Burrows Graham Ltd. on behalf of OXW Hayes S.à.r.l to support the planning application for the Demolition of the existing retail park and the development of a Class E(g)ii, E(g)iii, B2 and B8 use employment unit with ancillary office accommodation, including new vehicular access, associated external yard areas, HGV and car parking, servicing, external lighting, landscaping, infrastructure and associated works at a site known as Bridgewater Retail Park, Uxbridge Road, Hayes, UB4 0RH.

2.2 LOCATION

Site Name:	Bridgewater Retail Park, Uxbridge Road, Hayes, UB4 0RH.
Grid Reference:	511518, 180504
Application Area:	2.88 Ha
Site Description:	The broadly rectangular shape of the site encompasses a number of retail units with external parking areas. The site is currently accessed from Uxbridge Road and is located within the Uxbridge area, approximately 3km to the east of the Hayes Town Centre. The proposed development is within a largely retail and commercial led area with other units to the east, south & west. Flowing south along the eastern boundary is Yeading Brook. Residential areas are located north of the site beyond Uxbridge Road The application boundary site area measures 2.88 hectares and is located within the Hillingdon Council area. A review of the topographical information indicates the site to be flat with a moderate fall from north at 29.00m AOD to the south at 28.00m AOD.

Figure 1: Site Location

3.0 PLANNING OBLIGATIONS

3.1 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

Local planning authorities are advised by the National Planning Policy Framework (NPPF 2021) to consult the Environment Agency (EA) and Lead Local Flood Authorities (LLFA) on all developments of an area greater than 1Ha and those that are at an increased risk of flooding.

This report has been prepared to assess the requirements of the NPPF in accordance with the current EA and LLFA policies and will primarily assess the following;

- Determining whether the site is likely to be affected by flooding and whether it would increase flood risk elsewhere.
- Assessing whether the proposed development is appropriate in the suggested location.
- Detailing any measures necessary to mitigate any flood risk identified, to ensure that the proposed development and occupants would be safe, and that flood risk would not be increased elsewhere.
- Determine the current surface water drainage regime and assess any potential increase in surface water runoff as a result of the proposed development.
- Discuss Sustainable Drainage Systems (SuDS) as an option for reducing surface water flood risk.
- Devise an appropriate surface water drainage strategy (including calculation where appropriate) to deal with any potential increase in surface water runoff and include for climate change.
- Include the appropriate climate change allowances for both fluvial and surface water runoff.
- Consider the recommendations of the Hillingdon Council Strategic Flood Risk Assessment (SFRA) and other local policies.

A review of the EA indicative Flood Maps shows that the majority of the site is located within Flood Zone 2, i.e. land defined as having less than 1 in 100 but greater than a 1 in 1000 annual probability of flooding from river or sea in any year. However, a review of the EA Product 4 detailed flood model levels for the adjacent Yeading Brook has identified that these maps are incorrect and the majority of the site is in fact located in low risk Flood Zone 1, except for a small area in the south east corner. The site is defined as 'less vulnerable' such that the development can be considered 'appropriate' in accordance with NPPF guidelines. As the site is located within Flood Zone 1, the sequential and exception tests are not required by the local authority.

3.2 STRATEGIC FLOOD RISK ASSESSMENT

The aim of a Strategic Flood Risk Assessment (SFRA) is to assess the risks in a particular area with regard to all types of flooding and to determine how much development is permitted in that area. It can assess this by looking at how drainage systems in the area should function and how risks in vulnerable areas can be reduced and/or mitigated. The NPPF states that regional planning bodies (RPB's) or local planning authorities should prepare SFRA's in consultation with the EA.

The SFRA provides a detailed understanding of flood risk across all areas and from all sources. It states that the sequential and exception tests must be provided where applicable and climate change must be taken into consideration over the lifespan of the development.

The full report can be obtained from the Hillingdon Council website.

3.3 LOCAL FLOOD RISK MANAGEMENT STRATEGY

The aim of this document is to set out the council's approach to managing flood risk in the short and long term. It outlines how Hillingdon Council will engage with others to mitigate the flood risk to neighbouring catchments, in particular those areas which have increased flood risk. The proposed development is not within a critical drainage catchment and the drainage strategy has been produced in line with the fundamental principles set out.

3.4 HILLINGDON COUNCIL POLICIES

Hillingdon Council in consultation with a number of other local Boroughs have produced the West London Strategic Flood Risk Assessment to demonstrate and define its understanding and role in managing flood risk across all Boroughs. A fundamental aim of the strategy is that Hillingdon Council embraces and supports its role as Lead Local Flood Authority for the area, and this means taking the lead in helping with infrastructure development and re-development and working with other bodies in dealing with flood risk. The Council wants to encourage and wherever possible enforce current thinking and guidance and be able to provide improvements through working better together. The Strategy is aimed at providing an overview and assessment of local flood risk in Hillingdon, setting out objectives and measures for how Hillingdon Council will manage and reduce local flood risk. This Strategy builds on existing and developing approaches to flood risk management and promotes the use of a wide range of measures to manage flood risk. Risk should be managed in a co-ordinated way within catchments and balance the needs of communities, the economy and the environment.

The main objectives of the report are:

1) To better understand local flood risk and make best use of available information in order to better manage flood risk to people, businesses, property, infrastructure and the natural environment;
2) To reduce the potential impact and costs of flooding in the Borough;
3) To ensure resilience of local water bodies and drainage assets;
4) To ensure appropriate development in areas of flood risk;
5) To develop a collaborative partnership approach to flood risk management, and cooperate with other Risk Management Authorities (RMAs) and key stakeholders working across catchments;
6) To assist communities in understanding information on flood risk and supporting themselves;
7) To encourage, support and provide flood risk management which seeks to enhance and protect the environment.

3.5 LONDON PLAN POLICIES

In 2021 the Greater London Authority (GLA) provided an update to the London Plan, a strategic plan for London that set out integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. Chapter 9 of the London Plans incorporates Sustainable Infrastructure, with Policy SI 12 covering Flood Risk Management and Policy SI 13 covering Sustainable Drainage.

These sections of the London Plan have been assessed for this scheme as part of this FRA and all the main elements such as reducing flood risk and incorporating SuDS methods have all been incorporated.

4.0 FLOOD RISK

The NPPF guidelines require the developer to assess the impact of the proposed development runoff on the downstream catchment in conjunction with assessing the risk of runoff from the surrounding area on the proposed development layout.

In the following sections the flood risk to the site from all sources will be assessed. As the site will restrict the surface water runoff there is no increased flood risk to the downstream network.

4.1 FLUVIAL & TIDAL FLOODING

The site is not located near the sea or a tidally influenced watercourse, therefore the risk of tidal flooding is deemed to be very low.

The closest identified watercourse is Yeading Brook, flowing south immediately east of the site boundary.

The National Planning Policy Framework (NPPF) categorises flood risk as follows:

- Zone 1 (low probability) – Land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding (<0.1%);
- Zone 2 (medium probability) – Land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year; and
- Zone 3a (high probability) - Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- 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 EA. (Not separately distinguished from Zone 3a on the Flood Map).

Figure 2 below locates the site on the Environment Agency's (EA) indicative floodplain map. This indicates that the majority of the site is located within Flood Zone 2, i.e. land defined as having less than 1 in 100 but greater than a 1 in 1000 annual probability of flooding from river or sea in any year. The Product 4 Flood data has been obtained from the Environment Agency. Assessing this data for the peak 100, 100 + 35% climate change and 1000-year return period events against the site-specific topographical survey has confirmed that there is no flooding for the 1 in 100 year and 1 in 100 year plus climate change and only a small area of the south east corner would be impacted by the 1 in 1000 year event. Thus the majority of the site is actually located in low risk Flood Zone 1. Although considered low, the risk from fluvial flood water requires further consideration. Refer to Section 5 for details.

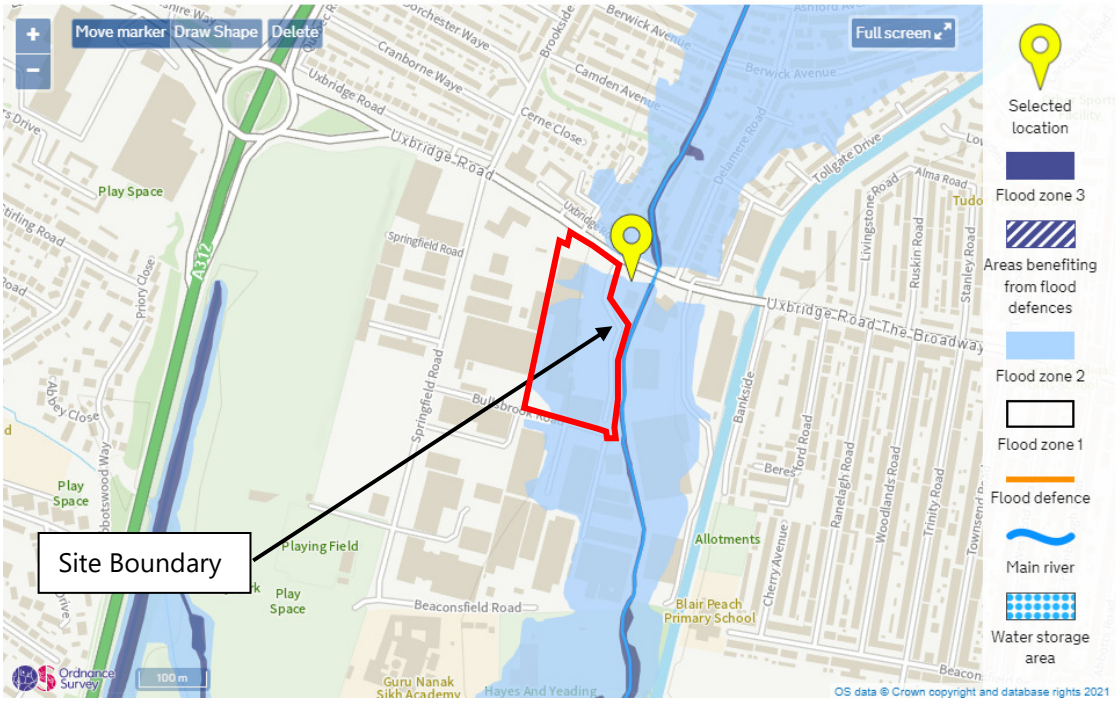

Figure 2: Extract from EA Fluvial Flood Risk Maps

4.2 SURFACE WATER FLOODING

The EA descriptions for the High, Medium and Low risk scenarios for surface water flooding are as follows:

- High risk means that each year this area has a chance of flooding of greater than 3.3%.
- Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%.
- Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.
- Very Low risk means that each year this area has a chance of flooding of less than 0.1%.

A review of the EA surface water flood maps (Figure 3 below) shows that the site is predominantly classified as 'Very low risk' with some minor areas of 'low, medium and high risk' located at various points around the site. These low-risk areas are primarily due to the low-lying areas in the existing topography where the water can hold on the surface. The maps do not take account that the drainage infrastructure serving these areas would reduce the surface flooding.

The development will mitigate against this risk by modifying the existing levels to suit the development intent and directing all impermeable areas into a new underground drainage network and as such will not pose a flood risk to the development.

Furthermore there are no existing surface water flow routes through the site that would need to be maintained. Therefore, based on this assessment, the site can be considered at low risk from surface water flooding.

Figure 3: Extract from EA Surface Water Flood Risk Maps

4.3 GROUNDWATER FLOODING

Groundwater flooding occurs when the water table, the level of water below the ground, rises above the ground surface or into cellars and basements. Groundwater flooding is most likely to occur in low lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks.

As the existing retail park is currently still trading there has been no opportunity to carry out a Phase 2 site investigation. A review of the BGS online ground data would indicate the existing strata to encompass silts and clays over London Clay. It would be expected that any groundwater levels to be hydraulically linked to the adjacent Yeading Brook. As this is set down some 3m below the general levels of the development site, the risk of groundwater flooding is considered to be low.

According to information contained within the SFRA there are no documented records of groundwater flooding within the Hillingdon District and the risk of groundwater flooding within the district is low.

4.4 SEWER FLOODING

The Thames Water (TW) sewer records have been reviewed and confirm that there is a 375mm diameter surface water sewer cutting across the north east corner of the site adjacent Uxbridge Road and outfalls to Yeading Brook. There is also a 600mm diameter surface water sewer flowing east within Bullsbrook Road to the south of the site, again outfalling to Yeading Brook. Small diameter foul sewers are also identified within the public highways, both north and south of the site.

A GPR survey has been undertaken within the site. This has identified a large private surface water drainage network that collects the runoff from the roof & car parking areas and outfalls unrestricted to Yeading Brook via a single headwall. The existing foul drainage outfalls to the Thames Water sewer in Uxbridge Road to the north.

All the Thames Water public sewers are set down from the proposed finished floor level of the building. Furthermore, the extensive drainage network serving the surrounding urban district ensures that the development footprint is protected from the impact of both upstream and downstream runoff. It is speculated that complete protection may well exist beyond a storm event equivalent to the 30-year statistical event. Beyond this projection, there may be a small degree of peripheral 'Exceedance' flooding within the areas above the sewers. However, this is expected to be localised and restricted to the location of specific manhole covers located outside the development footprint. Thus, flood risk to the site from sewers is diminished to acceptable levels and considered to be low.

4.5 ARTIFICIAL FLOODING

A review of the EA online mapping tool shows that the site is located in an area with low risk of flooding from reservoirs and other artificial features.

5.0 ASSESSMENT OF FLOOD RISK ON PROPOSED DEVELOPMENT

5.1 SUMMARY

As discussed in Section 3, the development site has been categorised in accordance with the SFRA and EA Flood Maps as being located within a Medium flood risk area from fluvial flooding. This is related to flood risk from the Yeading Brook to the east.

Other flood risk sources such as groundwater, sewer and overland flows have been considered and have been found not to be a flood risk generator to the site.

5.2 FLOODING FROM YEADING BROOK

Yeading Brook is located 20m to the east of the site and flows in a southerly direction towards the River Crane.

The EA have been consulted and have provided flood level data as taken from the River Crane Mapping Study (Halcrow 2008). Refer to Appendix F for full details. Table 1 provides the various flood level data from this model at the nearest node point for the various storm events with climate change also taken into account.

Node Ref:	**1 in 100 year (1% AEP)**	**1 in 100 year + 35% CC (1% AEP + 35%)**	**1 in 1000 year (0.1% AEP)**
Y727U	27.64m AOD	27.81m AOD	29.11m AOD

Table 1: Peak Flood Level of Mayes Brook

The EA flood mapping as shown in Appendix F indicates the south eastern corner of site to be located within the 1 in 1000 modelled flood extents. This aligns with the flood modelling maps within the Product 4 data request, but is significantly less than the extent shown on the indicative online flood maps.

When assessing these flood levels against the site-specific topographical survey has confirmed that the flood extent aligns exactly with the EA's flood maps shown in Appendix F.

The finished floor level of the new building will be set at 29.975m AOD (+/- 150mm). This level is a minimum 0.865m higher than the 1 in 1000 year event level and therefore confirms that there is no flood risk to the proposed building or to the future occupiers.

6.0 DRAINAGE STRATEGY

6.1 EXISTING DRAINAGE & FLOW RATES

The site area currently encompasses a number of existing retail buildings with external parking and a rear service yard. These all positively drain unrestricted via a private below ground surface water drainage network to Yeading Brook. As such the site is considered to be fully brownfield for drainage purposes.

The existing flow from the site has been defined in the table below for the impermeable areas currently draining direct to the sewer network.

	Area (ha)	1 year	30 year	100 year
Brownfield Runoff Rates	2.86	238 l/s (30mm/hr)	516 l/s (65mm/hr)	755 l/s (95mm/hr)

Table 2: Existing Brownfield Runoff Rates

The existing greenfield flow rates from the site as based on the proposed impermeable areas have been defined in Table 3 below:

	Area (ha)	1 year	Qbar	30 year	100 year
Greenfield Runoff Rates	2.84	4.0 l/s	4.7 l/s	10.6 l/s	15 l/s

Table 3: Existing Greenfield Runoff Rates

6.2 GEOLOGY

As the existing retail park is currently still trading there has been no opportunity to carry out a Phase 2 site investigation. A review of the BGS online ground data would indicate the existing strata to encompass silts and clays over London Clay. At this time, infiltration has been discounted as a means of draining the site. In due course and when access is possible, formal BRE 365 infiltration tests will be undertaken across the site to determine if infiltration is a viable means of draining the site.

6.3 SUSTAINABLE DRAINAGE

Sustainable Drainage Systems (SuDS) are utilised in line with the CIRIA 753 guidance, local Hillingdon Policy and the London Plan policy SI 13 with the aim to minimise the development's impact on the runoff quantity and quality and maximise amenity and biodiversity opportunities.

The management train approach is a fundamental principle of SuDS systems, it aims to primarily reduce pollution, flow rates and volume of runoff from the site. The main objective is to treat the runoff as close to the source as possible and it is imperative that at least two of the following should be included within the drainage strategy.

- **Prevention** – The use of good site design and rainwater re-use measures to prevent runoff.
- **Source Control** – Controlling the runoff as close to source as possible by using green roofs, porous pavements and soakaways.
- **Site Control** – Use of water management techniques within local area, i.e. detention basins and geocellular storage.
- **Regional Control** – Management of water from a number of sites in a specific location, ie. balancing ponds and wetlands.

At this time and subject to formal soakaway tests, the drainage strategy for this development will incorporate source control and site control methods. Source control in the form of permeable surfacing in the car parking areas, and site control in the form of geocellular attenuation tanks to retain the peak flows.

Whilst it would be beneficially to include more of these techniques, the available space on site means it is not viable to include any additional above ground 'Green' SuDS measures.

6.4 SURFACE WATER STRATEGY

Based on the SuDS review, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail in Table 4 below:

Method	Suitability	Suitability for Development
Infiltration to Ground	Maybe	No Phase 2 site investigation has been carried out at the site. When access is possible, formal soakaway tests are to be undertaken to define if infiltration is feasible.
Connection to Watercourse	Yes	The closest watercourse is Yeading Brook. The existing outfall from the site to this brook will be reused at restricted Greenfield rates.
Connection to Surface Water Sewer	No	There are other viable options which would take precedence.
Connection to a Combined Sewer	No	There are other viable options which would take precedence.

Table 4: SuDS Hierarchal Approach

Surface water generated from the roof of the new building will merge with the runoff from the new service yard and direct it through an underground geocellular attenuation tank where a flow control chamber will discharge the flows to Yeading Brook via an existing outfall pipe. This tank will be sized as a minimum to suit the 30-year storm event. In line with Hillingdon Council policy and the London Plan, brownfield sites with a positive outfall shall discharge post development at the respective Greenfield Rates.

Table 5 below defines the post development flows rates based on the local policy. As shown in the table below, these rates incorporate a minimum **98%** reduction in the existing predevelopment discharge rates. Full details of this strategy can be found on the BGL drawing in Appendix C and the hydraulic calculations in Appendix D.

	1 year	**30 year**	**100 year**
Greenfield Runoff Rates	4.0 l/s	10.6 l/s	15 l/s
Existing Brownfield Runoff Rates	238 l/s	516 l/s	755 l/s
BGL Designed Flow Rates	3.9 l/s	8.1 l/s	14.9 l/s
Percentage Reduction in Post Development Runoff Rates	98%	98%	98%

Table 5: Post Development Runoff Rates

The proposed private drainage layout for the new development site will be designed in accordance with BS EN 752: 2008 and Building Regulations part H guidance, i.e. to show no flooding to the 30-year storm return period criterion.

Events exceeding this up to and including the 100 year plus climate change allowance have been assessed. Flooding from these events is classed as exceedance flooding and will be directed away from building, where it will be stored in the low-lying dock areas and drain back into the surface water network as the levels recede.

A climate change factor of **40%** as required by Hillingdon Council has been specified and is deemed appropriate for this development which is primarily low risk (commercial units & car park) with a design life of 30 years.

The London Borough of Hillingdon Drainage Assessment Form has been completed in support of the planning application and can be found in Appendix G.

6.5 WATER QUALITY

Water quality has been considered and the following measures have been included within the surface water drainage proposals:

- Runoff from roofs is generally considered to be clean and will be discharged directly into the surface water network.
- All drainage from car park areas, which are considered low risk, will pass through the permeable paving to provide the necessary treatment.
- All drainage from service yards, which are considered high risk, will pass through a Class 1 full retention separator.
- Silt will be prevented from entering the system by the use of channels with silt traps and catch pits where required.

6.6 MANAGEMENT & MAINTENANCE

The long-term maintenance of the new drainage infrastructure will be with the owner / occupier of the proposed commercial unit in line with best practice guidance. Annual inspections will need to be carried out and clearing of drainage channels, gullies, catchpits and petrol interceptors undertaken. Typically the maintenance regime will be in line with Table 6 below.

Future Maintenance of the Drainage System			
Responsibility	**Feature**	**Maintenance**	**Frequency**
Owner / Occupier / Management Company	Drainage Channel.	Regular maintenance / removal of blockages and silts.	Ad-hoc flushing / jetting and emptying of silt traps required.
	Rainwater gutters, downpipes and above ground drainage.	Regular maintenance and inspections.	Ad-hoc sweeping and emptying of silt and debris required. Annual visual inspections to check for damage/leaks.
	Flow control chambers.	Regular maintenance / removal of blockages and debris.	Annual inspection and following significant rainfall events.
	Geocellular Attenuation / Tanks	Regular maintenance / removal of blockages and debris.	Annual inspection and following significant rainfall events.
	Permeable Paving	Brushing and Vacuuming, removal of weeds	Annual inspection and following significant rainfall events.
	Pipes, sewers, manholes, outfall headwall.	Regular maintenance / removal of blockages and debris.	Annual inspection and removal of silts if required.

Table 6: Outline Management and Maintenance Strategy

6.5 FOUL WATER STRATEGY

Foul flows will discharge to the adjacent TW foul water sewer network located to the north of the site in Uxbridge Road via an existing connection. The site will drain by a private gravity network to this sewer and be designed in line with Building Regulations Guidance.

7.0 MANAGEMENT, MAINTENANCE AND RISK

A private management company will maintain the drainage infrastructure as part of the site wide management and maintenance strategy. Typically, the maintenance regime will be in line with Table 6.

Should exceedance flooding occur, access and egress to the development shall be from the main site access onto Bullsbrook Road to the south or Uxbridge road to the north.

The use of SuDS in the form of Source Control and Site Control measures, will help to minimise the flood risk impact to the surrounding sewer and watercourse network.

Up to and including the 100-year plus increase in rainfall allowance due to climate change (CC) event, the report has justified that there is no risk of flooding to the building or occupiers.

Flood risk to people and property can be managed but it can never be completely removed; a residual risk remains after flood management or mitigation measures have been put in place. This relates to a rainfall event beyond what can be fully quantified.

APPENDIX A – SITE MASTERPLAN

- Dimensions are in millimeters, unless stated otherwise.
- Scaling of this drawing is not recommended.
- It is the recipients responsibility to print this document to the correct scale.
- All relevant drawings and specifications should be read in conjunction with this drawing.

N

SCHEDULE OF ACCOMMODATION

Gross Internal Area (GIA)

Unit 1			
Warehouse Area	-	151,415 ft²	(14,067m²)
2 Storey Office	-	19,181 ft²	(1,782m²)
Transport Office	-	3,433 ft²	(319m²)
Total Area	**-**	**174,030 ft²**	(16,168 m²)

Key

- Application Boundary 7.11 Ac (2.88 Ha)
- Ownership Boundary 7.84 Ac (3.17 Ha)

Unit 1

2 Storey Offices (1st & 2nd)

128 No. Car Parking

2 Storey Transport Office

50000

1 No. Level Access Door

8 No. Dock Loading Doors

8 No. Dock Loading Doors

17 No. HGV Parking Spaces

1 No. Level Access Door

35000

Existing

10m SCALE 1:500

rev	amendments	by	ckd	date

Bridge Retail Park, Hayes

Proposed Site Layout

OXENWOOD REAL ESTATE

GRAFTONGATE

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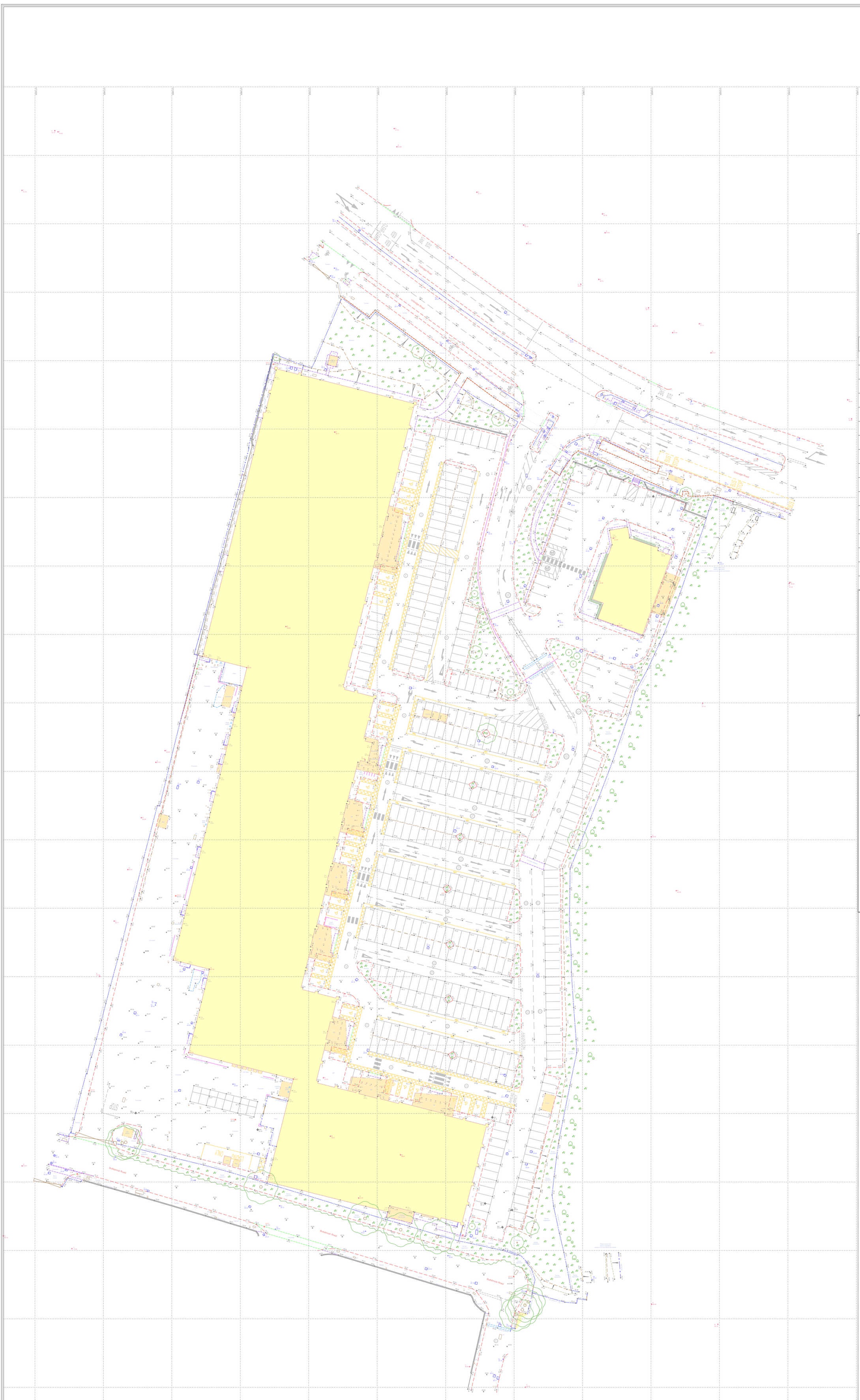
Drawing Status:	Preliminary
Drawn / Checked:	jrh / AJL
Date:	01/12/2021
Scale:	1:500 A1
Drawing no:	Revision:
21048 P0001	A

APPENDIX B – TOPOGRAPHICAL SURVEY



N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
GH1	511545.051	180404.489	29.305
GH2	511559.052	180440.337	29.293
GH3	511540.027	180504.795	29.562
GH3	511540.027	180504.795	29.562
GH5	511551.944	180651.887	30.132
GH6	511579.823	180634.188	30.202
GH7	511631.133	180631.268	29.916
GH10	511559.896	180392.387	28.075
GH11	511487.056	180406.941	29.119
GH12	511432.397	180422.375	30.288
GH13	511435.867	180446.653	30.010
GH14	511461.178	180503.603	29.311
GH15	511478.584	180438.221	29.233
GH16	511467.401	180570.002	29.365
GH17	511532.099	180648.275	29.357
GH18	511578.642	180585.224	29.378
GH19	511489.690	180658.966	29.372

OS Note:

Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.

OS Buildings *Surveyed Buildings*

This survey has been orientated to the Ordnance Survey (O.S) National Grid OSGB36(15) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

Buildings, Wall, Kerb line, Line marking, Drop kerb, Centre line, Top of bank, Overhead Cable, Concrete edge, Tarmac edge, Grass verge, Canopy/Overhang, Verge, Bottom of bank, Station and Name, Station Level, Tree / Bush / Sapling, Area of Undergrowth, Woodland, R: Ridge Level, E: Eaves Level, F: Flat Roof Level, Gate

Fence types: FW Interwoven, FR Iron Railings, WM Wire Mesh, PR Post & Rail, PW Post & Wire, CL Chain Link, WP Wooden Panels, CB Close Boarded, SP Steel Palisade

IC Inspection chamber, PInv Pipe invert, Gy Gully, Bg Back gully, Dp Down pipe, Pipe Pipe above ground, MH Manhole, WL Water level, Fl Flood light, Lp Lamp post, Tp Telegraph post, Ep Electricity post, Tl Traffic light, Bus Bus stop, Sv Stop valve, St Stop tap, Er Earth rod, Wm Water meter, Gas Gas valve, Av Air valve, ICU Unidentified inspection, Wo Wash out, Re Rodding eye, BB Bellsha beacon, CTV Cable tv, Mkr Marker post, Gmkr Gas marker post, So Soffit, Fh Fire hydrant

Bo Bollard, Ill Illuminated bollard, Bin Rubbish bin, Vp Vent pipe, Grd Ground light, Lbox Letter box, Stmp Tree Stump, Sty Stile, IFL Internal floor level, THL Threshold level, Sp Sign post, TH Trialhole, BH Borehole, ELC Electric, BT British Telecom, C'box Control box, TT Tactile, BP Brick paved, CPS Concrete paving slabs, CVR Cover, R/wall Retaining wall, TWL Top of Wall Level, TCL Tree canopy level, G: Girth, MG Multi girth, IC Inspection chamber, CL: Cover level, IL: Invert level, UTR Unable to raise

Rev	Date	Description	Drawn	Q. Ref.

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
- 3D Laser Scanning
- Revit & BIM Models

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CLIENT
Burrows Graham

PROJECT
Hayes Bridge Retail Park, Uxbridge Road, Hayes UB4 0RH

TITLE
Topographical Survey

SCALE	DATE
A1@ 1: 500	08.11.21
DRAWN: LB	QUALITY REF: GH12132

Level datum	See note
Grid orientation	See note
Job number	42047

Drawing No. 42047_T Rev. 0

Comments

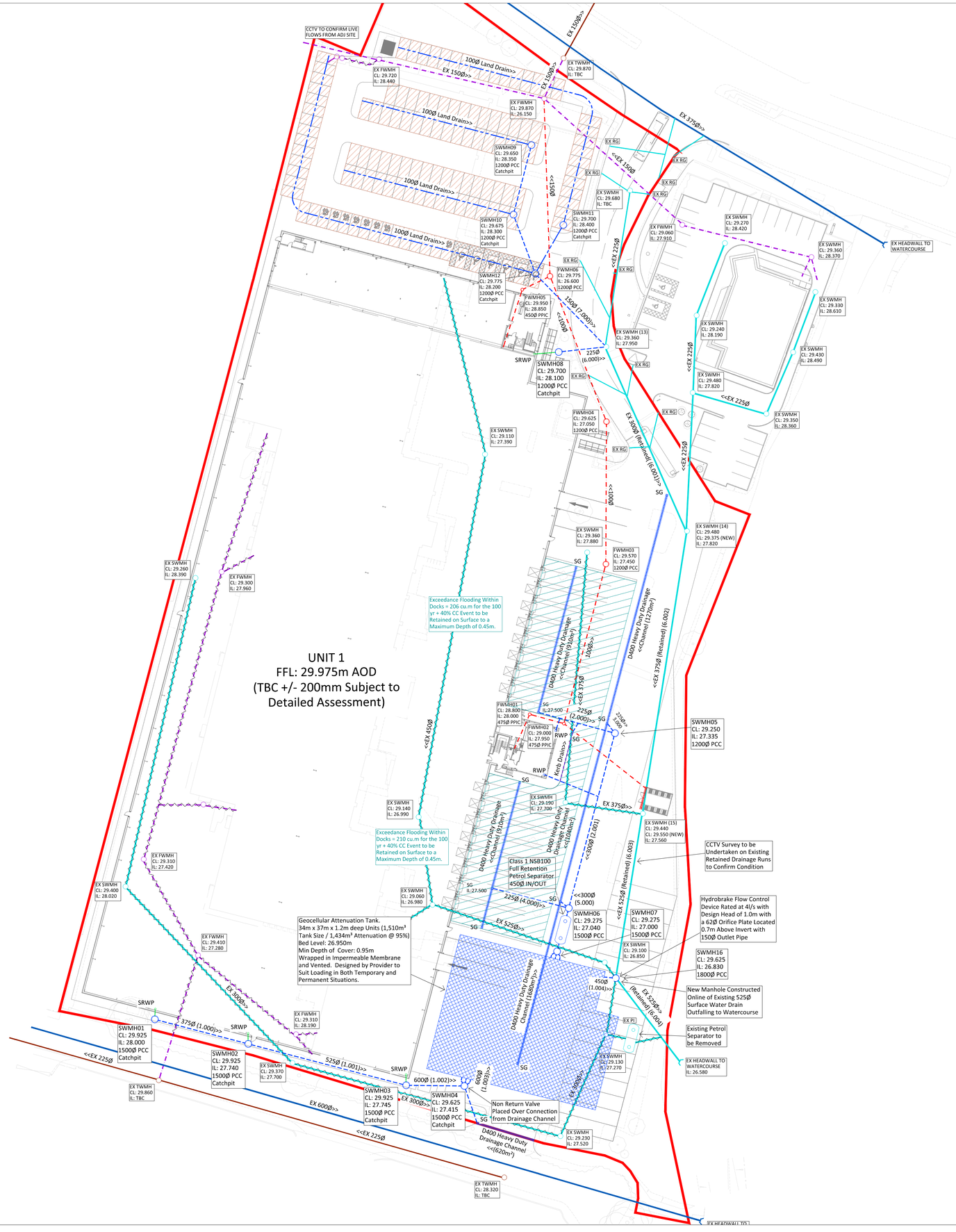
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

APPENDIX C – BGL DRAWINGS



Hydraulic Calculations Summary

	1 year	30 year	100 year
Greenfield Runoff Rates	4.0 l/s	10.6 l/s	15 l/s
Existing Brownfield Runoff Rates	238 l/s	516 l/s	755 l/s
BGL Designed Flow Rates	3.9 l/s	8.1 l/s	14.9 l/s
Percentage Reduction in Post Development Runoff Rates	98%	98%	98%

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION

MAINTENANCE

DEMOLITION

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT

GENERAL NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL THE RELEVANT ARCHITECTS, ENGINEERS' AND SERVICE ENGINEERS DRAWINGS & SPECIFICATIONS.

KEY:

- Existing TW Foul Water Sewer
- Existing Foul Water Drainage
- Existing TW Surface Water Sewer
- Existing Surface Water Drainage
- Existing Drainage to be Abandoned
- Surface Water Drainage Pipe
- Surface Water Drainage Manhole
- Surface Water Drainage Channel
- Foul Water Drainage Pipe
- Foul Water Drainage Manhole
- Filter / Land Drainage Pipe
- Syphonic Drainage Pipe
- Permeable Paving
- Exceedance Flooding for the 100yr + 40% CC Event
- Planning Boundary

Note not all Existing Drainage is Shown on this Drawing. Refer to GPR and Other Surveys for the Full Extent.

REV.	DATE	BY	REVISION	CHK'D
P02	05.05.22	PG	Site Boundary Amended	RM
P01	11.01.22	PG	Preliminary Issue	RM

CLIENT

OXW Hayes S.a.r.l

Burrows Graham
Arden Hall,
66 Brooklands Road,
Sale,
Cheshire
M33 3SJ
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PROJECT

Bridgewater Retail Park
Hayes

DRAWING TITLE

Drainage Strategy Plan

DRAWING STATUS	DRAWN BY
PRELIMINARY	PG
SCALE @ A1: 1:500	DATE: 11.01.22
	CHECKED BY: RM

DRAWING No.: 21093-BGL-XX-XX-DR-C-0250

REV.: P02

0 10 20 30 40 50
SCALE IN METRES

APPENDIX D – BGL HYDRAULIC CALCULATIONS

	Bridge Retail Park Greenfield Rates
Date 11/01/2022 File	Designed by paulg Checked by
Innovyze	Source Control 2017.1.2

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.300
Area (ha)	2.840	Urban	0.000
SAAR (mm)	644	Region Number	Region 6

Results l/s

QBAR Rural	4.7
QBAR Urban	4.7
Q1 year	4.0
Q1 year	4.0
Q30 years	10.6
Q100 years	15.0

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	20.100	Add Flow / Climate Change (%)	0
Ratio R	0.408	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	3.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.756	4-8	0.790	8-12	0.085	12-16	0.085	16-20	0.051

Total Area Contributing (ha) = 2.768

Total Pipe Volume (m³) = 60.086

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	22.000	0.110	200.0	0.356	4.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	38.000	0.190	200.0	0.694	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.002	12.000	0.060	200.0	0.310	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	5.000	0.025	200.0	0.062	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	75.00	4.29	28.000	0.356	0.0	0.0	0.0	1.28	141.1	72.3
1.001	75.00	4.69	27.740	1.050	0.0	0.0	0.0	1.58	342.1	213.3
1.002	75.00	4.80	27.475	1.360	0.0	0.0	0.0	1.72	485.8	276.2
1.003	75.00	4.85	27.415	1.422	0.0	0.0	0.0	1.72	485.8	288.8

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	18.000	0.090	200.0	0.091	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	4.000	0.020	200.0	0.127	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	43.000	0.143	300.0	0.029	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	18.000	0.233	77.3	0.090	4.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	4.000	0.016	250.0	0.272	4.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	10.000	0.033	300.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.003	5.000	0.017	300.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	10.000	0.020	500.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.000	11.000	0.150	73.3	0.085	4.00	0.0	0.600	o	225	Pipe/Conduit	
7.000	24.000	0.160	150.0	0.320	15.00	0.0	0.600	o	100	Pipe/Conduit	
6.001	47.000	0.130	361.5	0.123	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.002	67.000	0.191	350.0	0.209	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.003	53.000	0.212	250.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	75.00	4.33	27.500	0.091	0.0	0.0	0.0	0.92	36.6	18.5
3.000	75.00	4.07	28.000	0.127	0.0	0.0	0.0	0.92	36.6	25.8
2.001	75.00	5.12	27.335	0.247	0.0	0.0	0.0	0.90	63.8	50.2
4.000	75.00	4.20	27.500	0.090	0.0	0.0	0.0	1.49	59.2	18.3
5.000	75.00	4.07	28.000	0.272	0.0	0.0	0.0	0.99	70.0	55.2
2.002	75.00	5.26	27.042	0.609	0.0	0.0	0.0	1.17	185.8	123.7
2.003	75.00	5.33	27.008	0.609	0.0	0.0	0.0	1.17	185.8	123.7
1.004	75.00	5.52	26.950	2.031	0.0	0.0	0.0	0.90	143.5«	412.5
6.000	75.00	4.12	28.100	0.085	0.0	0.0	0.0	1.53	60.8	17.3
7.000	75.00	15.64	28.200	0.320	0.0	0.0	0.0	0.63	4.9«	65.0
6.001	72.84	16.47	27.765	0.528	0.0	0.0	0.0	0.95	104.6	104.2
6.002	69.93	17.63	27.820	0.737	0.0	0.0	0.0	0.96	106.3«	139.6
6.003	68.47	18.25	27.560	0.737	0.0	0.0	0.0	1.41	305.7	139.6

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	25.000	0.250	100.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	68.14	18.40	26.830	2.768	0.0	0.0	0.0	2.80	1236.4	510.8

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	SW01	29.925	28.000	1.550	Open Manhole	1350
1.001	o	525	SW02	29.925	27.740	1.660	Open Manhole	1500
1.002	o	600	SW03	29.925	27.475	1.850	Open Manhole	1500
1.003	o	600	SW04	29.625	27.415	1.610	Open Manhole	1500
2.000	o	225	SG	28.650	27.500	0.925	Open Manhole	1200
3.000	o	225	SG	29.200	28.000	0.975	Open Manhole	1200
2.001	o	300	SW05	29.250	27.335	1.615	Open Manhole	1200
4.000	o	225	SG	28.650	27.500	0.925	Open Manhole	1200
5.000	o	300	SG	29.200	28.000	0.900	Open Manhole	1200
2.002	o	450	SW06	29.275	27.042	1.783	Open Manhole	1350
2.003	o	450	SW07	29.275	27.008	1.817	Open Manhole	1350
1.004	o	450	Tank	29.200	26.950	1.800	Open Manhole	1500
6.000	o	225	SW08	29.700	28.100	1.375	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	22.000	200.0	SW02	29.925	27.890	1.660	Open Manhole	1500
1.001	38.000	200.0	SW03	29.925	27.550	1.850	Open Manhole	1500
1.002	12.000	200.0	SW04	29.625	27.415	1.610	Open Manhole	1500
1.003	5.000	200.0	Tank	29.200	27.390	1.210	Open Manhole	1500
2.000	18.000	200.0	SW05	29.250	27.410	1.615	Open Manhole	1200
3.000	4.000	200.0	SW05	29.250	27.980	1.045	Open Manhole	1200
2.001	43.000	300.0	SW06	29.275	27.192	1.783	Open Manhole	1350
4.000	18.000	77.3	SW06	29.275	27.267	1.783	Open Manhole	1350
5.000	4.000	250.0	SW06	29.275	27.984	0.991	Open Manhole	1350
2.002	10.000	300.0	SW07	29.275	27.008	1.817	Open Manhole	1350
2.003	5.000	300.0	Tank	29.200	26.992	1.758	Open Manhole	1500
1.004	10.000	500.0	SW16	29.625	26.930	2.245	Open Manhole	1800
6.000	11.000	73.3	SW13 (EX)	29.360	27.950	1.185	Open Manhole	1350

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	o	100	SW12	29.775	28.200	1.475	Open Manhole	1200
6.001	o	375	SW13 (EX)	29.360	27.765	1.220	Open Manhole	1350
6.002	o	375	SW14 (EX)	29.375	27.820	1.180	Open Manhole	1350
6.003	o	525	SW 15 (EX)	29.550	27.560	1.465	Open Manhole	1500
1.005	o	750	SW16	29.625	26.830	2.045	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	24.000	150.0	SW13 (EX)	29.360	28.040	1.220	Open Manhole	1350
6.001	47.000	361.5	SW14 (EX)	29.375	27.635	1.365	Open Manhole	1350
6.002	67.000	350.0	SW 15 (EX)	29.550	27.629	1.546	Open Manhole	1500
6.003	53.000	250.0	SW16	29.625	27.348	1.752	Open Manhole	1800
1.005	25.000	100.0	BROOK	29.000	26.580	1.670	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005	BROOK	29.000	26.580	26.580	0	0

Simulation Criteria for Storm

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022	Designed by paulg	
File Bridge Retail Park SW N...	Checked by	
Innovyze	Network 2017.1.2	

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.100	Storm Duration (mins)	30
Ratio R	0.408		

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

Online Controls for Storm

Complex Manhole: SW16, DS/PN: 1.005, Volume (m³): 19.6

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0095-4000-1000-4000
Design Head (m)	1.000
Design Flow (l/s)	4.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	26.830
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.0
Flush-Flo™	0.294	4.0
Kick-Flo®	0.629	3.2
Mean Flow over Head Range	-	3.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	1.200	4.3	3.000	6.7	7.000	10.0
0.200	3.9	1.400	4.7	3.500	7.2	7.500	10.3
0.300	4.0	1.600	5.0	4.000	7.6	8.000	10.6
0.400	3.9	1.800	5.3	4.500	8.1	8.500	10.9
0.500	3.8	2.000	5.5	5.000	8.5	9.000	11.2
0.600	3.4	2.200	5.8	5.500	8.9	9.500	11.5
0.800	3.6	2.400	6.0	6.000	9.3		
1.000	4.0	2.600	6.2	6.500	9.6		

Orifice

Diameter (m) 0.062 Discharge Coefficient 0.600 Invert Level (m) 27.530

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022	Designed by paulg	
File Bridge Retail Park SW N...	Checked by	
Innovyze	Network 2017.1.2	

Storage Structures for Storm

Cellular Storage Manhole: Tank, DS/PN: 1.004

Invert Level (m) 26.950 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1260.0	1260.0	5.200	0.0	1430.5
0.400	1260.0	1316.8	5.600	0.0	1430.5
0.800	1260.0	1373.6	6.000	0.0	1430.5
1.200	1260.0	1430.4	6.400	0.0	1430.5
1.201	0.0	1430.5	6.800	0.0	1430.5
2.000	0.0	1430.5	7.200	0.0	1430.5
2.400	0.0	1430.5	7.600	0.0	1430.5
2.800	0.0	1430.5	8.000	0.0	1430.5
3.200	0.0	1430.5	8.400	0.0	1430.5
3.600	0.0	1430.5	8.800	0.0	1430.5
4.000	0.0	1430.5	9.200	0.0	1430.5
4.400	0.0	1430.5	9.600	0.0	1430.5
4.800	0.0	1430.5	10.000	0.0	1430.5

Porous Car Park Manhole: SW12, DS/PN: 7.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	40.0
Membrane Percolation (mm/hr)	1000	Length (m)	40.0
Max Percolation (l/s)	444.4	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	29.400	Membrane Depth (mm)	0

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022	Designed by paulg	
File Bridge Retail Park SW N...	Checked by	
Innovyze	Network 2017.1.2	

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.408
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.000	SW01	15 Winter	1	+0%	30/15 Summer	100/15 Summer	
1.001	SW02	15 Winter	1	+0%	30/15 Summer		
1.002	SW03	15 Winter	1	+0%	30/15 Summer		
1.003	SW04	15 Winter	1	+0%	30/15 Summer		
2.000	SG	15 Winter	1	+0%	30/15 Summer	100/15 Summer	
3.000	SG	15 Summer	1	+0%	30/15 Summer		
2.001	SW05	15 Winter	1	+0%	30/15 Summer		
4.000	SG	15 Summer	1	+0%	30/15 Summer	100/180 Winter	
5.000	SG	15 Winter	1	+0%	30/15 Summer		
2.002	SW06	960 Winter	1	+0%	30/15 Summer		
2.003	SW07	960 Winter	1	+0%	30/15 Summer		
1.004	Tank	960 Winter	1	+0%	30/60 Summer		
6.000	SW08	15 Winter	1	+0%	30/15 Summer		
7.000	SW12	30 Winter	1	+0%	1/15 Summer		
6.001	SW13 (EX)	15 Winter	1	+0%	30/15 Summer		
6.002	SW14 (EX)	15 Winter	1	+0%	30/15 Summer		
6.003	SW 15 (EX)	15 Winter	1	+0%	100/120 Winter		
1.005	SW16	960 Winter	1	+0%	30/120 Winter		

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

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

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SW01		28.175	-0.200	0.000	0.45		53.5	OK
1.001	SW02		27.981	-0.284	0.000	0.43		127.3	OK
1.002	SW03		27.813	-0.262	0.000	0.50		159.6	OK
1.003	SW04		27.785	-0.230	0.000	0.69		167.3	OK
2.000	SG		27.601	-0.124	0.000	0.42		13.7	OK
3.000	SG		28.148	-0.077	0.000	0.76		19.2	OK
2.001	SW05		27.505	-0.130	0.000	0.59		35.0	OK
4.000	SG		27.577	-0.148	0.000	0.26		13.6	OK
5.000	SG		28.212	-0.088	0.000	0.84		40.9	OK
2.002	SW06		27.348	-0.143	0.000	0.05		6.3	OK
2.003	SW07		27.348	-0.110	0.000	0.05		6.2	OK
1.004	Tank		27.348	-0.052	0.000	0.05		3.7	OK
6.000	SW08		28.176	-0.149	0.000	0.25		12.8	OK
7.000	SW12		29.413	1.113	0.000	2.83		13.5	SURCHARGED
6.001	SW13 (EX)		28.052	-0.088	0.000	0.26		25.1	OK
6.002	SW14 (EX)		28.005	-0.190	0.000	0.46		46.0	OK
6.003	SW 15 (EX)		27.704	-0.381	0.000	0.17		45.8	OK
1.005	SW16		27.348	-0.232	0.000	0.01		3.9	OK

PN	US/MH Name	Level Exceeded
1.000	SW01	2
1.001	SW02	
1.002	SW03	
1.003	SW04	
2.000	SG	17
3.000	SG	
2.001	SW05	
4.000	SG	14
5.000	SG	
2.002	SW06	
2.003	SW07	
1.004	Tank	
6.000	SW08	
7.000	SW12	
6.001	SW13 (EX)	
6.002	SW14 (EX)	
6.003	SW 15 (EX)	
1.005	SW16	

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.408
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.000	SW01	15 Winter	30	+0%	30/15 Summer	100/15 Summer	
1.001	SW02	15 Winter	30	+0%	30/15 Summer		
1.002	SW03	15 Winter	30	+0%	30/15 Summer		
1.003	SW04	15 Winter	30	+0%	30/15 Summer		
2.000	SG	15 Winter	30	+0%	30/15 Summer	100/15 Summer	
3.000	SG	15 Summer	30	+0%	30/15 Summer		
2.001	SW05	15 Winter	30	+0%	30/15 Summer		
4.000	SG	960 Winter	30	+0%	30/15 Summer	100/180 Winter	
5.000	SG	15 Summer	30	+0%	30/15 Summer		
2.002	SW06	960 Winter	30	+0%	30/15 Summer		
2.003	SW07	960 Winter	30	+0%	30/15 Summer		
1.004	Tank	960 Winter	30	+0%	30/60 Summer		
6.000	SW08	15 Winter	30	+0%	30/15 Summer		
7.000	SW12	60 Winter	30	+0%	1/15 Summer		
6.001	SW13 (EX)	15 Winter	30	+0%	30/15 Summer		
6.002	SW14 (EX)	15 Winter	30	+0%	30/15 Summer		
6.003	SW 15 (EX)	960 Winter	30	+0%	100/120 Winter		
1.005	SW16	960 Winter	30	+0%	30/120 Winter		

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SW01		28.655	0.280	0.000	0.97		117.0	SURCHARGED
1.001	SW02		28.538	0.273	0.000	1.05		311.8	SURCHARGED
1.002	SW03		28.323	0.248	0.000	1.27		409.4	SURCHARGED
1.003	SW04		28.148	0.133	0.000	1.77		427.5	SURCHARGED
2.000	SG		28.056	0.331	0.000	0.90		29.7	SURCHARGED
3.000	SG		28.309	0.084	0.000	1.87		47.3	SURCHARGED
2.001	SW05		27.983	0.348	0.000	1.34		80.1	SURCHARGED
4.000	SG		27.830	0.105	0.000	0.04		2.0	SURCHARGED
5.000	SG		28.435	0.135	0.000	2.08		101.2	SURCHARGED
2.002	SW06		27.830	0.338	0.000	0.10		13.2	SURCHARGED
2.003	SW07		27.829	0.371	0.000	0.11		13.2	SURCHARGED
1.004	Tank		27.829	0.429	0.000	0.10		7.6	SURCHARGED
6.000	SW08		28.531	0.206	0.000	0.56		28.7	SURCHARGED
7.000	SW12		29.512	1.212	0.000	2.93		14.0	FLOOD RISK
6.001	SW13 (EX)		28.438	0.298	0.000	0.73		70.6	SURCHARGED
6.002	SW14 (EX)		28.357	0.162	0.000	1.29		129.3	SURCHARGED
6.003	SW 15 (EX)		27.828	-0.257	0.000	0.06		16.1	OK
1.005	SW16		27.828	0.248	0.000	0.01		8.1	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	SW01	2
1.001	SW02	
1.002	SW03	
1.003	SW04	
2.000	SG	17
3.000	SG	
2.001	SW05	
4.000	SG	14
5.000	SG	
2.002	SW06	
2.003	SW07	
1.004	Tank	
6.000	SW08	
7.000	SW12	
6.001	SW13 (EX)	
6.002	SW14 (EX)	
6.003	SW 15 (EX)	
1.005	SW16	

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.408
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.000	SW01	15 Winter	100	+40%	30/15 Summer	100/15 Summer	
1.001	SW02	15 Winter	100	+40%	30/15 Summer		
1.002	SW03	15 Winter	100	+40%	30/15 Summer		
1.003	SW04	600 Winter	100	+40%	30/15 Summer		
2.000	SG	960 Winter	100	+40%	30/15 Summer	100/15 Summer	
3.000	SG	15 Winter	100	+40%	30/15 Summer		
2.001	SW05	960 Winter	100	+40%	30/15 Summer		
4.000	SG	960 Winter	100	+40%	30/15 Summer	100/180 Winter	
5.000	SG	720 Winter	100	+40%	30/15 Summer		
2.002	SW06	720 Winter	100	+40%	30/15 Summer		
2.003	SW07	600 Winter	100	+40%	30/15 Summer		
1.004	Tank	600 Winter	100	+40%	30/60 Summer		
6.000	SW08	15 Winter	100	+40%	30/15 Summer		
7.000	SW12	60 Winter	100	+40%	1/15 Summer		
6.001	SW13 (EX)	15 Winter	100	+40%	30/15 Summer		
6.002	SW14 (EX)	15 Winter	100	+40%	30/15 Summer		
6.003	SW 15 (EX)	600 Winter	100	+40%	100/120 Winter		
1.005	SW16	600 Winter	100	+40%	30/120 Winter		

	Bridge Retail Park Surface Water Drainage Network V1	
Date 12/01/2022 File Bridge Retail Park SW N...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SW01		29.928	1.553	2.859	1.64		196.8	FLOOD
1.001	SW02		29.696	1.431	0.000	1.84		545.5	FLOOD RISK
1.002	SW03		29.061	0.986	0.000	2.22		716.6	SURCHARGED
1.003	SW04		28.906	0.891	0.000	0.32		78.1	SURCHARGED
2.000	SG		28.857	1.132	206.960	0.38		12.5	FLOOD
3.000	SG		29.003	0.778	0.000	3.19		80.5	FLOOD RISK
2.001	SW05		28.860	1.225	0.000	0.21		12.5	SURCHARGED
4.000	SG		28.860	1.135	210.309	0.15		8.2	FLOOD
5.000	SG		28.864	0.564	0.000	0.28		13.4	SURCHARGED
2.002	SW06		28.863	1.371	0.000	0.23		29.2	SURCHARGED
2.003	SW07		28.880	1.421	0.000	0.29		33.6	SURCHARGED
1.004	Tank		28.903	1.503	0.000	0.18		14.3	FLOOD RISK
6.000	SW08		29.466	1.141	0.000	0.97		49.9	FLOOD RISK
7.000	SW12		29.640	1.340	0.000	3.07		14.6	FLOOD RISK
6.001	SW13 (EX)		29.326	1.186	0.000	1.26		121.8	FLOOD RISK
6.002	SW14 (EX)		29.105	0.910	0.000	2.27		227.8	FLOOD RISK
6.003	SW 15 (EX)		28.913	0.828	0.000	0.13		36.1	SURCHARGED
1.005	SW16		28.906	1.326	0.000	0.02		14.9	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	SW01	2
1.001	SW02	
1.002	SW03	
1.003	SW04	
2.000	SG	17
3.000	SG	
2.001	SW05	
4.000	SG	14
5.000	SG	
2.002	SW06	
2.003	SW07	
1.004	Tank	
6.000	SW08	
7.000	SW12	
6.001	SW13 (EX)	
6.002	SW14 (EX)	
6.003	SW 15 (EX)	
1.005	SW16	

APPENDIX E – THAMES WATER & GPR SURVEY

Asset Location Search Sewer Map - ALS/ALS Standard/2012_2332773

TQ1180SE

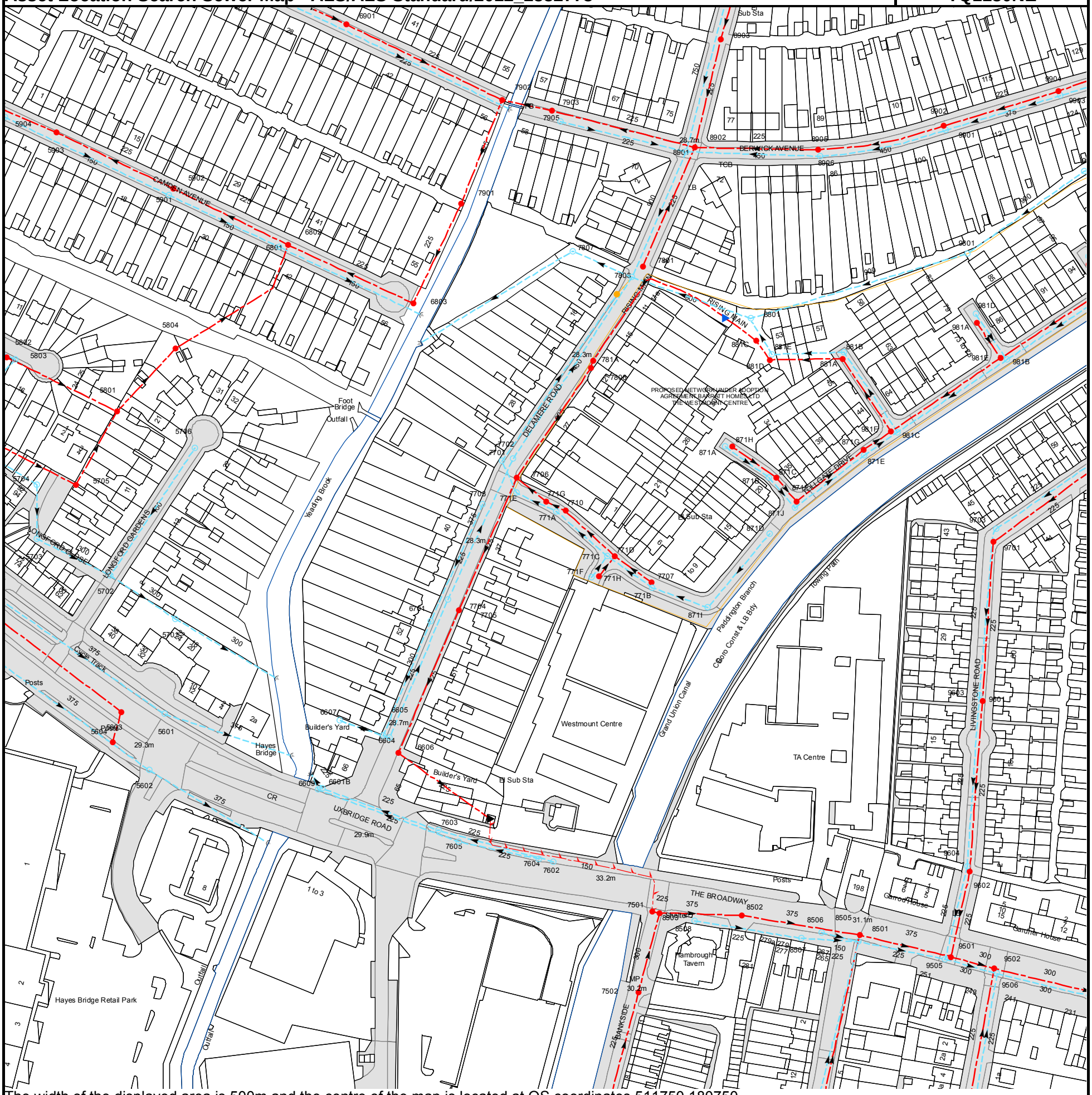
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 511750,180250

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
9201	30.8	28.91
9204	30.79	29.15
8002	30.87	29.12
8007	30.858	29.258
8105	30.848	29.368
8102	30.88	29.22
9301	30.67	28.55
5103	n/a	n/a
5302	n/a	n/a
9404	30.575	28.67
9401	30.58	28.17
9002	30.82	29.02
9005	30.82	29.15
9001	30.88	29.03
9004	30.89	29.21
9007	n/a	n/a
9102	30.62	29.12
9101	30.61	28.52
911B	n/a	n/a
911A	n/a	n/a
9104	n/a	n/a
9103	n/a	n/a
9203	30.49	28.93
9202	30.51	28.31
9303	30.43	28.76
9302	30.45	28.15
9006	n/a	n/a
9304	30.62	28.93
7003	29.62	27.62
7004	29.51	27.46
7302	30.15	n/a
7005	29.66	27.34
8008	30.51	29.34
7402	29.87	28.29
8306	n/a	n/a
8303	30.99	29.04
8006	30.87	29.4
8101	30.9	29.6
8401	31.07	28.19
8305	n/a	n/a
8403	31.087	28.597
8304	31.09	28.93
8302	31.09	28.42
8301	30.98	28.5
6101	29.04	19.15
6103	30.33	19.95
6102	29.16	27.64
6201	29.52	27.67
6302	n/a	n/a
7401	29.88	28.44
8001	30.51	29.26
8201	30.05	28.56
8202	30.05	28.55
701A	n/a	n/a
701B	n/a	n/a
7001	30.13	27.52
7002	30.1	28.01
7301	30.56	28.85
7403	29.94	28.15
8003	30.46	27.34
8103	29.76	27.96
8104	29.78	28.23

Asset Location Search Sewer Map - ALS/ALS Standard/2012_2332773

TQ1180NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 511750,180750

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 511750,180750

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
881A	n/a	n/a
881B	n/a	n/a
981C	n/a	n/a
981F	n/a	n/a
8505	31.15	28.49
8501	31.18	27.85
871E	n/a	n/a
871G	n/a	n/a
5706	29.68	28.75
5701	n/a	n/a
5804	n/a	n/a
5602	n/a	n/a
5902	30.03	25.43
5601	n/a	n/a
5901	30.03	28.51
5903	30.66	25.32
5703	29.47	28.25
5704	n/a	n/a
5604	n/a	n/a
5603	n/a	n/a
5702	29.37	27.97
5705	n/a	n/a
5801	n/a	n/a
9506	31.32	28.39
9502	31.34	27.74
9505	31.2	28.42
9501	31.23	27.78
9602	30.68	27.96
9604	30.65	28.64
9601	30.39	28.13
9603	30.386	28.706
9701	30.17	n/a
9703	30.14	28.78
981B	n/a	n/a
981E	n/a	n/a
981A	n/a	n/a
981D	n/a	n/a
9801	31.55	28.82
9905	27.99	26.48
9901	28.19	27.18
9903	28.3	27.31
9904	28.31	26.74
9902	28.2	26.6
7604	n/a	n/a
7702	n/a	n/a
771E	n/a	n/a
7706	n/a	n/a
7605	n/a	n/a
7705	n/a	n/a
7703	n/a	n/a
7901	n/a	n/a
6701	n/a	n/a
7603	30.69	28.51
7701	n/a	n/a
7902	28.98	26.03
7704	n/a	n/a
771H	n/a	n/a
7806	n/a	n/a
771F	n/a	n/a
781A	28.32	26.97
8903	n/a	n/a
881C	n/a	n/a
8502	31.77	28.92
8506	31.11	n/a
8801	28.63	26.4
8906	28.36	27.09
8905	28.36	26.48
8507	31.325	29.705
871J	n/a	n/a
871F	n/a	n/a
871D	n/a	n/a
871C	n/a	n/a
871B	n/a	n/a
881D	n/a	n/a
881E	n/a	n/a
6609	n/a	n/a
6601B	29.77	27.93
6605	n/a	n/a
6607	n/a	n/a
6801	29.32	28
6802	29.27	25.67
6901	39.53	37.53
6606	n/a	n/a
6604	n/a	n/a
6803	n/a	n/a
7707	n/a	n/a
7602	32.5	29.82
771A	n/a	n/a
7710	n/a	n/a
771G	n/a	n/a
7807	28.71	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7905	n/a	n/a
7903	n/a	n/a
871I	n/a	n/a
8503	33.06	29.01
7502	n/a	n/a
771C	n/a	n/a
771D	n/a	n/a
7803	28.6	n/a
7801	28.34	26.67
7501	33.18	31.12
771B	n/a	n/a
8508	32.66	31.35
8901	n/a	n/a
8902	28.5	26.27
871A	n/a	n/a
871H	n/a	n/a
5803	30.31	29.34
5802	30.36	28.71
5904	30.9	29.46

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

- Trunk Surface Water
- Trunk Foul
- Storm Relief
- Trunk Combined
- Vent Pipe
- Bio-solids (Sludge)
- Proposed Thames Surface Water Sewer
- Proposed Thames Water Foul Sewer
- Gallery
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Sludge Rising Main
- Proposed Thames Water Rising Main
- Vacuum

Sewer Fittings

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

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

Operational Controls

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

- Control Valve
- Drop Pipe
- Ancillary
- Weir

End Items

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

- Outfall
- Undefined End
- Inlet

Other Symbols

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

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

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

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

- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Gulley
- Culverted Watercourse
- Proposed
- Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

NOTES

In all cases please call the BT Dial before you dig service to mark their own plant before any site works commence
0800 917 3993
Always consult utility plans

1. *Drainage Information provided has been determined without man entry into the chambers. Whilst every effort has been made to correctly identify the duty/pipes/chamber detail, it is recommended that this information should be checked in areas that are critical to the future proposal/development.*
2. *All sewer runs are presumed to be straight line connections between chambers unless proven otherwise by the use of a sonde or CCTV survey.*
3. *GAS is plastic, Unable to trace. Taken from record.*
4. *Water is plastic in parts, Unable to trace. Taken from record.*
5. *Power & Radio sweeps / GPR practices done where possible, unable in certain areas due to dense vegetation.*

UTILITY LINETYPES

Air Line	AIR	Electric - Unknown Voltage	E
British Telecom	BT	Electric Overhead	OH
British Telecom Overhead	OH	Fibre Optic	FO
CCTV / Cable Television	TV	Fuel Line	FL
Communication Cable	COM	Gas Line	GAS
Drainage - Combined Water	(Dmy)	Gauge Line	GL
Drainage - Foul Water	(Dmy)	GPR Line	GPR
Drainage - Storm Water	(Dmy)	Heating Pipes	HTG
Drainage - Combined Water - Assumed/TFR	(Dmy)	Offlead Fills	OF
Drainage - Foul Water - Assumed/TFR	(Dmy)	Oil Pipe	OL
Drainage - Storm Water - Assumed/TFR	(Dmy)	Rising Main	RM
Drainage - Approximate Pipe Size/Extents		Telecom	TEL
Earth Cable	E	Traffic Light Signals	TL
Empty Duct	FD	Unknown	UNK
Electric & Comms	TAC	Vapour Recovery	VR
Electric Low Voltage	LV	Vent Line	VT
Electric High Voltage	HV	Water	WTR
		Trench Scar	

UTILITY SURVEY INFORMATION

Contractad Survey Area		Unable to Raise (cover)	UTR
Depth to Top of Service (m)	0.40d	Unable to Trace	UTT
End of Trace	EOT	Assumed Route	AR
Head of Run	HoR	Assumed Connection	ACP
Weak Signal	WS	Sound Connection	S/C
Taken From Records	TFR	No Visible Exit	NVE
Off Survey Area	OSA	No Pipes Visible	NPV
Back Drop	BD	No Depth Indicated	NDI
Silt Level	SL	Base Level	BL
Above Ground	A/G	High Level	HL
Unable to Locate	UTL	Tops of Pipe / Top of Valve	T.o.P / T.o.V
Unable to Survey	UTS	APPROXIMATE LOCATION	
Unable to Survey		GPR Anomaly	
Chamber Extents		Multiple Services Route	

LEGEND

Buildings	Overhead Cable	IC	Inspection chamber	Bo	Bollard
Wall	Concrete edge	PInv	Pipe invert	IB	Illuminated bollard
Kerb line	Tarmac edge	Gy	Gully	Bin	Rubbish bin
Line marking	Grass verge	Bg	Back gully	Vp	Vent pipe
Drop kerb	Canopy/Overhang	Dp	Down pipe	Grl	Ground light
Centre line	Verge	Pipe	Pipe above ground	Lbox	Letter box
Top of bank	Bottom of bank	MH	Manhole	Stmp	Tree Stump
1 100.000	Station and Name / Station Level	WL	Water level	Sty	Stile
Tree / Bush / Sapling		Fl	Flood light	IFL	Internal floor level
Area of Undergrowth		Lp	Lamp post	THL	Threshold level
Woodland		Tp	Telegraph post	Sp	Sign post
R: Ridge Level		Ep	Electricity post	TH	Trialhole
E: Eaves Level		Tl	Traffic light	BH	Borehole
F: Flat Roof Level		Bus	Bus stop	ELC	Electric
Gate		Sv	Stop valve	BT	British Telecom
Fence types:		St	Stop tap	CBox	Control box
IW Interwoven		Er	Earth rod	TT	Tactile
IR Iron Railings		Wm	Water meter	BP	Brick paved
WM Wire Mesh		Gas	Gas valve	CPS	Concrete paving slabs
PR Post & Rail		Av	Air valve	CVR	Cover
PW Post & Wire		ICU	Unidentified inspection	RWall	Retaining wall
CL Chain Link		Wo	Wash out	TWL	Top of Wall Level
WP Wooden Panels		Re	Rodding eye	TCL	Tree canopy level
CB Close Boarded		BB	Bellsha beacon	G:	Girth
SP Steel Palisade		CTV	Cable tv	MG	Multi girth
		Mkr	Marker post	IC	Inspection chamber
		Gmkr	Gas marker post	CL:	Cover level
		So	Soffit	IL:	Invert level
		Fh	Fire hydrant	UTL	Unable to locate

PAS 128 : 2014 LEVEL B SURVEY

QUALITY LEVEL	CRITERIA USED IN THE DETERMINATION OF QUALITY LEVEL	ACCURACY
QL-D	A UTILITY SEGMENT WHICH IS SUSPECTED TO EXIST BUT HAS NOT BEEN DETECTED AND THEREFORE SHOWN AS AN ASSUMED ROUTE. (NO DETECTION POSSIBLE)	UNDEFINED
QL-B/C/D*	POSITION OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES. (EML OR GPR DETECTION WITH LIMITED CONFIDENCE IN DEPTH)	+/- 500mm HORIZONTAL. UNDEFINED VERTICAL
QL-B/C/D*	POSITION AND DEPTH OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES. (EML OR GPR DETECTION WITH CONFIDENCE IN DEPTH)	+/- 250mm OR +/- 40% OF DETECTED DEPTH, WHICHEVER IS GREATER (HORIZONTAL) & +/- 40% OF DETECTED DEPTH (VERTICAL)
QL-B/C/D*	POSITION AND DEPTH OF THE UTILITY DETECTED BY MULTIPLE GEOPHYSICAL TECHNIQUES. (EML + GPR DETECTION)	+/- 150mm OR +/- 15% OF DETECTED DEPTH, WHICHEVER IS GREATER (HORIZONTAL) & +/- 15% OF DETECTED DEPTH (VERTICAL)

DISCLAIMER

Whilst every effort has been taken in the preparation of this drawing, the original land marks/apparatus configuration may have been altered since the survey/drawing was produced. The user shall make further enquiries and investigations to satisfy himself as to the accuracy of this drawing and position of the apparatus. The exact positions of the apparatus should be verified by the use of suitable detection devices and safe digging practices in accordance with HSG47, further advice on the location of apparatus should be recommended by the owner. No representation is made by Greenhatch Group, its agents or servants as to the accuracy, completeness, and sufficiency or otherwise of this drawing and the position of the apparatus.

All apparatus shall be treated as live unless proved otherwise by the owner. It is the users responsibility to ensure that the information on the location of apparatus is provided to all persons (either direct labour or contractors) working in proximity to the apparatus.

Rev	Date	Description	Drawn	Q. Ref.

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
- 3D Laser Scanning
- Revit & BIM Models

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admin@greenhatch-group.co.uk
www.greenhatch-group.co.uk

St Albans
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Alban Park
St Albans
Hertfordshire
AL4 0LA
t. (01727) 854481

Newcastle
24 Riverside Studios
Amethyst Road
Newcastle Bus. Park
Newcastle-U-Tyne
NE4 7YL
t. (01912) 736391

London
27, Cornwall Terrace Mews
Regents Park
London
NW1 5LL
t. (02072) 241806

CLIENT
Burrows Graham

PROJECT
Hayes Bridge Retail Park
Uxbridge Road,
Hayes UB4 0RH

TITLE
Utility Survey

SCALE	DATE
A1@ 1: 500	27.11.21
DRAWN	QUALITY REF
DM, GS, JM, NS	GH12226

Level datum
Grid orientation
Job number: 42047

Drawing No.: 42047_T_UG
Rev.: 0

Comments
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

APPENDIX F – ENVIRONMENT AGENCY FLOOD DATA

Detailed FRA centred on: Hayes Bridge Retail Park UB4 0RH - 18/08/2021 - HNL228341NR

Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

- Main Rivers
- Site location

Defended Flood Outlines

- 1 in 5 (20%) Defended
- 1 in 10 (10%) Defended
- 1 in 20 (5%) Defended
- 1 in 50 (2%) Defended
- Current

The data in this map has been extracted from the River Crane Mapping Study (Halcrow 2008).
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites withinthe catchment.
Modelled outlines take into account catchment wide defences.

Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Detailed FRA centred on: Hayes Bridge Retail Park UB4 0RH - 18/08/2021 - HNL228341NR

Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

- Main Rivers
- Site location

Defended Flood Outlines

- 1 in 100 (1%) Defended
- 1 in 100+20% (*CC) Defended
- 1 in 100+25% (*CC) Defended
- 1 in 100+30% (*CC) Defended
- Current

The data in this map has been extracted from the River Crane Mapping Study (Halcrow 2008).
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites withinthe catchment.
Modelled outlines take into account catchment wide defences.

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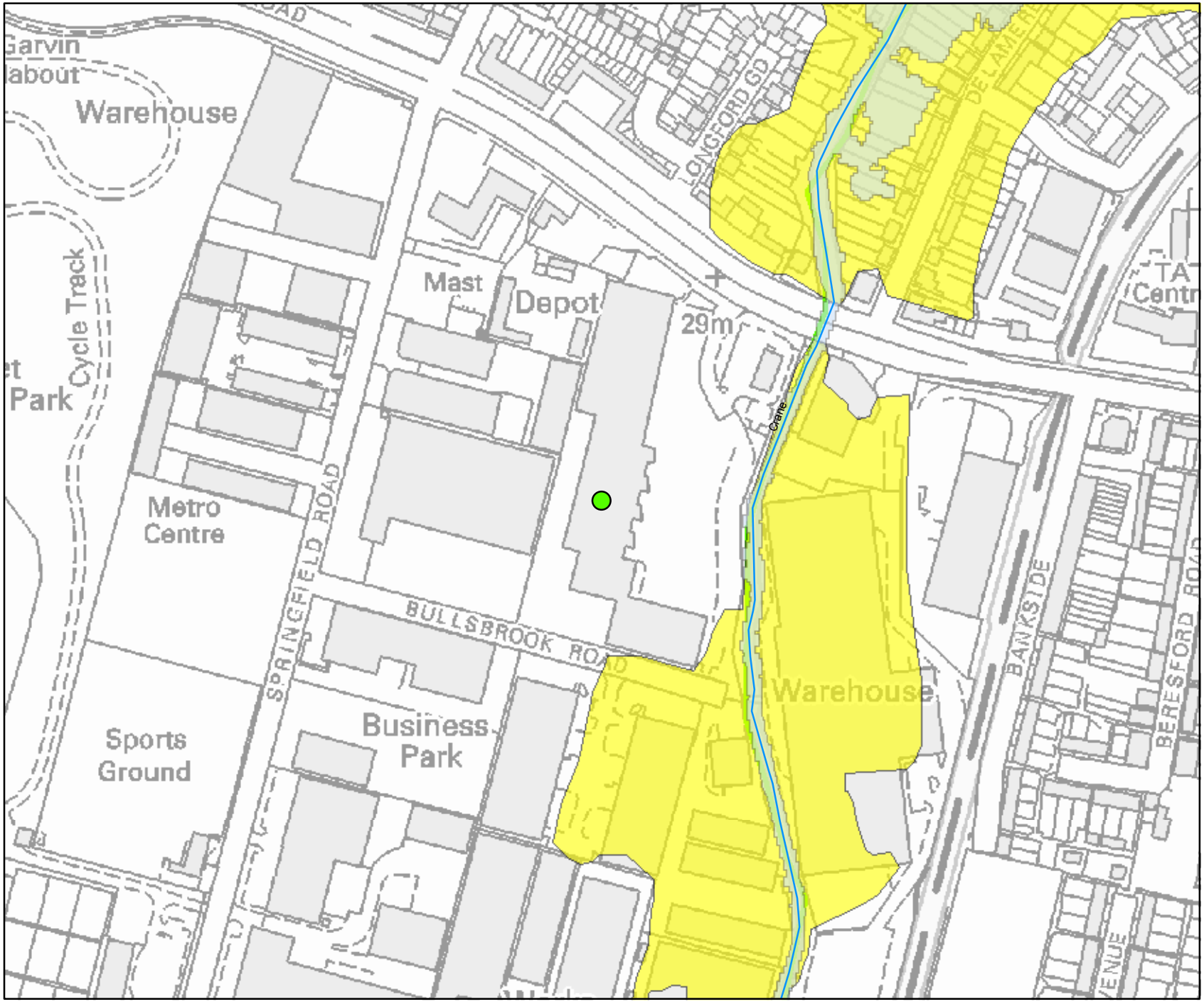
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Detailed FRA centred on: Hayes Bridge Retail Park UB4 0RH - 18/08/2021 - HNL228341NR



Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

- Main Rivers
- Site location

Defended Flood Outlines

- 1 in 100+70% (*CC) Defended
- 1 in 1000 (0.1%) Defended
- Current

The data in this map has been extracted from the River Crane Mapping Study (Halcrow 2008).
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites withinthe catchment.
Modelled outlines take into account catchment wide defences.

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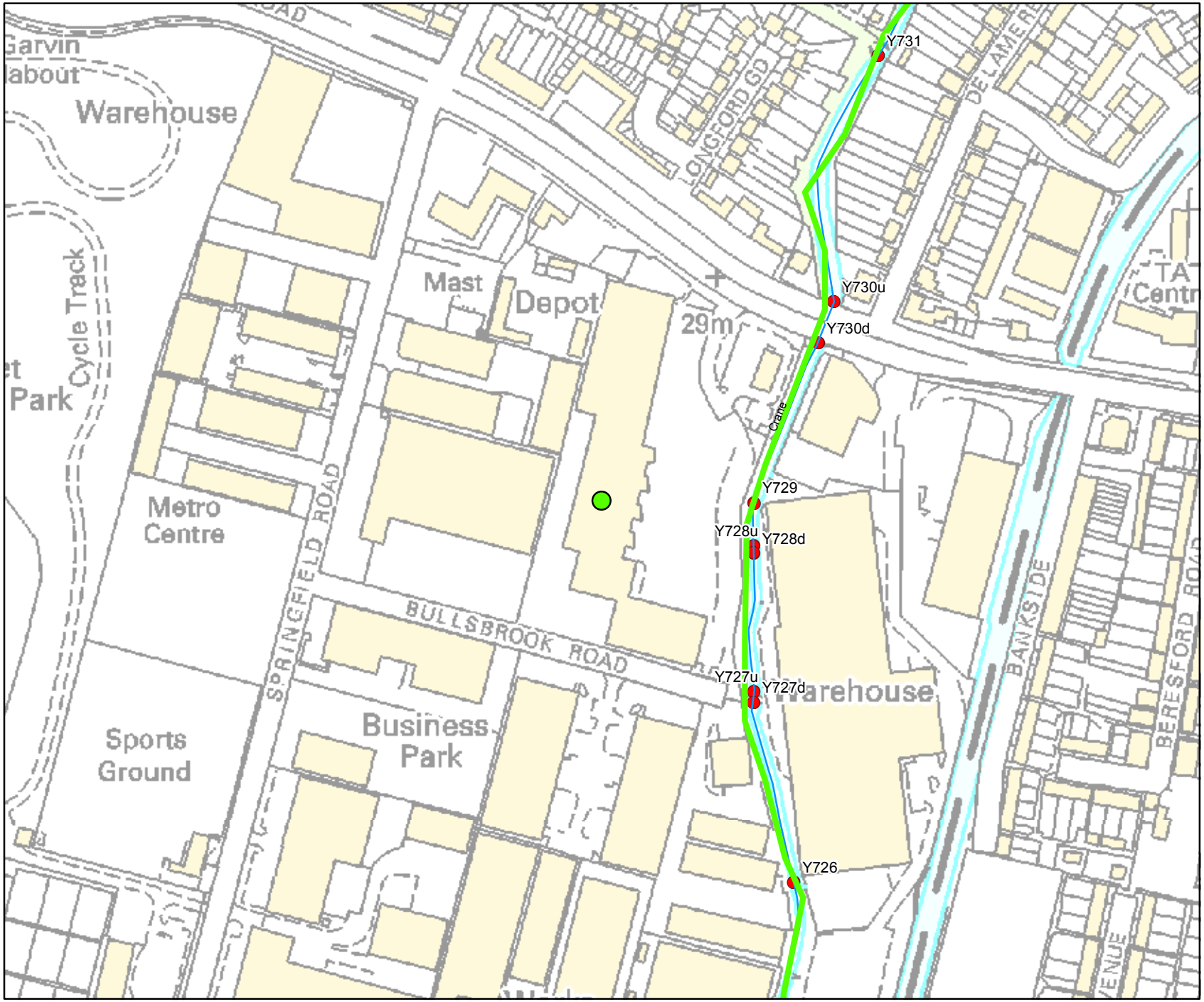
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Detailed FRA centred on: Hayes Bridge Retail Park UB4 0RH - 18/08/2021 - HNL228341NR



Environment Agency

Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

- Main Rivers
- Site location

1D Node Results

- Current
- Node Results

The data in this map has been extracted from the River Crane Mapping Study (Halcrow 2008).
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites withinthe catchment.
Modelled outlines take into account catchment wide defences.

Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Environment Agency ref: HNL 228341 NR

The following information has been extracted from the River Crane Mapping Study (Halcrow 2008)

Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to ‘Flood risk assessments: climate change allowances’ to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Caution:
The modelled flood levels and extents are appropriate for catchment wide strategic flood risk mapping. However, for more detailed flood risk assessment it is recommended that each of the underlying flood mapping, hydraulic modelling and hydrological assumptions are re-evaluated to determine the appropriateness in a more detailed analysis.

All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

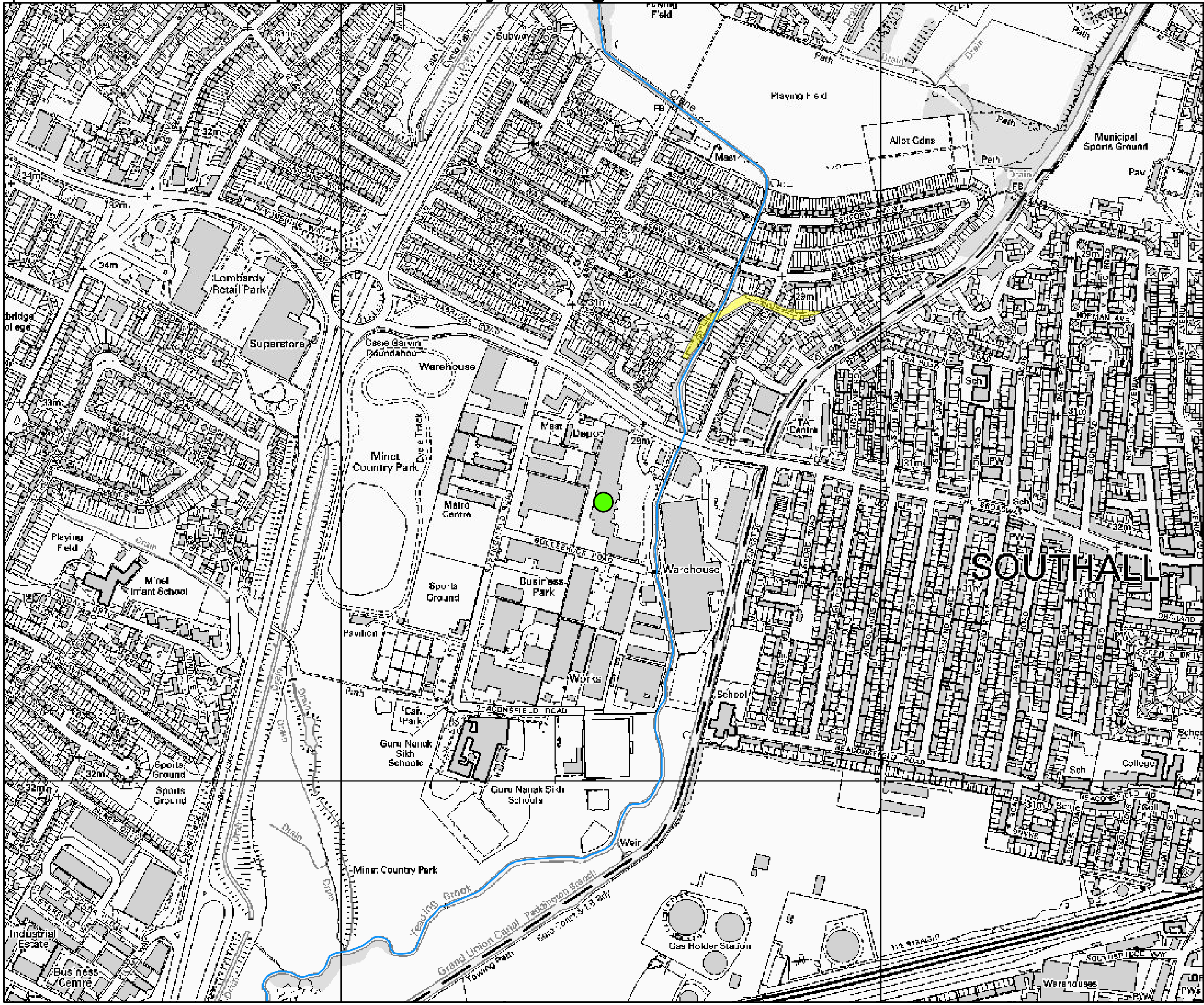
MODELLED FLOOD LEVEL

			Return Period									
Node Label	Easting	Northing	5 yr	10 yr	20 yr	50 yr	100 yr	100yr + 20%	100yr + 25%	100yr + 35%	100yr + 70%	1000yr
Y731	511669	180803	27.74	27.78	27.82	27.90	27.96	28.06	28.08	28.12	28.25	29.26
Y730u	511638	180644	27.61	27.65	27.70	27.79	27.85	27.95	27.97	28.01	28.15	29.19
Y730d	511629	180617	27.58	27.62	27.67	27.76	27.82	27.92	27.94	27.98	28.12	29.11
Y729	511601	180509	27.45	27.49	27.54	27.63	27.70	27.79	27.82	27.86	28.03	29.13
Y728u	511587	180483	27.47	27.51	27.56	27.65	27.72	27.81	27.84	27.88	28.05	29.13
Y728d	511587	180482	27.46	27.51	27.56	27.65	27.71	27.81	27.83	27.87	28.04	29.12
Y727u	511587	180388	27.40	27.44	27.49	27.58	27.64	27.74	27.76	27.81	27.99	29.11
Y727d	511586	180384	27.37	27.42	27.46	27.55	27.61	27.70	27.73	27.77	27.95	29.11
Y726	511612	180266	27.21	27.26	27.32	27.42	27.48	27.59	27.61	27.67	27.88	29.09

MODELLED FLOWS

			Return Period									
Node Label	Easting	Northing	5 yr	10 yr	20 yr	50 yr	100 yr	100yr + 20%	100yr + 25%	100yr + 35%	100yr + 70%	1000yr
Y731	511669	180803	7.64	7.92	8.23	8.76	9.16	9.78	9.92	10.18	10.97	24.46
Y730u	511638	180644	7.76	8.06	8.40	9.01	9.46	10.17	10.33	10.62	11.51	24.37
Y730d	511629	180617	7.76	8.06	8.40	9.01	9.46	10.17	10.33	10.62	11.51	24.37
Y729	511601	180509	7.97	8.32	8.70	9.43	9.98	10.83	11.03	11.39	12.50	24.31
Y728u	511587	180483	7.97	8.32	8.70	9.43	9.97	10.83	11.03	11.39	12.49	24.27
Y728d	511587	180482	7.97	8.32	8.70	9.43	9.97	10.83	11.03	11.39	12.49	24.27
Y727u	511587	180388	7.97	8.32	8.70	9.43	9.97	10.82	11.01	11.37	12.46	24.13
Y727d	511586	180384	7.97	8.32	8.70	9.43	9.97	10.82	11.01	11.37	12.46	24.13
Y726	511612	180266	7.97	8.31	8.70	9.42	9.96	10.80	11.00	11.35	12.43	23.93

Historic Flood Map centred on: Hayes Bridge Retail Park UB4 0RH - 18/08/2021 - HNL228341NR



Environment Agency

Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 150 300 600
Metres

Legend

Main Rivers

Site location

Flood Event Outlines

1977

The historic flood event outlines are based on a combination of anecdotal evidence, Environment Agency staff observations and survey.
Our historic flood event outlines do not provide a definitive record of flooding.
It is possible that there will be an absence of datain places where we have not been able to record the extent of flooding.
It is also possible for errors occur in the digitisation of historic records of flooding.

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

APPENDIX G – HILLINGDON DRAINAGE ASSESSMENT FORM

HILLINGDON LONDON

GREATER LONDON AUTHORITY

LoDEG

1. Project & Site Details	
Project / Site Name (including sub-catchment / stage / phase where appropriate)	Bridgewater Retail Park
Address & post code	Bridgewater Retail Park, Uxbridge Road, Hayes, UB4 0RH
OS Grid ref. (Easting, Northing)	E 511518
	N 180504
LPA reference (if applicable)	
Brief description of proposed work	Demolition of existing retail units and the development of a Class E, B2 and B8 use employment unit with ancillary office accommodation, including new vehicular access, associated external yard areas, car parking, landscaping and associated works
Total site Area	31700 m^2
Total existing impervious area	28600 m^2
Total proposed impervious area	28400 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	no
Existing drainage connection type and location	Unrestricted surface water connection to the adjacent Yeading Brook
Designer Name	Paul Graveney
Designer Position	Senior Engineer
Designer Company	Burrows Graham

2. Proposed Discharge Arrangements			
2a. Infiltration Feasibility			
Superficial geology classification	Made ground over silt / clay		
Bedrock geology classification	not recorded		
Site infiltration rate	not recorded (TBC) m/s		
Depth to groundwater level	TBC m below ground level		
Is infiltration feasible?	TBC when SI complete		
2b. Drainage Hierarchy			
		Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use		Y	N
2 use infiltration techniques, such as porous surfaces in non-clay areas		Y	Y
3 attenuate rainwater in ponds or open water features for gradual release		N	N
4 attenuate rainwater by storing in tanks or sealed water features for gradual release		Y	Y
5 discharge rainwater direct to a watercourse		Y	Y
6 discharge rainwater to a surface water sewer/drain		N	N
7 discharge rainwater to the combined sewer.		N	N
2c. Proposed Discharge Details			
Proposed discharge location	Ex connection to Yeading Brook		
Has the owner/regulator of the discharge location been consulted?	No, existing connection reused.		

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	4.7			
1 in 1	4	238	477	3.9
1 in 30	10.6	516	1054	8.1
1 in 100	15	755	1438	14.9
1 in 100 + CC				14.9
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Hydrobrake		

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^3)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	0	0
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	3200	2240	97
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	25200		1438
Total	**28400**	**2240**	**1535**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	As the existing retail park is currently occupised, no site investigation has been undertaken at this time
Drainage hierarchy (2b)	Pg 15 / Sect 6.4
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Drainage GA in Appendix C
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Appendix D
Proposed SuDS measures & specifications (3b)	Pg 14 / Sect 6.3
4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix A
Detailed drainage design drawings, including exceedance flow routes	Appendix C
Detailed landscaping plans	Appendix A
Maintenance strategy	Pg 17 / Sect 6.4
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	Catchpits, tanks, permeable paving
b) biodiversity?	
c) amenity?	