

Flood Risk Assessment and Drainage Strategy

Broad Street Reading

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Prepared For:

McLaren (Broad Street Mall) Ltd and UREF III LP

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

BROAD STREET READING

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Executive Summary

Meinhardt have undertaken this Flood Risk Assessment (FRA) and prepared this Drainage Strategy (DS) on behalf of McLaren (Broad Street Mall) Ltd and UREF III LP to support two detailed planning applications for the construction of the development scheme and the temporary construction method, these applications are defined by two distinct red line boundaries which are necessary for these applications.

The two red line and applications can essentially be summarised as:

- That relating to BSM (Development Scheme)
- That relating to the construction area necessary to enable the construction of BSM (Temporary Construction)

The development scheme is for part-demolition of existing retail units, car park and service areas, demolition and rebuild of car park ramp, and construction of a residential-led, mixed-use development fronting Queens Walk and Dusseldorf Way, including all necessary enabling and alteration works required.

The temporary construction is for part-demolition of podium deck on Dusseldorf Way and Queens Walk, amendments to existing retaining wall, excavation works and road and hardstanding re-alignment to create a temporary construction area related to proposed redevelopment works at Broad Street Mall.

This report focuses on the Development Scheme, as the Temporary Construction works have minimal impact of Flood Risk and Drainage.

The planning boundary is defined for planning as 0.79ha at basement level, however for the purpose of this report, the drainage strategy assesses an area of 0.4691 hectares (ha) as this is the area that will be directly changing in terms of drainage catchment within the wider 1.05ha that comprises the development scheme and temporary construction areas at basement level. All other hardstanding areas will drain as existing as fundamentally these areas will remain unchanged. The site is located approximately 900m south of the River Thames and approximately 373m north of the River Kennet. The OS Grid Reference for the approximate centre of the Site is National Grid Reference 471238, 173310.

The drainage strategy aims to follow in principle the consented scheme (RBC Reference 182054) Drainage Strategy in which it was agreed with RBC that given the works proposed, no attenuation for surface was required as the scheme would not be increasing hardstanding. However, the scheme will provide a reduction in surface water runoff as much as viable. BREEAM requirements require a 30% reduction compared to existing flows, so the strategy will achieve this requirement.

This FRA investigates flood risk on site and in the area and outlines the mitigation measures proposed to ensure the sustainable and safe development of the Site in line with the requirements of the National Planning Policy Framework (NPPF), Environment Agency's (EA) Climate Change allowances guidance and Standing Advice, and the Flood Risk and Coastal Change Planning Practice Guidance (PPG).

The Site is located in Flood Zone 1 where the probability of river or sea flooding is less than 0.1% (1 in 1000) chance in any given year. Therefore, the probability of tidal or fluvial flooding is assessed as negligible.

Available baseline information indicates that within the Site there are no significant flood risk concerns for the development. All sources of flooding have been investigated and have been deemed low/negligible.

A surface water drainage strategy has been designed in line with the most recent EA Climate Change Guidance to consider and manage the impact of a 1:100 year plus climate change rainfall event and is presented within this report. The surface water drainage strategy considers surface water runoff management: the solutions proposed ensure that for the 100 year plus 40% climate change allowance

event, surface water will be accommodated within the Site and therefore prevent potential exceedance flows off-site.

The proposed drainage strategy incorporates sustainable drainage systems (SuDS) features in the form of blue roofs. The Site's surface water has been reduced as low as possible to ensure a gravity connection, in accordance with the Borough of Reading's requirements before discharging into the local Thames Water surface water sewer network.

Consultation with the EA, LLFA and Thames Water (TW) has been carried out throughout the preparation of this FRA and DS ensure their awareness of the proposals, their ability to advise on site constraints and on the proposed surface water drainage strategy.

1 Introduction

1.1 Project Brief

Meinhardt have been appointed by McLaren (Broad Street Mall) Ltd and UREF III LP to undertake this Flood Risk Assessment (FRA) and Drainage Strategy to accompany the planning application for the part-demolition of existing retail units, car park and service areas, demolition and rebuild of car park ramp, and construction of a residential-led, mixed-use development fronting Queens Walk and Dusseldorf Way, including all necessary enabling and alteration works required (hereafter referred to as the 'Proposed Development') located at Broad Street, Reading, Borough of Reading (hereafter referred to as the 'Site'). This report relates solely to the above Site and should not be used for any other reasons other than for which the report was originally prepared.

This FRA/DS will be more focused on the proposed development as opposed to the temporary construction since the existing ramp will drain the same way due to all of it being hardstanding.

1.2 Assessment Methodology

The below methodology has been carried out to investigate flood risk on Site and in the surrounding area and to identify suitable mitigation measures required to ensure the sustainability and safety of the Proposed Development over its lifetime.

The report has been produced in line with the requirements of the NPPF and the Environment Agency (EA) Standing Advice, as well as through consultation with Thames Water (TW) and Reading Borough Council (RBC) as the LLFA.

The following documents and policies have been reviewed to inform this report:

- RBC – Strategic Flood Risk Assessment (SFRA) (2017);
- RBC – Preliminary Flood Risk Assessment (PFRA) (2011);
- Terrain Surveys – Topographical Survey (2021);
- Thames Water Asset Records and Historic Sewer Flooding Records (2016);
- British Geological Society (BGS) Online Viewer, 1:50,000 Bedrock and Superficial deposits;
- DEFRA's online Magic Map; and
- EA – Flood risk assessments; climate change allowances;
- EA – Preparing a flood risk assessment; standing advice;
- GOV.UK's Planning Practice Guidance: Flood Risk and Coastal Change; and
- GOV.UK's online Long Term Flood Maps.

The local policies discussed in Section 2 have also been considered to inform this assessment.

Meinhardt does not guarantee that the advice provided by this report will guarantee the availability of flood insurance. The insurance industry carry out their own assessments to properties in terms of determining the insurability for flood risk. Those intending to undertake development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurers (ABI) to seek further guidance prior to commencement.

Although this report was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances, please note that Meinhardt cannot take responsibility for errors in the information provided by third parties.

2 Planning Policy and Guidance

The below policy and guidance are considered relevant to this FRA and DS and have been used to inform this assessment.

2.1 National and Regional Policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF) was updated and published in September 2023 with the aim of protecting the environment and to promote sustainable growth. There is an overarching objective to strive towards sustainable development and ensuring that this is a key element in every proposal.

The following paragraphs from the NPPF are considered relevant to this assessment:

Paragraph 159: Requires that “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

Paragraph 162: Explains that “the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source”.

Paragraph 167: Explains that “When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. [...] and

Paragraph 169: Recommends that “major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- a) take account of advice from the lead local flood authority.
- b) have appropriate proposed minimum operational standards.
- c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- d) where possible, provide multifunctional benefits”.

Reading Borough Local Plan (2019)

According to EN18: Flooding and sustainable drainage systems, Development will be directed to areas at lowest risk of flooding in the first instance, following the Sequential and Exceptions Test set out in the NPPF, and taking into account the effects of climate change. It will consider flooding from all sources, including fluvial, surface water, groundwater and sewer flooding. Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.

All major developments must incorporate sustainable drainage systems (SuDS) as appropriate and in line with the Government's Technical Standards. Smaller schemes are encouraged to incorporate SuDS, where possible. Runoff rates should aim to reflect greenfield conditions and, in any case, must be no greater than the existing conditions of the site. Schemes should ensure that the movement of water through vertical infiltration as well as horizontal run-off does not worsen contamination effects. Wherever possible, SuDS provision should maximise ecological benefits, link into the existing Green Network, incorporate tree planting and landscaping and avoid damage to existing significant trees, including through changes to the site hydrology. All new developments in areas of flood risk should give priority to SuDS.

Sustainable-Design-and-Construction-SPD (December 2019)

Section 6 under Water Management, encourages as per the local plan for all major developments to incorporate SuDS features to help reduce surface water runoff and promote bio-diversity.

2.2 Climate Change Guidance

The EA guidance “Flood risk assessments: climate change allowances was issued in 2016 (last updated October 2021) and provides the most recent information on expected changes in rainfall, river flows and sea levels as a consequence of climate change.

The latest update to the guidance provides peak river flow allowances by management catchments, the sub-catchments of the river basin districts. The peak flows are based on percentiles, a percentile is a measure used to describe the proportion of possible scenarios that fall below an allowance level (e.g. a 50% percentile means that the allowance has 50% chances of not being exceeded).

The guidance states that Table 1 should be used to determine changes in peak rainfall intensity in small catchments (less than 5km²) and for urbanised drainage catchments. It notes that for large rural drainage catchments that the peak river flow allowances should be used. As per Table 1 of the guidance document, the following figures should be considered:

- Upper End – 40% increase in peak rainfall by 2115;
- Central – 20% increase in peak rainfall by 2115.

Sea level allowances by river basin district for each epoch is provided in Table 2 of the guidance document.

3 Existing Site

3.1 Site Location and Description

The planning boundary is defined for planning as 0.79ha at basement level, however for the purpose of this report, the drainage strategy assesses an area of 0.4691 hectares (ha) as this is the area that will be directly changing in terms of drainage catchment within the wider 1.05ha that comprises the development scheme and temporary construction areas at basement level. All other hardstanding areas will drain as existing as fundamentally these areas will remain unchanged..

The site is located approximately 900m south of the River Thames and approximately 373 north of the River Kennet. The OS Grid Reference for the approximate centre of the Site is National Grid Reference 471238, 173310.

The site is located within Reading town centre, approximately 450 metres (m) southwest of Reading railway station, in a mixed-use commercial, retail and residential area. Oxford Road is located adjacent to the north of the site, beyond which numerous retail, residential and commercial buildings are located. St. Mary's Butts is located adjacent to the east of the site, beyond which a church and further retail, residential and commercial buildings are located. Refer to Error! Reference source not found.for an indicative Site location plan.

3.2 Topography

The following is based on the topographical survey that was carried out by Warner Land Surveys Ltd in December 2020. The site gently slopes up from the east to the central of the site rising from approximately 39.56mAOD to 40.16mAOD. The site slopes from the south-west falling from 41.48mAOD to 39.54mAOD up to the existing building, then slopes up across the site up to 40.13mAOD with consistent spot levels. Refer to **Appendix A** for the Topographical Survey.

3.3 Existing Drainage

A CCTV drainage survey has not been completed at the site, and at this stage only the underground survey (**Appendix B**) and Thames Water (TW) Asset records (**Appendix C**) are available.

The survey extents do not show connections from the private drainage connecting into the TW assets. The survey shows both surface and foul water networks.

3.3.1 Public Sewers

Please refer to **Appendix C** for the TW sewer asset plans, a summary of the public sewers is indicated below with reference to the TW sewer asset plans.

- The TW asset records show that along Dusseldorf Way there is a 375mm diameter foul trunk water sewer connecting into (TW Manhole Reference 2201). The records do not show a connection and could possibly be used as an outfall, although this is unclear until a CCTV survey is done. The sewer then connects into (TW Manhole Reference 2301) along Hosier Street. This sewer then connects into (TW Manhole Reference 3301) into St Mary's Butts.
- There are also five foul trunk water manholes (TW records unknown references) located beyond the eastern part of the site boundary connecting into both St Mary's Butts and Hosier Street.
- There are three surface water manholes (TW records unknown references) located beyond the eastern part of the site boundary connecting into Hosier Street.
- The western part of the site shows a 225mm diameter foul trunk water sewer from (TW Manhole Reference 0366) to (TW Manhole Reference 0303) and then into (TW Manhole Reference 0352). This sewer then connects into the 225mm diameter foul trunk water sewer located in the car park.

- The western part of the site shows a 475mm diameter surface water sewer connecting into (TW Manhole Reference 0351). This then connects into the surface water sewer located in the car park.

3.3.2 Private On Site Drainage

- A CCTV drainage survey has not been completed at the site, and at this stage only the Thames Water asset records (**Appendix C**) are available.
- A review of as-built drainage information indicates that the existing shopping center drainage is currently pumped towards the Local TW sewer network.

3.4 Existing Watercourses, Waterbodies and Flood Defences

The Site is located approximately 900m south of the River Thames and approximately 373m north of River Kennet. No other waterbodies of merit are of note.

Based on the BGS online maps the Site is underlain by Taplow Gravel superficial deposits and is in close proximity to the boundary between the Taplow Gravels and a channel of Alluvium to the south. The Seaford Chalk formation outcrops in this area in between deposits of Lambeth Group and London Clay and is present beneath the superficial deposits.

According to the DEFRA's online Magic Map for Source Protection Zones (SPZ), the site is not located within an SPZ as shown in **Figure 2** below.



Figure 2: Extract of EA/DEFRA Source Protection Zone Map

The EA/Defra has developed aquifer designations which are in line with the Water Framework Directive and are based on maps produced by the British Geological Survey (BGS). Definitions for the aquifer types are provided below based on the EA website:

- **Principal Aquifer:** "These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may

support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as a major aquifer.”

- **Secondary A aquifer:** “permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.”
- **Secondary B aquifer:** “predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons, and weathering. These are generally the water-bearing parts of the former non-aquifers.”
- **Secondary Undifferentiated aquifer:** “assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.”
- **Unproductive Strata:** “rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.”

Figure 3 shows that the superficial deposits on the site are classified as Principal Aquifer. Principal aquifers are designated by the EA as strategically important rock units that have high permeability and water storage capacity and are based on geological mapping provided by BGS.

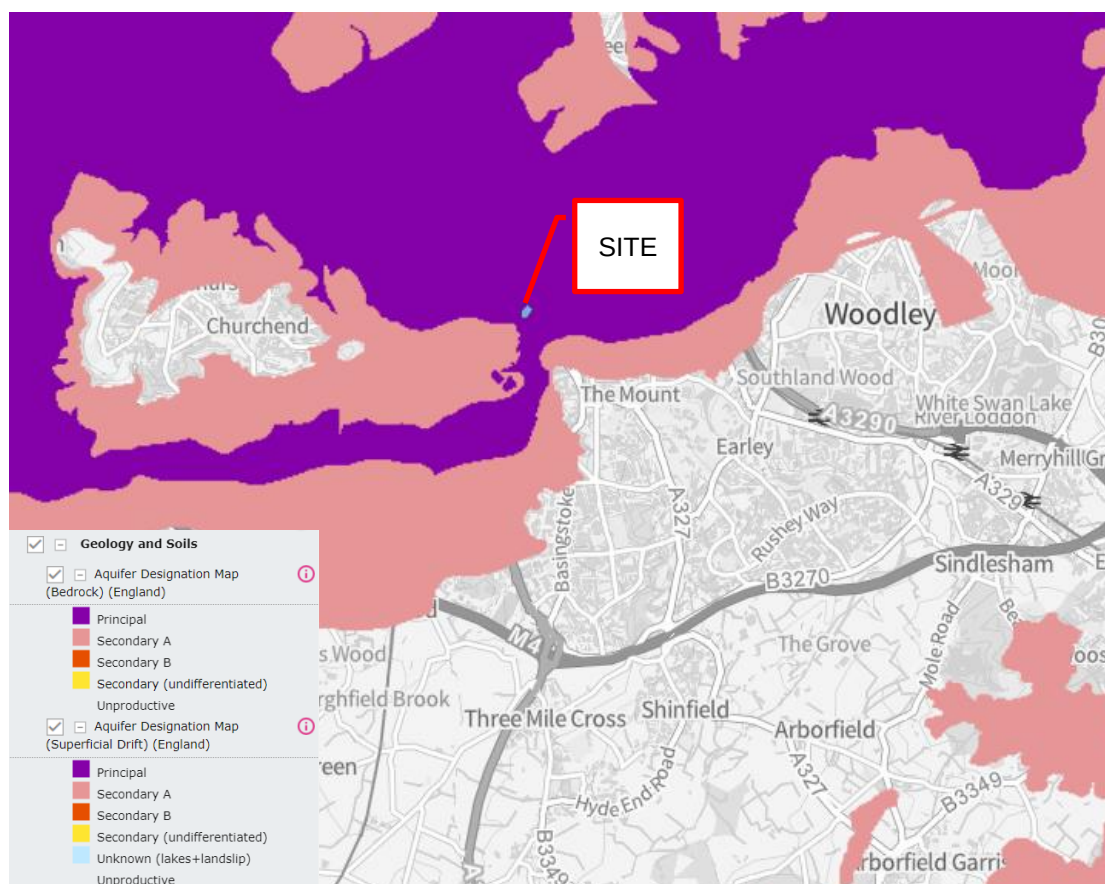


Figure 3: EA Bedrock Aquifer Designation Map

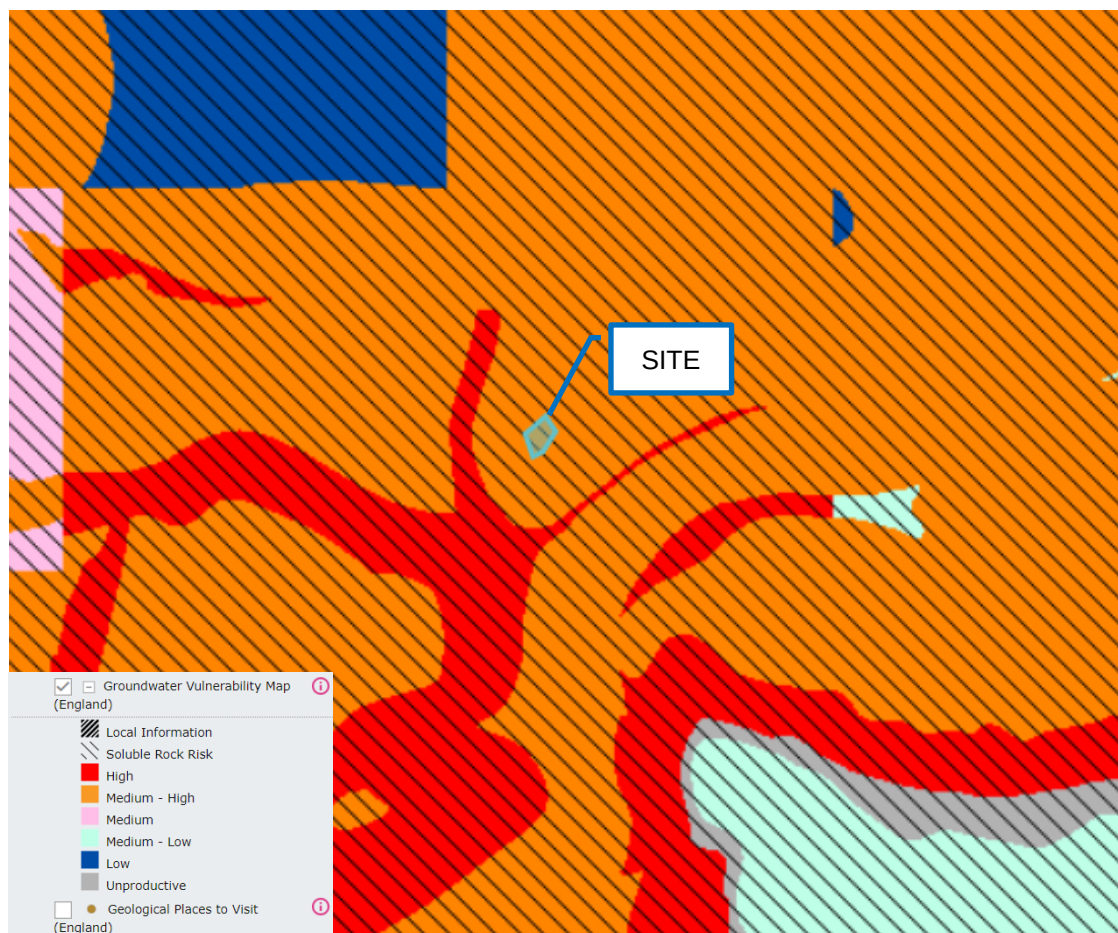


Figure 4: EA Bedrock Aquifer Designation Map

The EA has produced groundwater vulnerability maps to illustrate the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a square kilometre.

The simplified groundwater vulnerability map defines five risk categories:

- **High:** “high priority groundwater resources that have very limited natural protection”
- **Medium-high:** “high priority groundwater resources that have limited natural protection.”
- **Medium:** “medium priority groundwater resources that have some natural protection.”
- **Medium-low:** “lower priority groundwater resources that have some natural protection.”
- **Low:** “low priority groundwater resources that have a high degree of natural protection.”

It can be seen from the maps in **Figure 4**, that the site is located in an area classed as having a medium-high groundwater vulnerability.

3.5 Geological and Hydrogeological Setting

Table 1 provides a summary of British Geological Survey (BGS) Geological Map Sheet No. 271, Dartford, 1:50,000, Solid and Drift (1998), BGS ‘Geology of Britain’ online maps. In addition, a site investigation report was undertaken by Arc Environmental Ltd in March 2021 where multiple exploratory boreholes had been taken around the site. The information included in Table 1 below.

Geological Unit/Stratum	Minimum Depth (mbgl)	Maximum Depth (mbgl)	Thickness (m)	Typical Strata Description
Made Ground	0.00	6.50	0.43 to 2.50	Variable anthropogenic deposits

Taplow Gravels	2.50	4.90	2.40	Soft to firm brown silty gravelly CLAY
Seaford Chalk (Principal Aquifer)	4.90	35.31	Unproven	Recovered as buff / white sandy silty gravel and gravelly silt with flint gravel and cobbles

Table 1: Geological Distribution

According to the site investigation report, **Figure 4.1** illustrates the location of the development within the context of a regional geological map. The map illustrates the spatial distribution of superficial (drift) deposits and bedrock outcrops at the ground surface. Made Ground is generally not shown but is assumed to be present on site due to historical construction works associated with the residential development at the site.

The geology map indicates that the site is underlain by Taplow Gravel superficial deposits and is in close proximity to the boundary between the Taplow Gravels and a channel of Alluvium to the south. The Seaford Chalk formation outcrops in this area in between deposits of Lambeth Group and London Clay and is present beneath the superficial deposits.

Based on the EA's online Groundwater Vulnerability Zones Map the Site is located within a Principal Aquifer Groundwater Vulnerability Zone (GWVZ).

Based on the SI completed and the presence of Made Ground and Chalk, infiltration will not be a viable method of discharge for surface water and therefore no pollutant pathways will be introduced by the development that could pose a threat to the groundwater below the site.

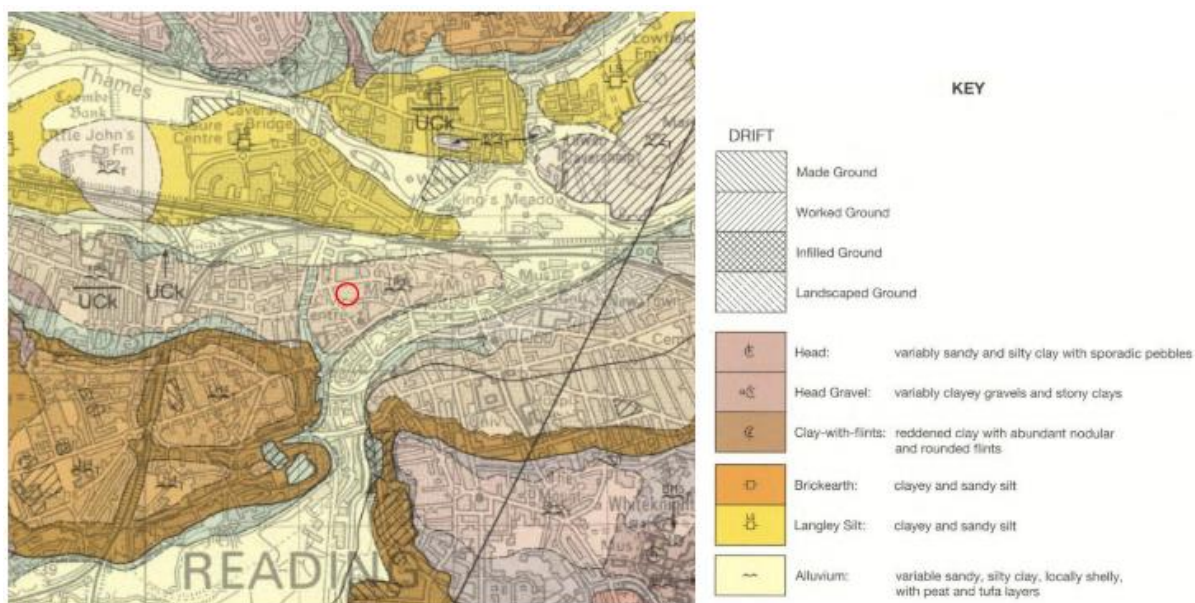


Figure 4.2: Summary of the encountered geographical profile

4 Proposed Development

4.1 Proposed Development Description

The development scheme is for part-demolition of existing retail units, car park and service areas, demolition and rebuild of car park ramp, and construction of a residential-led, mixed-use development fronting Queens Walk and Dusseldorf Way, including all necessary enabling and alteration works required.

4.2 Temporary Construction Description

The temporary construction is for part-demolition of podium deck on Dusseldorf Way and Queens Walk, amendments to existing retaining wall, excavation works and road and hardstanding re-alignment to create a temporary construction area related to proposed redevelopment works at Broad Street Mall.

4.3 Vulnerability Classification

According to Annex 3 of the NPPF the Proposed Development will have uses which range between 'less vulnerable' and 'more vulnerable'.

4.4 Sequential and Exception Tests

As stated in the NPPF, a sequential risk-based approach to determine the suitability of land for development in flood risk areas should be applied at all stages of the planning process giving precedence to low flood risk areas wherever possible.

Since the Site is in Flood Zone 1 the development is considered appropriate and automatically meets the requirements of the sequential test.

4.5 Impact of Climate change on the Proposed Development

The typical lifespan for residential development is 100 years. Climate change allowances have been considered based on this lifespan.

As the Site is located within Flood Zone 1 where the probability of fluvial and tidal flooding is lower than 0.1% in any year, fluvial and tidal flooding is not expected to become a significant issue when the impact of climate change is taken into account.

The impact of climate change on surface water runoff at the Site in the surrounding areas could present a higher risk however the Drainage Strategy produced as part of this report has been designed to accommodate surface runoff during all events up to and including the 100 year plus a 40% climate change allowance.

Based on the EA's climate change allowance guidance, the attenuation requirements for the proposed drainage strategy will be determined using the central estimates but will be modelled with a freeboard that can accommodate the upper end estimates to prevent potential exceedance flows off-site.

5 Flood Risk

5.1 Relevant Maps and Data

Online UK Government Flood Maps have been used to identify flood risk from fluvial, tidal, surface water, and artificial sources.

RBC SFRA have also been reviewed and relevant maps are included in **Appendix D**.

Relevant correspondence with TW is included in **Appendix E**.

5.2 Tidal and Fluvial Flooding

Based on the online GOV.UK Flood Map for Planning, the Site is located in Flood Zone 1 where the probability of river or sea flooding is less than 0.1% (1 in 1000) chance in any given year. As see on **Figure 5** below.

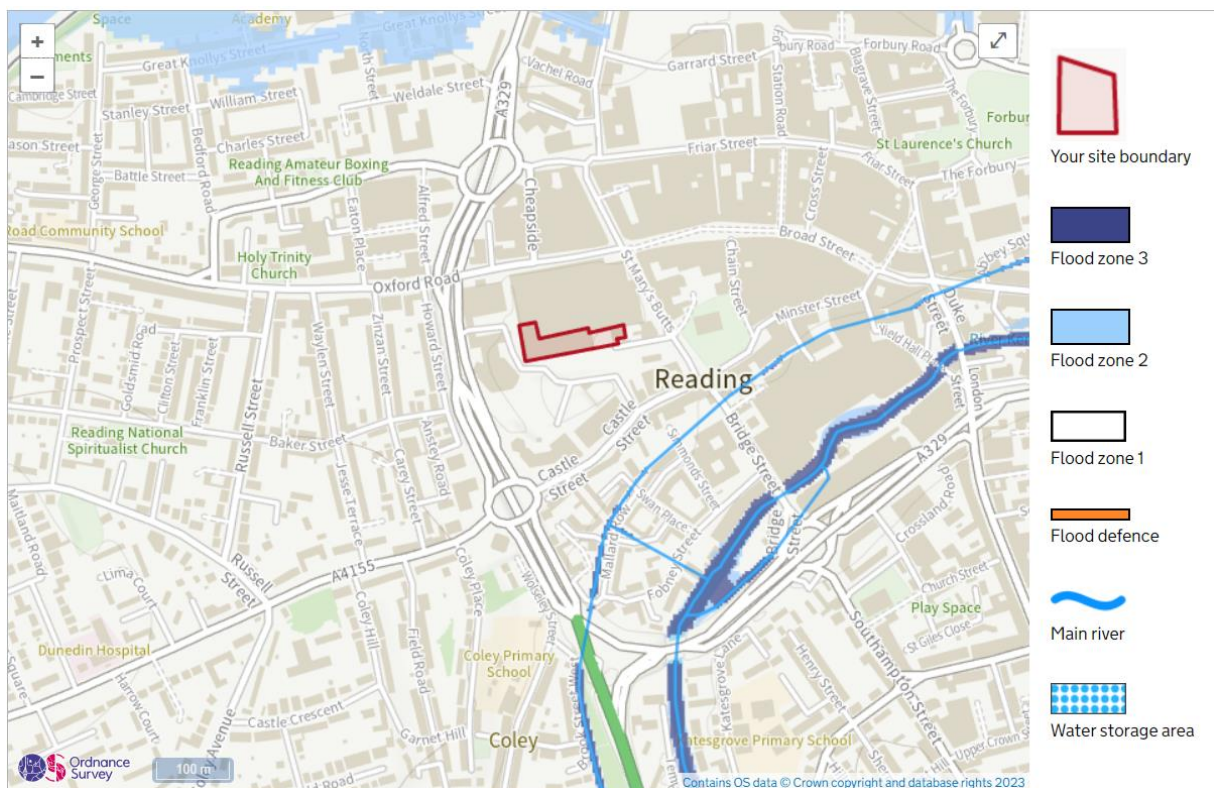


Figure 5: Extract from EA Flood Maps – Flood Map for Planning (Tidal and Fluvial)

Based on the information available, the probability of fluvial and tidal flooding can be assessed as **negligible**.

5.3 Surface Water Flooding

The GOV.UK Long Term Flood Risk Maps provide a general indication of areas that may be at risk of surface water flooding. The maps take a broad account of underground drainage and typical storms which are likely to cause flooding. The map identifies that there is at a very low risk of surface water flooding across the majority of the Site, refer to **Figure 6.1**. The long-term flood map shows that beyond the southern site boundary (Dusseldorf Way) and Hosier Street there are spots where the depth of surface water flooding could be up to 300mm. However, this is outside of the site boundary and does not have an impact on the proposed site.



Figure 6.1: Extract from GOV.UK's Long Term Flood Risk Map for Surface Water Flooding



Figure 6.2 Extract from EA Flood Maps – Flood Map for Surface Water Runoff (High Risk Depth)

Based on the available information and modelling, surface water flooding within the Site cannot be excluded and the probability of surface water flooding can be considered as **Low**.



Surface water flood risk: water depth in a low risk scenario
Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

Figure 6.3: Extract from EA Flood Maps – Flood Map for Surface Water Runoff (Low Risk Depth)

Figures 6.1-6.3 show and prove that the site itself is not susceptible to surface water flooding and as previously mentioned there is a low risk of flooding to the surrounding roads (Dusseldorf Way and Hosier Street). As the proposed development is located in Flood Zone 1 means it is at very low risk (less than 1 in 1000 year or 0.1% probability)

Based on the available information and modelling, surface water flooding within the Site cannot be excluded and the probability of surface water flooding can be considered as **Low**.

5.4 Artificial Sources of Flooding

The flood risk from reservoirs within the study area is very low, as the probability of occurrence is very low, but the potential consequences are high.

According to the online GOV.UK's Long Term Flood Risk Map, the Site is not shown to be within the maximum extent of flooding from any reservoir. Refer to **Figure 7** below.

Since spring 2009 all reservoirs, under the 1975 Reservoir Act, require the development of a Flood Plan and associated inundation mapping along with governing their maintenance and management. As such the risk of flooding from a reservoir is low and is being managed on a strategic level under the 1975 Reservoir Act.

No other artificial sources relevant to the Site have been noted in the Woking Borough documents or as part of the correspondence undertaken.

Based on the available information, the probability of flooding from artificial sources can be assessed as **Negligible**.



Figure 7 – Extract from EA Flood Maps – Maximum Extent of Flooding from Reservoirs

5.5 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. In a groundwater flooding event, water levels rise sufficiently to intersect the surface and inundate low lying land.

The risk of groundwater flooding across the Reading area is typically considered to be low, but it is noted that the historic records from RBC (Map F3 in **Appendix D**) identify some isolated records of groundwater flooding; these are typically low-lying areas in close proximity to the River Thames (and therefore where groundwater levels would potentially be at seasonal shallow depths).

Groundwater level gauging has been carried out on four occasions between November 14 and December 6, 2018. Groundwater was encountered during the monitoring visits within the Seaford Chalk, and this is anticipated to be a regional Principal Aquifer. A summary of the groundwater monitoring results is shown below in **Table 2**.

The groundwater monitoring from the site-specific investigation works indicate that the top of the Principal Aquifer water table in the Seaford Chalk is approximately 7.5mbgl. This is below basement level and the anticipated formation level of any pile caps or pad footings.

The water table within the Seaford Chalk is likely to vary seasonally over the design life of the proposed development, as a result of human induced phenomena and hydrological/hydrogeological features in proximity of the site.

Location	Date	Well Base Depth (mbgl)	Water Depth (mbgl)
BH1	14/11/18	10.0	7.27
	21/11/18		7.80
	28/11/18		7.78
	06/12/18		7.66
BH2	14/11/18	7.0	Dry
	21/11/18		Dry
	28/11/18		Dry
	06/12/18		Dry
BH3	14/11/18	11.0	8.17
	21/11/18		8.19
	28/11/18		8.21
	06/12/18		8.07

Table 2 – Extract from SI Report – Groundwater Monitoring Results

Based on the information available and the assessment undertaken, the probability of groundwater flooding impacting the Site can be assessed as **Negligible**.

5.6 Sewers Flooding

The risk of flooding to the site from overloaded sewers and surrounding drainage is based on the capacity of the network, operational / maintenance of the network and topography in the vicinity of the Site. When sewer flooding occurs, sewage can be released back out of the drainage network through the top of manholes, drains or low-lying fittings such as toilets and showers.

In the SFRA for LLFA, there is a map of the historical sewer flooding incidents. RBC holds a flood history DG5 register and has presented the historic sewer flood records within **Appendix D**. The SFRA states that records only appear on the register where they have been reported to TWUL, and as such the records may not include all instances of sewer flooding within the district.

Furthermore, given that TWUL targets these areas for maintenance and improvements, areas that have experienced flooding in the past may no longer be at the greatest risk of flooding in the future. Based on the SFRA's Figure 8: Recorded Incidents of Sewer Flooding of EFDC's SFRA, the site lies within a postcode that has had 6-10 sewer flooding incidents recorded.

The Thames Water DG5 flooding records in Map F9 indicate the RG47 and RG48 postcode areas have a significant number of sewer flooding records (>100) over the preceding 5-year period. The RG45 and RG46 areas over the eastern part of this character area have a lesser but still significant number at between 51 and 100.

Based on the information available, the probability of sewer flooding impacting the Site can be assessed as **Negligible**.

6 Flood Risk Mitigation Measures

As discussed in the previous sections the only source of flooding at the site was identified as surface water flooding, however this is deemed low risk.

Any potential risk linked to surface water runoff generated is limited through the design of the Drainage Strategy, with attenuation provided to cater for the 1:100 year + 40% climate change event. The management of surface water runoff is discussed in the proposed Drainage Strategy below.

6.1 Site Levels

In line with general best practice, it is proposed the site levels will fall away from building entrances to mitigate against any potential flood water entering the properties, especially if drainage networks get blocked or are not maintained, as well as protecting the site from any offsite flooding within the highway.

7 Drainage Strategy

7.1 Sustainable Surface Water Drainage Strategy

The proposed surface water has been designed in accordance with best practise and guidance to ensure that surface water is managed effectively to limit the risk off-site as well as on site.

Defra - Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (March 2015), refers to Peak Flow Control, which states the following:

- For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.
- For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

Therefore, the proposed surface water drainage network has been designed to restrict runoff rates as close as practicable to the Greenfield run-off rates whilst still maintaining a gravity led surface water drainage network.

The proposed drainage strategy includes five 100mm deep blue roofs with areas of 412m², 412m², 186m², 185m² and 185m² which are proposed on both level 1 podiums, level 21 terrace and both level 25-28 block A and block C roof terraces. Total area for blue roofs is 1380m². These blue roofs will attenuate the surface water before discharging it at a total discharge rate of 3.51/s to the below ground surface water drainage network. Refer to **Appendix H** for blue roof sketches and updated calculations from Bauder.

In order to reduce surface water and pick up ground level surface runoff an attenuation tank will be required below the building footprint to provide additional attenuation, external space outside the building footprint is limited due to sewer/existing utility constraints that exist, and therefore an attenuation tank located below the building footprint is the only viable option.

Surface water from the roof areas will be routed to the manhole and below ground attenuation tank beneath the service yard access road at the lower ground/basement level which will have a volume of 157m³. At the next design stage, the structural design of the attenuation tank will be confirmed by Polypipe to ensure the tank can withstand the proposed loading during construction and any potential floatation (based on a worst-case groundwater level following further site investigation works). If required a concrete slab will be proposed above the tank to mitigate against floatation and/or to accommodate the loading. Refer to **Appendix H** for surface water strategy.

Surface water discharging from the Site will be routed to a chamber containing a flow control device which will limit the surface water discharging from the site as a whole to 29.86 l/s. This flow control device chamber will be located immediately upstream of the surface water outfall from the Site. Surface water from the Site will discharge to the existing Thames Water surface water sewer (ref. 2201) running beneath Dusseldorf Way, the proposed connection detail will be discussed with TW and agreed by a S106 agreement post-planning.

A Pre-planning enquiry has been submitted to Thames Water, they have confirmed that there is sufficient capacity for foul and surface water. Refer to **Appendix E**.

7.2 Proposed Options

7.2.1 Blue Roof

A blue roof comprises a multi-layered system that covers the roof of a building or podium structures with a deep layer of attenuation along with various layers of insulation, waterproofing, and roofing material. These systems are designed to intercept and retain precipitation, increasing the time of concentration and reducing the volume of runoff and attenuation peak flows.

The system is designed to restrict the rainwater discharge from the roof to allow the surface water to build upon the roof for a period of time while slowly releasing the water down the drainpipe and into the below ground drainage system.

These roofs vary in specification and can be designed to accommodate any type of roof material that allows infiltration into the attenuation layer below.



Figure 11: Typical Blue Roof Details

Advantages:

Can decrease/eliminate the requirement for below ground drainage attenuation and the excavation for it; reduces the number of internal rainwater down points within the building; with the use of planting within the roof water quality can be improved; with systems of 100mm attenuation or lower, the structure is generally unaffected.

Disadvantages

The cost of the system itself may be more than the saving, depending on attenuation requirements and the impact of the system on the building structure. With systems greater than 85mm there may be an implication to the structure, roof height is increased slightly, design and exposure may preclude use.

Maintenance:

- Check inlets, outlets, control structures, and overflows
- Litter and debris removal
- Silt removal
- Check for damage

7.2.2 Below Ground Cellular Attenuation

Cellular attenuation involves storing surface water within pipework or underground tanks prior to controlled discharge into the public sewer. Typically, the cellular attenuation is formed with plastic “egg-crates” wrapped in impermeable geotextiles as indicated in Figure 12. The proposed attenuation tank is to be located beneath the service yard access road at the lower ground/basement level.



Figure 12: Typical cellular attenuation tank

Advantages:	Effective storage of surface water can be used below trafficked areas, can be used below public open areas, minimum maintenance.
Disadvantages	Cost of excavation. Sometimes complicated integration with foundations. No water quality treatment.
Maintenance:	Check inlets, outlets, control structures, and overflows Jetting and suctions as required

7.2.3 Surface Water Modelling

When undertaking the modelling for the surface water drainage strategy the following assumptions were made:

- Causeway Flow software has been used for all hydraulic design;
- FEH 22 rainfall data has been used when determining existing runoff rates;
- HR Wallingford Greenfield Runoff Rate Estimation Tool (www.uksuds.com) was used to determine the proposed greenfield runoff rates;
- CV values are set at 1.0
- The Site area is 0.4691ha.
- The existing site impermeable area is considered to be 0.4690ha. Refer to impermeable/permeable drawings within **Appendix H**
- The proposed drainage area of the site is considered to be 0.4691ha. Refer to impermeable/permeable drawings within **Appendix H**.
- Blue Roof draining area is 1300m², therefore remaining area draining to attenuation tank is 0.3391ha.
- The proposed drainage network has been designed for the 1 in 100 year plus 40% climate change event.

All surface water drainage options outlined in this report adhere to these principles.

Modelling results are available in **Appendix H**.

7.2.4 Existing Surface Water Network Results

The existing site area draining to the surface water network is 0.4691ha. Existing surface water runoff rates have been calculated below (**Table 2**) using the modified rationale method ($Q = 2.78 \times A \times I$). rainfall intensity (i) has been calculated using Microdrainage. (Refer to **Appendix H**).

$$Q = 2.78 \times A \times I$$

$$A = 0.4691\text{ha}$$

$$I = 50\text{mm/hr}$$

$$Q = 65.205 \text{ l/s}$$

Table 2: Existing Surface Water Discharge Rates

Return Period (years)	Existing Surface Water Discharge Rates (l/s)
1 in 2	34.337
1 in 30	77.904
1 in 100	99.531
1 in 100 + 40%	N/A

7.2.5 Greenfield Rates

Greenfield runoff rates for the site have been calculated using the HR Wallingford Greenfield Runoff Rate Estimation Tool (www.uksuds.com). Refer to **Appendix H** for full results.

Table 3: Greenfield Discharge Rates

Return Period (years)	Greenfield Discharge Rates (l/s)
Qbar	0.77
1 in 1	0.66
1 in 30	1.78
1 in 100	2.46

7.2.6 Proposed Surface Water Network Results

It has been deemed appropriate that the upper climate change figure of 40% should be used for storage design as there may be a risk of surface water flooding leaving the Site i.e., off-site flooding.

The proposed surface water discharge rates will be limited to 29.86 l/s, this ensures that the site can discharge via gravity and reduces runoff compared to the existing by 30%. The proposed surface water discharge rates are shown in **Table 4** below.

Table 4: Proposed Surface Water Discharge Rates

Return Period (years)	Proposed Surface Water Discharge Rates (l/s)
1 in 2	10.3
1 in 30	23.37
1 in 100	29.86
1 in 100 + 40%	29.86

The drainage has been modelled to accommodate the 1:100 year +40% climate change storm event and to ensure that as a whole the Site's discharge rate does not exceed greenfield runoff rates for each storm event. The results of this modelling are provided within **Appendix H**.

Proposed surface water flows will be directed towards TW MH 1351.

7.3 Offsite Effects

The surface water drainage strategy demonstrates that the drainage network at the Site is designed to accommodate runoff during all events up to and including the 100 year plus 40% climate change allowance and therefore prevents potential exceedance flows off-site, refer to **Appendix H** for the exceedance flow routes plan.

Thames Water have confirmed that the public water drainage network will be able to accommodate the proposed flows for both foul and surface water discharge from the Proposed Development.

The development will not cause effects elsewhere in terms of fluvial and tidal flood risk due to its location within Flood Zone 1.

7.4 Residual Flood Risk

The only substantial risk of flooding from the Proposed Development was identified as surface water flooding, all other potential sources of flooding were considered negligible to low. As discussed in the previous sections, the proposed design solutions detailed in the proposed drainage strategy minimise any residual risk linked to potential extreme rainfall events. It has been recommended that the Site's external levels remain slightly elevated compared to the surrounding roads to reduce risk of the surface water flow paths in the surrounding roads entering the site. The proposed drainage strategy demonstrates that the drainage network at the Site is designed to accommodate runoff during all events up to and including the 100 year plus a climate change allowance preventing potential exceedance flows off-site. Drainage exceedance routes have also been considered and allowed for as part of the development of parameters to ensure that any surface water runoff exceeding the drainage network capacity would naturally flow away. It has also been recommended in accordance with best practice that all buildings within the development will have raised thresholds above the external levels, to help mitigate against any surface water flooding.

7.5 Residual Flood Risk

The only substantial risk of flooding from the Proposed Development was identified as surface water flooding, all other potential sources of flooding were considered negligible to low. As discussed in previous sections, the proposed flood risk mitigation measures will aid in reducing any residual risk.

7.6 Foul Water Drainage Strategy

As per correspondence with Thames Water via the capacity check application (Refer to **Appendix E**). It's proposed that foul water from the site is directed to TW manhole 2201. This is depicted in **Figure 13**, as submitted to Thames Water as part of the capacity check application.

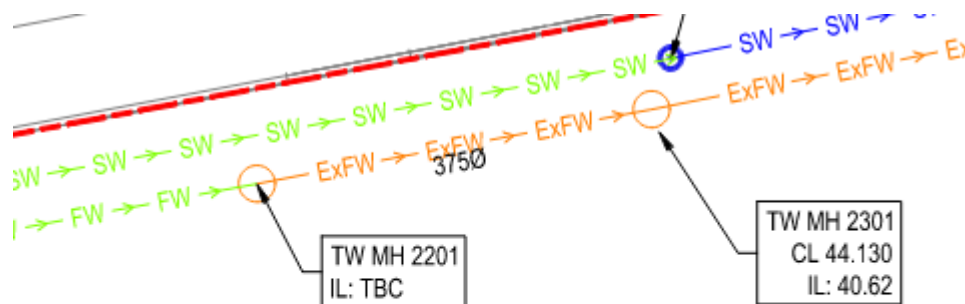


Figure 13: Proposed Foul Water Connection

8 Drainage Maintenance and Management strategy

The Drainage Maintenance and Management Strategy (**Table 5**) has been produced based on the information provided within the SUDS Manual; it is expected that the maintenance for the entire scheme will be under the management of the Applicant and/or an identified management company, in which a suitably qualified maintenance specialist will undertake the work.

Table 3: Proposed Drainage Maintenance Strategy

Drainage Feature	Regular Maintenance	Occasional Maintenance	Monitoring
Drainage Channels	Inspections will be frequent and regular, depending on local conditions, but at least annually by Site management. Inspections will include gratings; covers including their locking bolts; sumps and sump buckets; exposed concrete surround and adjacent paving. Channels will be flushed with water or high-pressure jetting (no boiling water or cleaning agent will be used). All silt buckets and sumps will be cleaned out replaced back into the units ensuring they are correctly fitted.	All channel surfaces and joints will be checked and repaired as necessary.	Inspected every 6 months or after large storm.
Geo-Cellular Attenuation Tank	Inspection chambers will be checked every 6 months for the accumulation of debris and silt and cleaned as necessary. Remove debris from the catchment surface where it may cause risk to performance (monthly).		Inspect every 6 months or after large storm.
Blue Roofs	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes, integrity of waterproofing and structural stability. Inspect drain inlets to ensure unrestricted runoff from the drainage attenuation layer. Remove debris and litter to prevent clogging of inlet drains and inference with plant growth.	Replace dead plants as required Remove invasive and nuisance vegetation including weeds. Inspect outlets from blue roof	Inspected every 6 months or after large storm. Inspect outlets and overflows from blue roofs.
Manholes / Inspection Chambers	Inspection chambers will be checked every 6 months for the accumulation of debris and silt and cleaned as necessary.		Inspect every 6 months or after large storm.

9 Conclusion

This FRA and DS has been prepared on behalf of McLaren (Broad Street Mall) Ltd and UREF III LP to support the planning application for part-demolition of existing retail units, car park and service areas, demolition and rebuild of car park ramp, and construction of a residential-led, mixed-use development fronting Queens Walk and Dusseldorf Way, including all necessary enabling and alteration works required.

The EA and the online GOV.UK Flood Map for Planning identify that the Site is located in Flood Zone 1 where the probability of river or sea flooding is less than 0.1% (1 in 1000) chance in any given year. Meaning that the probability of tidal or fluvial flooding can therefore be assessed as negligible.

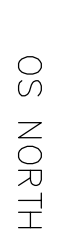
Other potential sources of flooding have been investigated and are deemed negligible to low.

The proposed surface water drainage strategy optimises the use of SuDS (predominantly blue roofs) in line with best practice, national and local policy and has been developed in discussion with the relevant stakeholders. At this outline stage it is proposed that surface water runoff will be attenuated to 29.86 l/s on site and then discharge to the existing TW water sewer (reference: 2201) running along Dusseldorf Way.

This offers a 30% reduction compared to the existing discharge rate for that catchment.

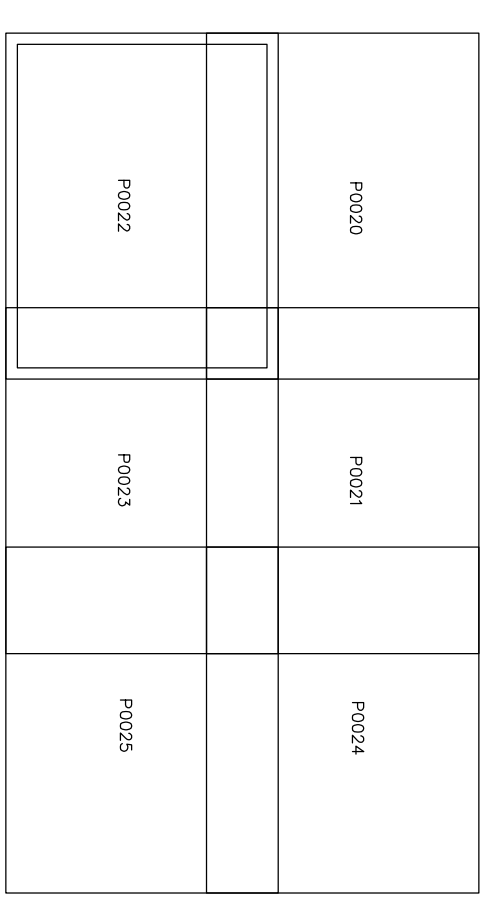
TW have been consulted via a capacity check and have confirmed both foul and surface water exists to cater for the development. Its proposed surface water flows are directed to TW MH 1351, and foul water flows are directed towards TW MH 2201.

Appendix A – Topographical Survey



Building Abbreviations

BL	Basement Level	HD	Heating Duct
BSL	Basement Soffit Level	RMP	Rain Main Pipe
C	Cill Height from FFL	SL	Soffit Level
DP	Down Pipe	SVP	Soil and Vent Pipe
DPC	Damp Proof Course	VP	Vent Pipe
FFL	Finished Floor Level	W	Window Height from Cill
	Floor to Ceiling Height		Direction of Floor Joist Span



Sheet Layout

Rev	OA	Check	Description	Date
5	-	-	-	-
4	-	-	-	-
3	-	-	-	-
2	-	-	-	-
1	-	-	-	-
0	AI	First Complete Issue	06/05/2017	-
Profil	AI	Preliminary - Not Complete	22/12/2017	-

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Continuation Project/Discussion Surveyors (working free, NAD)
Habitat Management Products Ltd., Chichester & Basingstoke
Vertical Vires, Right of Light, NE Landmark Areas
3D Laser Scanning & Dimensional Control
CAD Resources – 3D Modelling, Visualisations etc.

SURVEYED	WLSL	Moorgarth Properties
DRAWN	AS	
SCALE	1:100	

Broad Street Mall, RG1 7QE

BASEMENT FLOOR PLAN

JOB NO	DRAWING NUMBER
S715/0357	S715/0357/P/0020

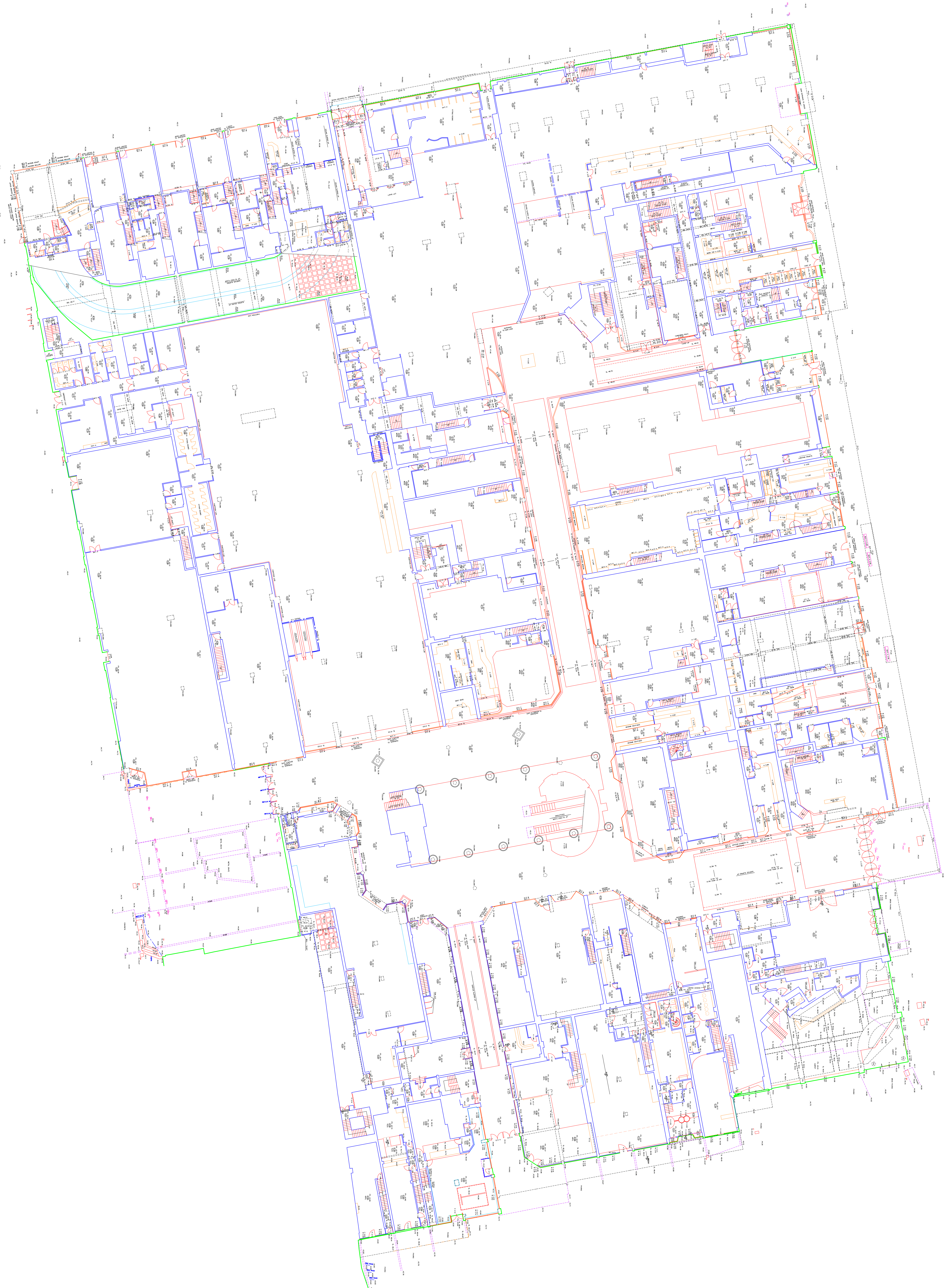
A0 Sheet - 1,189mm X 841mm



OS NORTH

Building Abbreviations

BL	Basement Level	HD	Heating Duct
BSL	Below Sill Level	RWP	Riser Water Pipe
C	Cill	SFP	Soffit Floor Pipe
DP	Down Pipe	SVP	Sill and Vent Pipe
DPC	Damp Proof Course	VP	Vent Pipe
FFL	Finished Floor Level	W	Window Height from Cill
Floor to Ceiling Height		↙	Direction of Floor Joist Span



Sheet Layout:

Notes

The Grid is related to OS National Grid using GPS.
All Levels are related to OS datum using GPS.
All dimensions are in metres unless otherwise specified.

Rev	QA Check	Description	Date
5	-	-	-
4	-	-	-
3	-	-	-
2	-	-	-
1	-	-	-
0	AI	First Complete Issue	06/05/201
Prelim	AI	Preliminary - Not Complete	22/12/201

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Construction Project Division: Surveying, Monitoring, and NDT
Hazardous Waste Management, Environmental Remediation,
Landfill and Maximum Daily Loads (MDL) Data
Vertical Vires, Right of Light, Wet Land Use
3D Laser Scanning & Dimensional Control
CAD Research – 3D Modeling, Visualizations, etc

CONVERTED	WIDE
DRAWN	AS
SCALE	1:100

Moorgarth Properties

Broad Street Mall, RG1 7QE

GROUND FLOOR PLAN

JOB No	DRAWING NUMBER
S715 / 0357	S715 / 0357 / P / 0014

Appendix B – Underground Utilities Survey

Note: The underground services information has been supplied by Amethyst Surveys Ltd

UTILITY KEY	
— HV	HV ELECTRIC CABLE
— LV	LV ELECTRIC CABLE
— ER	EARTHING ROD / CABLE
— TS	TRAFFIC SIGNAL CABLE
— TEL	TELECOM CABLE
— COM	COMMUNICATION CABLE
— W	WATER PIPE
— G	GAS PIPE
— FWS	FOUL DRAINAGE
— SWS	SURFACE DRAINAGE
— CWS	COMBINED DRAINAGE
— F	FUEL PIPE
— H	HEATING PIPES
— ED	EMPTY DUCTS
— TRENCH	TRENCH SCAR
— SURVEY	SURVEY BOUNDARY

— Q1-A	HORIZONTAL AND VERTICAL LOCATION OF THE UTILITY VISUALLY DETECTED ABOVE GROUND OR LOCATED WITHIN TRAIL PITS, I.C. IN ITS ETC
— B1	HORIZONTAL AND VERTICAL LOCATION OF THE UTILITY DETECTED BY MULTIPLE GEOPHYSICAL TECHNIQUES USED
— B2	HORIZONTAL AND VERTICAL LOCATION OF THE UTILITY DETECTED BY ONE GEOPHYSICAL TECHNIQUE USED
— B3	HORIZONTAL LOCATION ONLY OF THE UTILITY DETECTED BY ONE GEOPHYSICAL TECHNIQUE USED (PASSIVE)
— B4	A UTILITY SEGMENT WHICH IS SUSPECTED TO EXIST BUT HAS NOT BEEN DETECTED AND IS THEREFORE SHOWN AS AN ASSUMED ROUTE
— Q1-C	A SEGMENT OF UTILITY WHOSE LOCATION IS DEMONSTRATED BY VISUAL REFERENCE TO SURFACE FEATURES OR EVIDENCE OF PREVIOUS STREET WORKS
— Q1-D	A SEGMENT OF UTILITY WHOSE LOCATION CANNOT BE DEMONSTRATED BY VISUAL REFERENCE TO SURFACE FEATURES OR EVIDENCE OF PREVIOUS STREET WORKS
— END OF TRACE	END OF TRACE
— HEAD OF RUN / CAPPED	HEAD OF RUN / CAPPED
— PIPE INLET / OUTFALL	PIPE INLET / OUTFALL

ABBREVIATIONS	
AC	ASSUMED ROUTE
AR	ASSUMED ROUTE
BB	BASE BEND
BO	BORING
BR	BORING
BT	BT INSPECTION CHAMBER
CB	CAST IRON
CL	COVER LEVEL
CR	CABLE RISER
CP	CATCHPIT
DI	DUCTILE IRON
DP	DOWN PIPE
ED	EMPTY DUCT
END	END OF TRENCH SCAR
EP	ELECTRICITY POLE
FI	FIRE INSULANT
FL	FLOOD LIGHT
G	GULLY
GR	GROUND PENETRATING RADAR
GP	GLASS REINFORCED PLASTIC
HL	HIGH LEVEL
HR	HEAD OF RUN
IC	INSPECTION CHAMBER
I	INVERT LEVEL
SW	SURFACE WATER SEWER
CS	CONTAMINATED SURFACE WATER SEWER
FWS	FOUL WATER SEWER
CWS	COMBINED WATER SEWER
LP	LAMP POST
MW	MONITORING WELL
OS	OFF SURVEY AREA
PE	PIPE RISER
PL	PLASTIC
PR	PIPE RISER
PVC	POLYVINYL CHLORIDE
RWP	RAIN WATER PIPE
S/A	SOAKAWAY
SI	SPUN IRON
ST	STOP TAP
S.T	STEEL
SV	SURFACE VALVE
SVP	SOIL VENT PIPE
TE	TAKEN FROM RECORD
TL	TRAFFIC LIGHT
TP	TELEGRAPH POLE
UT	UNABLE TO FIND
UTL	UNABLE TO LIFT
UTCT	UNABLE TO CUT
VP	VENT PIPE
VR	VARIOUS RECOVERY
WL	WATER LEVEL
WM	WATER METER
WO	WASH OUT VALVE

DISCLAIMER

ELECTRO-MAGNETIC TECHNIQUES AND/OR GROUND PENETRATING RADAR HAVE BEEN USED IN THE LOCATION OF UNDERGROUND SERVICES.

THE RESULTS ARE NOT INFALLIBLE AND TRAIL EXCAVATIONS SHOULD BE CARRIED OUT TO CONFIRM SERVICE IDENTIFICATION, POSITIONS AND PARTICULARLY DEPTHS WHERE THESE ARE CRITICAL. ALTHOUGH ALL REASONABLE EFFORT HAS BEEN MADE IN SEARCHING AVAILABLE RECORD DRAWINGS, THE COMPLETENESS OF THE UNDERGROUND SERVICES INFORMATION CANNOT BE GUARANTEED. THE METHOD OF SURVEY DOES NOT DIFFERENTIATE BETWEEN LIVE AND DEAD SERVICES AND AS SUCH ALL SERVICES SHOULD BE TREATED AS LIVE.

WHERE SERVICES ARE NON-METALLIC POSITIONS MAY BE TAKEN FROM RECORDS, TRENCH SCARS & SURFACE DETAIL WHERE QUOTED. DEPTH ESTIMATES ARE GENERALLY TO THE CENTRE OF THE SERVICE. DEPTHS TO GRAVITY SEWERS AND DRAINS ARE GENERALLY TO INVERT LEVELS UNLESS OTHERWISE STATED.

PIPE SIZES WHICH CANNOT BE OBTAINED BY VISUAL SURVEY ARE TAKEN FROM RECORD DRAWINGS OR MARKER PLATES WHERE AVAILABLE.

WHERE GROUND PENETRATING RADAR HAS BEEN USED IT WILL PRIMARILY HAVE BEEN TO IDENTIFY UNDERGROUND UTILITIES.

IF POSSIBLE WE WILL ALSO IDENTIFY UNDERGROUND STRUCTURES / TANKS ETC BUT CANNOT GUARANTEE TO HAVE LOCATED ALL SUCH ITEMS.

THE USE OF RADAR CAN BE LIMITED BOTH BY SURFACE CONDITIONS AND ALSO BY SOIL TYPE. DEPTH ESTIMATES WOULD NOT NORMALLY BE PROVIDED FOR SERVICES LOCATED WITH GPR.

Client
SILVER DEVELOPMENT & CONSTRUCTION GROUP PLC

Project
BROAD STREET MALL READING

Title
UNDERGROUND SURVEY

Drawing Number
TS21-619-3

Revision	Description	Date

Scale	1:100@A0	Sheet	2 of 2
Drawn by	SC-ASL	Checked by	PG
		Date of Survey	DEC 2021



Tel 01438 841300
enquiries@terrainsurveys.co.uk
www.terrainsurveys.co.uk

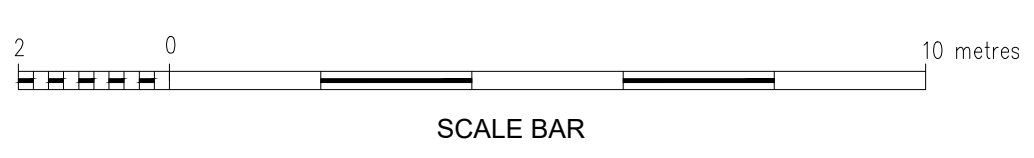
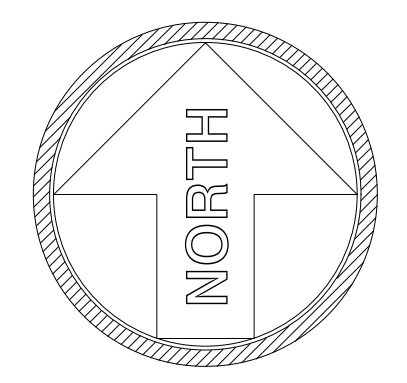


SURVEY NOTE

TS21-619 is an extension of survey drawing S7150357P0020-P0025, as supplied by client. No verification of the previous survey has taken place.



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Appendix C – Drainage Authority Asset Records

Asset Location Search



Groundwise Searches Ltd
Suite 8 Chichester House
45 Chichester Road
SOUTHEND ON SEA
SS1 2JU

Search address supplied Broad Street Mall
Reading
RG1 7QE

Your reference 18731DM

Our reference ALS/ALS Standard/2016_3411896

Search date 15 September 2016

Notification of Price Changes...

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

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

www.thameswater-propertysearches.co.uk





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
	Gully
	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 millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Sewer Map - ALS/ALS Standard/2016 3411896

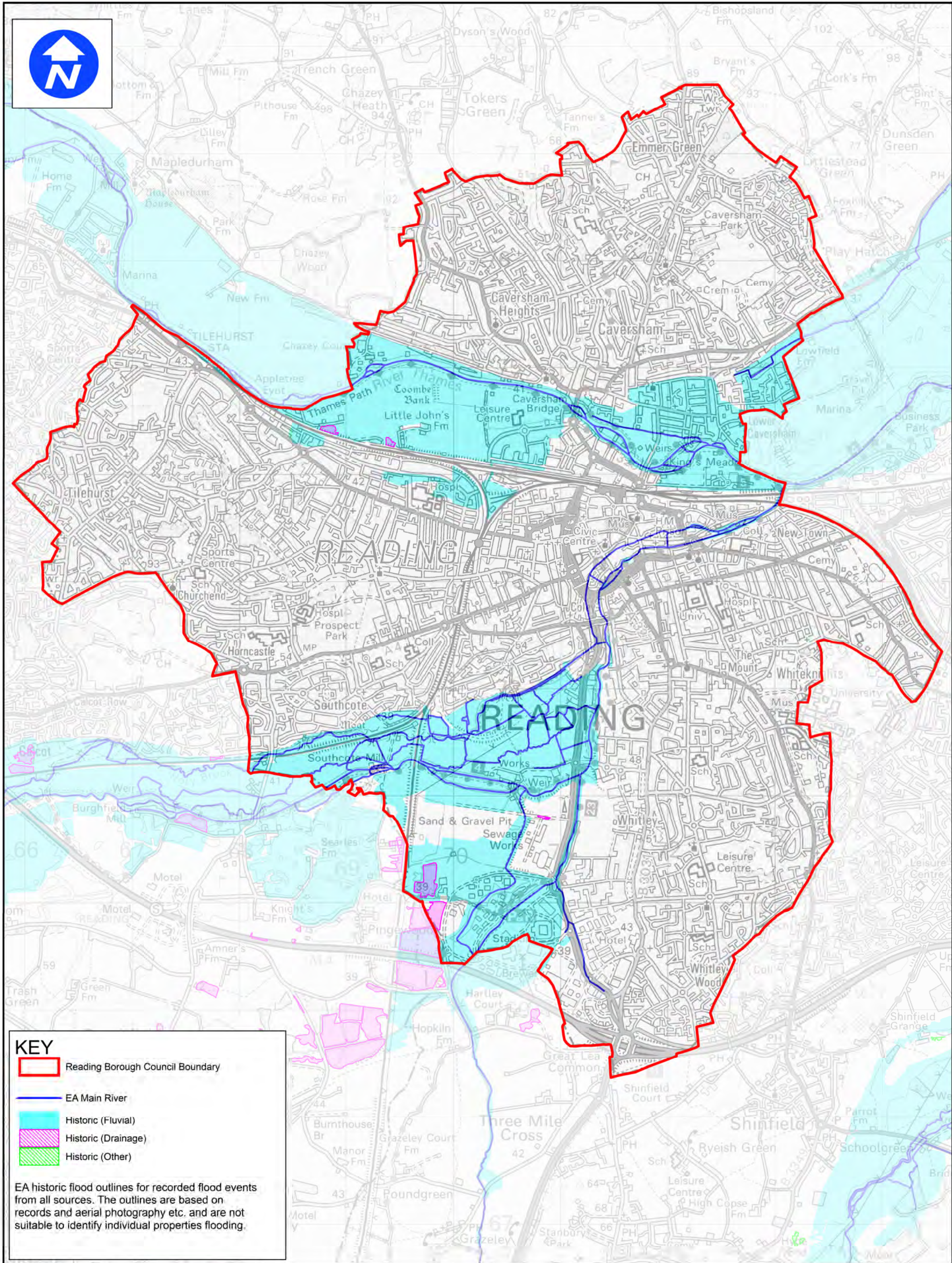


The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 471239,173352

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

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

Appendix D – Relevant Maps and Data



- KEY**
- Reading Borough Council Boundary
 - EA Main River
 - Historic (Fluvial)
 - Historic (Drainage)
 - Historic (Other)

EA historic flood outlines for recorded flood events from all sources. The outlines are based on records and aerial photography etc. and are not suitable to identify individual properties flooding.



www.peterbrett.com

Peter Brett Associates LLP
READING
Tel: 0118 950 0761 Fax: 0118 959 7498

Client



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RBC SFRA

EA Historic Floodplain Maps

Date: 04/04/2016

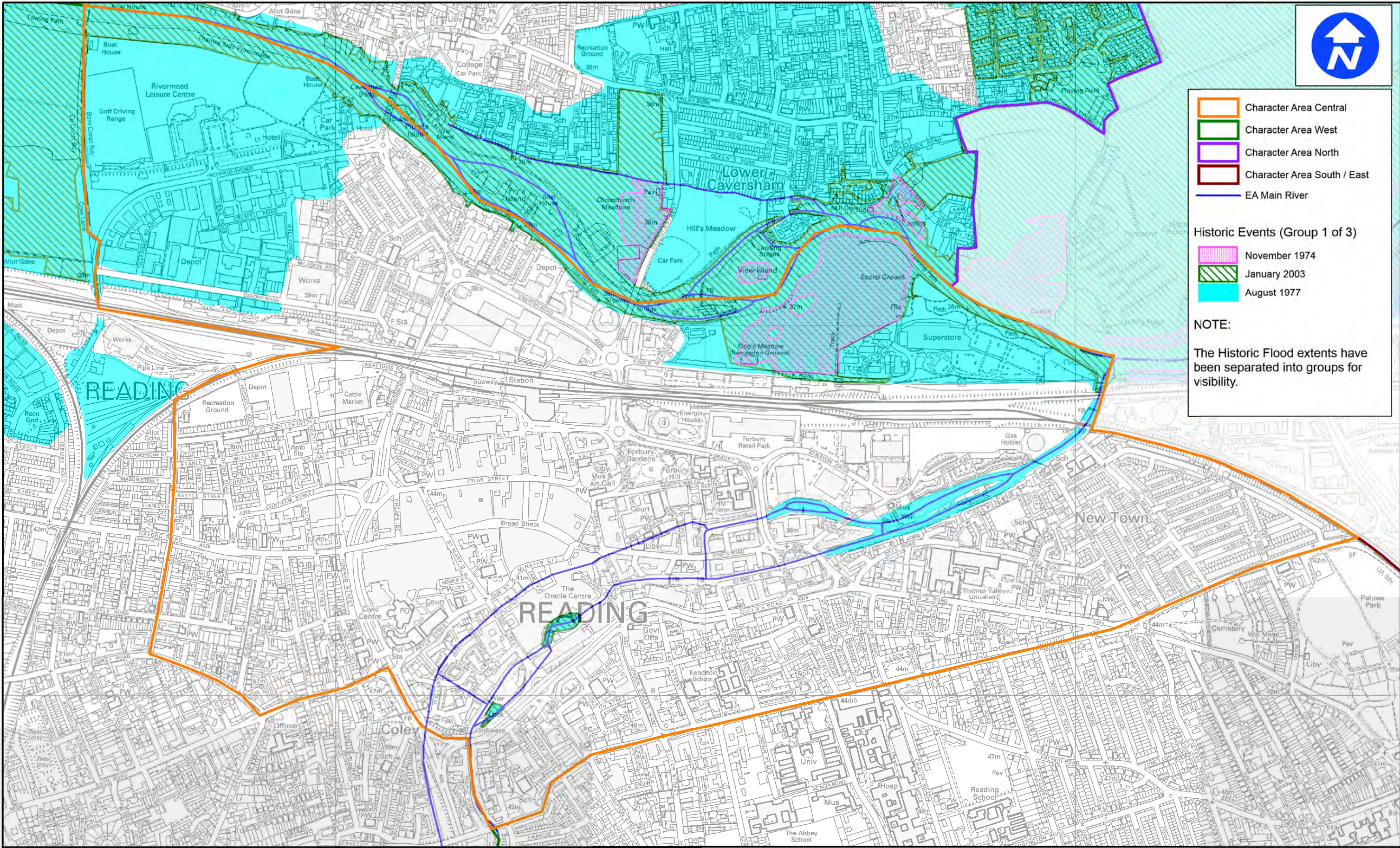
Scale: NTS

Drawn By: SB Checked By: RF

Rev: -

Figure Number

Map F1



- Character Area Central
- Character Area West
- Character Area North
- Character Area South / East
- EA Main River

Historic Events (Group 1 of 3)

- November 1974
- January 2003
- August 1977

NOTE:
The Historic Flood extents have been separated into groups for visibility.



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Client
Reading Borough Council
Working better with you
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RBC SFRA

Character Area Central
EA Historic Flood Map (map 1 of 3)

Date: 03/01/2017
Scale: NTS
Drawn By: SB Checked By: RF
Rev: -
Figure Number
Map F2_C1