Flood Risk Assessment Report

Bartley Wood BP
Hook, Hampshire

Project Ref: (EB / 12962 / FRA)

First Issue
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REPORT STATUS

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2 Introduction

The Baynham Meikle Partnership Ltd has been commissioned on behalf of XLB Property LLP to prepare a Flood Risk Assessment and Drainage Strategy for a planning application for Demolition of existing buildings and redevelopment of the site to provide 9No. industrial units (Flexible Use Class B1/B8/E(g)(i)-(iii)) and 1No. foodstore (Use Class E(a)), together with associated parking, a new vehicular access off Griffin Way South, landscaping and other associated works in Bartley Wood Business Park.

The Flood Risk Assessment will be part of a Planning Application to be made to Hart District Council.

The site itself is located in Bartley Wood Business Park and is accessed of Bartley Way. The Ordnance Survey Grid reference is E473300, N453750. A Site location plan is included in Appendix A.

The development area is approximately 3.900 hectares.

It is a requirement for development applications to consider the potential risk of flooding to the proposed development over its expected lifetime and any possible impacts on flood risk elsewhere in terms of its effects on flood flows and runoff.

This Flood Risk Assessment has been prepared following guidance set out in the National Planning Policy Framework (NPPF) and is undertaken in consultation with other relevant bodies. The following aspects of flood risk should be addressed in all planning applications in flood risk areas:

- The area liable to flooding.
- The probability of flooding occurring now and over time.
- The extent and standard of existing flood defences and their effectiveness over time.
- The rates of flow likely to be involved.
- The likelihood of impacts on other areas, properties, and habitats.
- The effects of climate change which currently requires designs to include 1 in 100-year rainfall events + 40% climate change allowance.
- The nature and current expected lifetime of the development proposed and the extent to which it is designed to deal with flood risk.

Further guidance has been obtained from:

- The SuDs Manual V2 (CIRIA c753).
- “Interim Code of Practice for Sustainable Drainage Systems 2004” (ICOP SUDS).
- “Interim National Procedures” point 3, 10.2 & 10.3.
- The council’s subject Strategic Flood Risk Assessment.

3 Existing Site

3.1 Site Location

The development is situated in Bartley Wood Business Park and has a postcode RG27 9FF. Ordnance Survey National Grid reference to the centre of the proposed site is E473300, N453750. A site location plan can be found in Appendix A. The current site is a brownfield site which is developed / hard surfaced, however, existing structures / finishes are to be demolished.

The site occupies an approximate area of approximately 3.900Ha. The neighbouring land use is as follows:

- North commercial units / offices
- East undeveloped land
- South undeveloped land / soft landscaping part of SSSI site
- West commercial units / offices / some residential conversions

3.2 Topography

The topography of the existing site is such that it falls from north to south at approx. 1 in 50 and east to west at approx. 1 in 80.

There is also a retaining wall to the east of the site retaining approx. 2m and south-west of the site boundary which retains approx. 1.0m.

A copy of the topographical survey drawing is included within Appendix A.

3.3 Existing Ground Conditions

A desk study report was carried out by Applied Geology in May 2021. The report confirmed that the site is underlain by solid geology of the London Clay Formation with overlying River Terrace Deposits in the West of the site only.

The Applied Geology are currently in the process of carrying out phase 1 & 2 geotechnical site investigation and were able to provide their draft results prior to issuing the full report. The results indicate that the site geology is made ground (asphalt, concrete block paving, granular sub-base, concrete) up to an average depth of 1.1m bgl. The made ground is then underlain by River Terrace Deposits (slightly sandy clayey gravel) at approx. 2.1m bgl. London Clay Formation comprising silty orange and brown clay was encountered up to the depths of 10.5m bgl.

No evidence of contamination was recorded during the desk study.

There is a watercourse, described as Inland River, running through the site travelling south to north direction.

The BGS have established that the potential for ground stability hazards on site varied from Negligible to Low.

The Desk top report indicates that the previous ground investigations undertaken in the vicinity of the site, prior to the business park being developed, have not encountered any contamination. As such, no sources of potential gross contamination that could impact potential receptors have been identified by the desk study. However, the following potential sources are still considered and are to be confirmed by further phase 2 geological / geotechnical site investigation works:

- Localised hydrocarbon spillages of fuels on site
- Sulphates in underlying natural strata (London Clay Formation)

Several soil infiltration tests have been carried out, all tests confirmed that the water level within the test pits did not drop sufficiently for the calculations to be made. Therefore, this concluded that infiltration into the underlying ground will not be feasible. This should however not preclude the use of tanked infiltration drainage techniques and will be discussed later on in the report.

Extracts from the report are included within Appendix D.

3.4 Aquifer Designation

An extract from the geographic information map (figure 1 & figure 2) indicates that a small portion of the site is located within High Vulnerability Secondary A Aquifer and is within an area of London Clay Formation (low permeability).

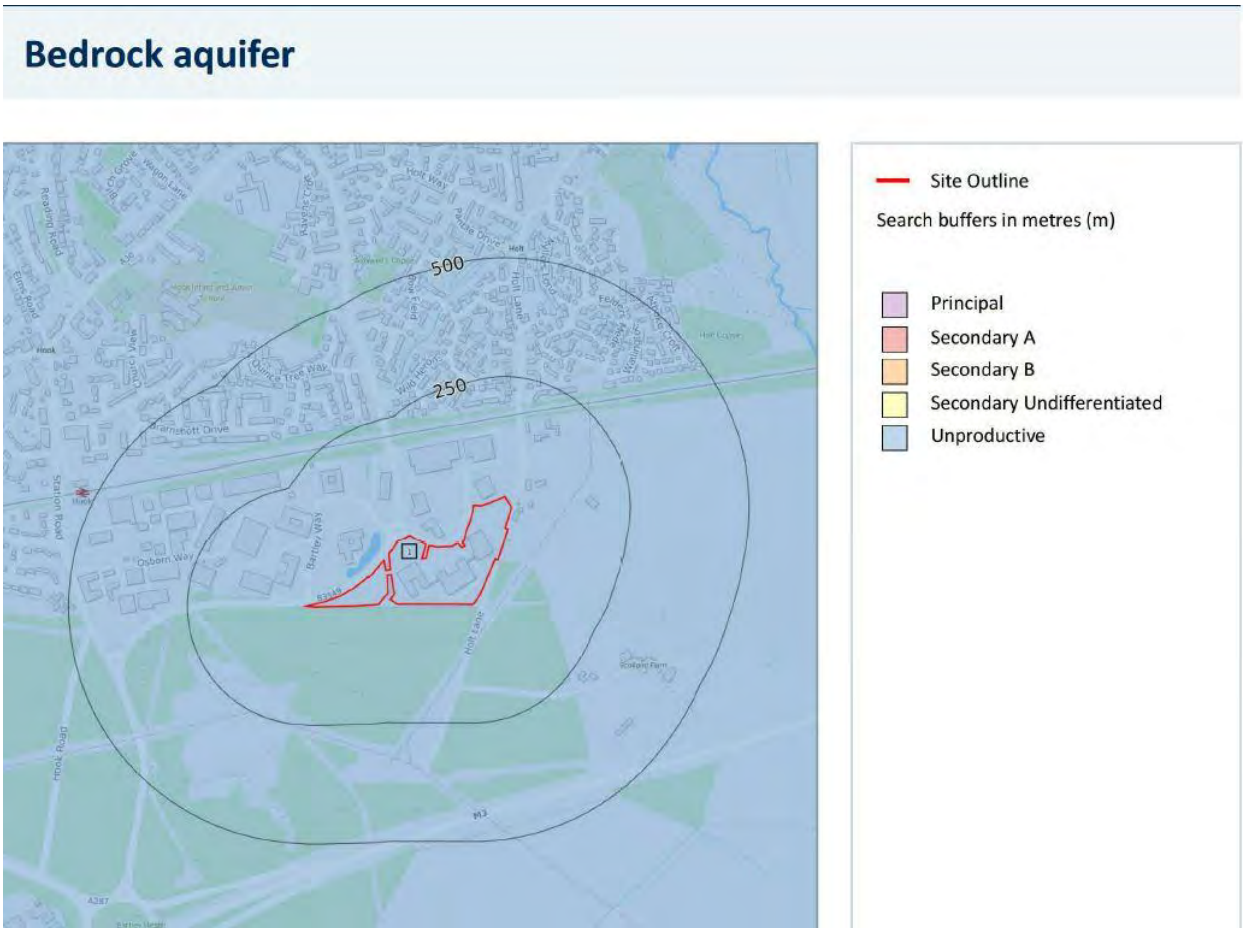

Figure 1. Aquifer Designation Map (Bedrock Drift)

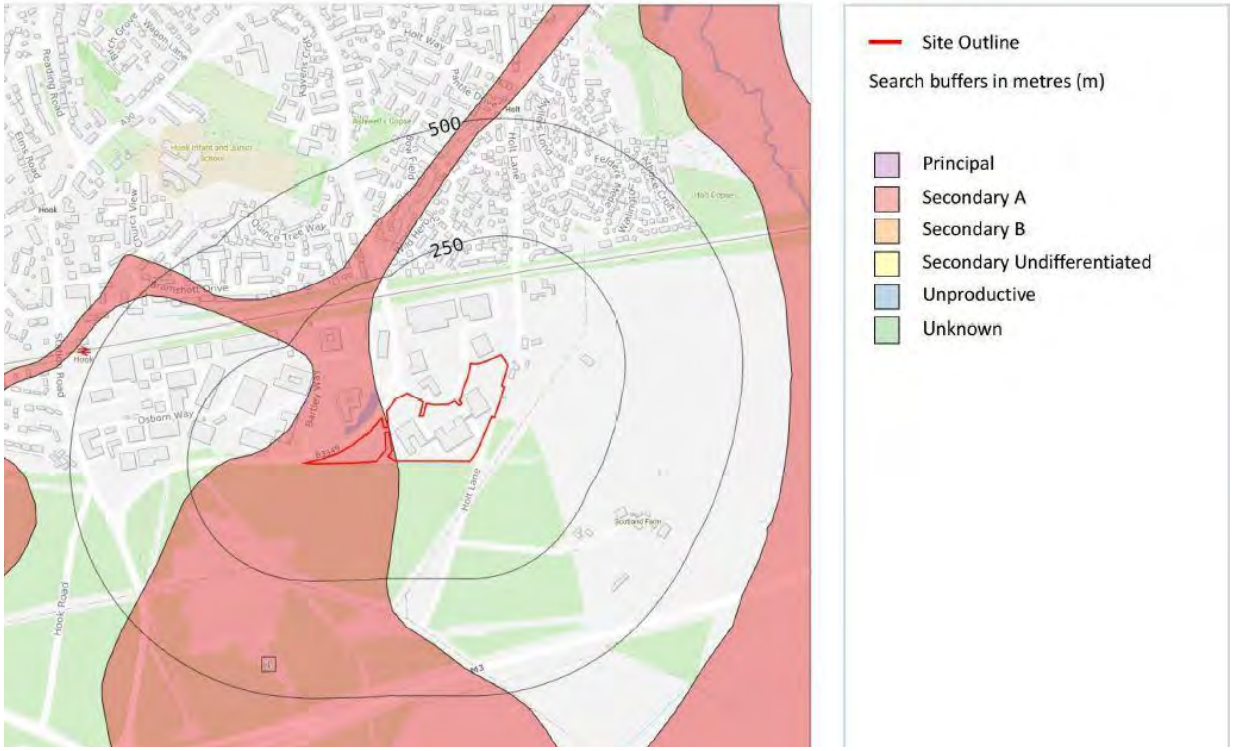

Figure 2. Aquifer Designation Map (Superficial Drift)

3.5 Site Specific Flood Risks

This section reviews the possible sources of flooding relevant for the site and assesses the impacts both on the development itself and on other areas as a result of the proposed development. The Environment Agency is responsible for the provision of information pertaining to flood risk from tidal and main watercourses throughout England and Wales. The EA provides an online information service through its flood map data. An extract from the flood maps is given below which indicates that the site is in Flood Zone 1. EA identifies the land having less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).

3.5.1 Tidal/Fluvial Flooding

River flooding occurs when water levels rise as a result of high or intense rainfall which flows into them, resulting in watercourses overflowing their banks.

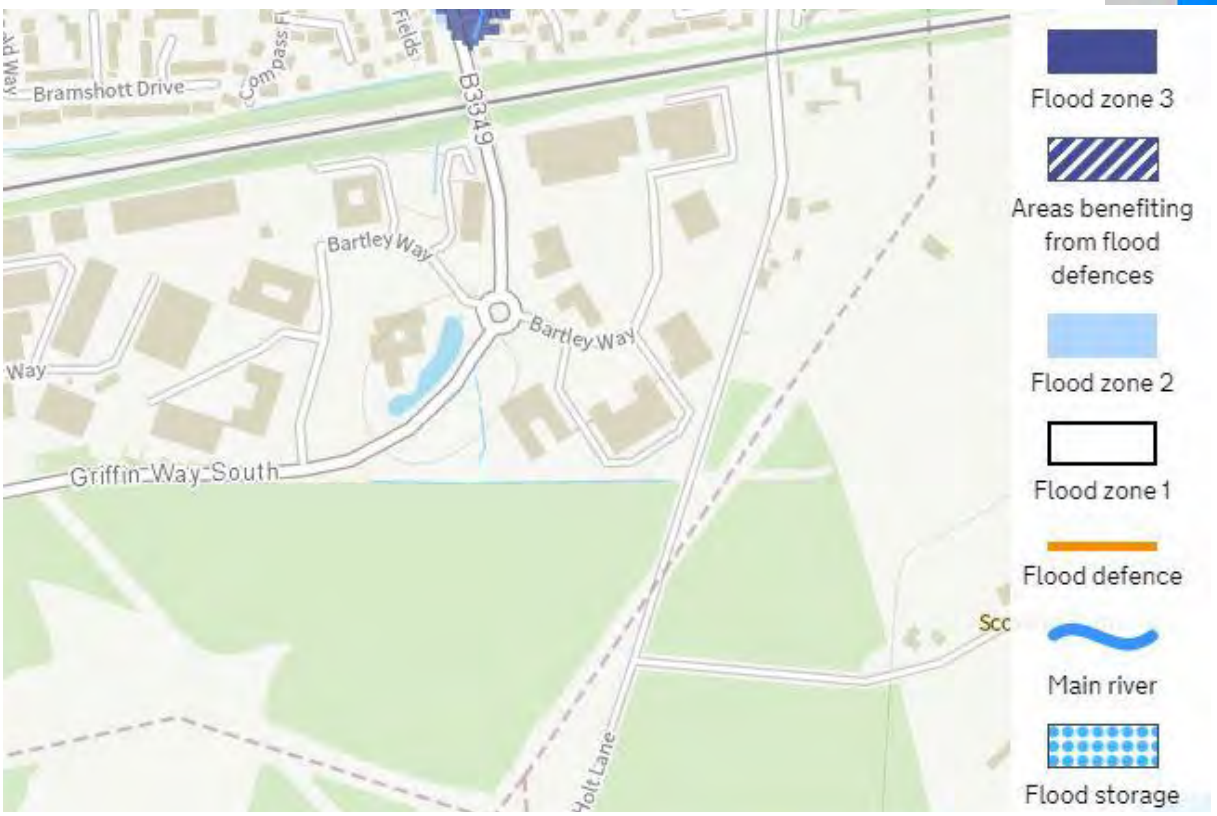

Figure 3. EA Flood Map – Rivers and Sea

Sea (Tidal) - The site is not located in the vicinity of the coast, and is therefore not at risk of flooding due to tidal flows.

River (Fluvial) – The site is not located adjacent to existing watercourse. Therefore, there is no risk of flooding from fluvial flows.

From figure 3, we can see that the proposed site is in a very low risk area (flood zones 1. Meaning, each year this area has a chance of flooding less than 1 in 1000 (0.1%) from tidal and fluvial flows.

3.5.2 Surface Water Flooding (Pluvial Flooding)

Surface water flooding can occur when heavy rainfall overwhelms the local drainage network which depends on existing ground levels, rainfall and the local drainage network. The EA website contains mapping of areas believed vulnerable to surface water flooding. An extract from the flood map is given in figure 4. This shows that the majority of the site is in a very low flood risk area. Meaning that each year this area has a chance of pluvial flooding of less than 0.1%, however, the maps also indicates that the western part of the site is at a high risk level of pluvial flooding. This is discussed later in this report.

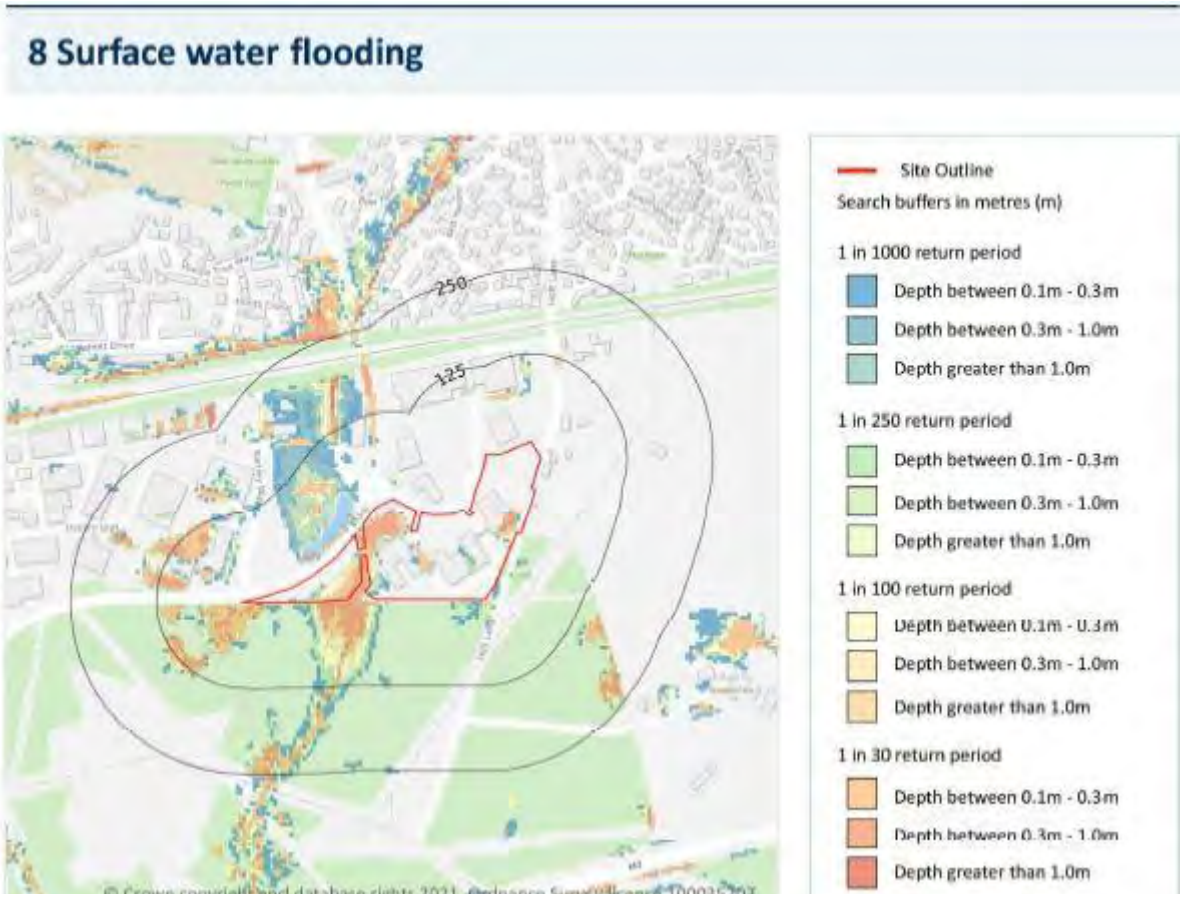

Figure 4. Groundsure Flood Map – Surface Water

3.5.3 Artificial Sources Flooding

Artificial sources include any water bodies not covered under other categories and typically include canals, lakes and reservoirs.

There is no major artificial water sources within the vicinity of the site, and therefore there is no flood risk due to artificial sources.

The EA website provides mapping of areas considered at risk to Reservoir flooding (artificial sources). An area is considered at risk if peoples' lives could be threatened by an uncontrolled release of water from a reservoir. An extract from the flood map is given in figure 5. This shows that there is no major artificial water within the vicinity of the site, therefore, the site is in a very low flood risk area. Meaning that each year this area has a chance of flooding from reservoirs of less than 0.1%.

Figure 5. EA Flood Map – Reservoirs

3.5.4 Historic Flooding

There are no records to confirm any historic flooding within the site area.

3.5.5 Sewer Flooding

Sewer flooding usually coincides with heavy rainfall, and may occur if the amount of rainfall exceeds the capacity of the sewer system, the system becomes blocked and/or water surcharges (i.e. rises above the ground) due to high water levels in the receiving watercourse.

The topographical survey information provided by Greenhatch in June 2020 as well as obtained Thames Water records in June 2020 show there are existing private drains running within the site area with discharge points onto public sewers running along Bartley Way. However, there are no records of sewer flooding, as such, sewer flooding is not considered to be a risk.

3.5.6 Groundwater Flooding

Groundwater flooding occurs as a result of water rising up from underlying aquifers or from water flowing from springs. This tends to occur after long periods of sustained heavy rainfall and can be sporadic in both location and time, often lasting longer than a river or surface water flood.

The desktop study report indicates that the western part of the site is within high risk of flooding from groundwater. Therefore, further geotechnical / geo-environmental site investigation will be carried out and groundwater flooding will be reviewed.

3.6 Source Protection Zone

The EA have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. The maps show three main zones (inner which is buffered around the abstraction point, outer and total catchment) and a fourth zone of special interest.

The zones are used in conjunction with the EA's Groundwater Protection Policy to set up pollution prevention measures in areas which are at a higher risk, and to monitor the activities of potential polluters nearby.

As shown in figure 6, the proposed development is not near or within any Source Protection Zone.

Figure 6. EA - Source Protection Zones

4 Proposed Site

4.1 Description of development

The proposed application is the demolition of existing buildings and redevelopment of the site to provide 9No. industrial units and 1No. foodstore together with associated parking, a new vehicular access off Griffin Way South, landscaping and other associated works in Bartley Wood Business Park. A copy of the site's layout plan can be found in Appendix B.

The proposed developments will have a total impermeable area of 3.044ha and permeable area of 0.856ha, also, there is an additional area of 0.210Ha for S278 works which is excluded from the current drainage scheme and will be designed / developed by others.

The proposed site levels have been designed such that they follow the approved contours of the existing site to prevent the requirement for any new retaining walls and also adhere to best practice and building regulation design standards.

The proposed development will also minimise any potential for surface water flooding from the new development drainage network and ensure that should any flooding occur it is controlled and kept within the new development demise and not affect neighbouring properties or highway land.

5 Drainage Policy & Consultation

5.1 Drainage Authority

The existing site development is currently served by an existing foul and surface water public sewers running along Bartley Way (northern site boundary).

Thames Water (TW) have been contacted and pre-development enquiry submitted in order to understand the existing network capacity as well as obtain their approval for foul and surface water discharge rates into their sewers. At the time of writing this report Thames Water had not concluded their recommendations.

5.2 Lead Local Flood Authority

The Lead Local Flood Authority (LLFA) is Hart District Council who are to be contacted to obtain their advice on the proposed development scheme.

Hart District Council has a Strategic Flood Risk Assessment and Local Plan which may define flooding and drainage requirements.

Key items discussed within the SFRA are:

- 40% – Climate Change
- Use of SuDS (where possible use of strategic SuDS should be made)
- Discharge rates should be restricted to Greenfield rates as a maximum.
- Brownfield sites should seek to discharge surface water from the redeveloped site at Greenfield rates wherever possible. At the least, a 20% betterment should be offered (in terms of reduced runoff) for all redeveloped sites.
- 1 in 100-year attenuation of surface water, taking into account climate change.
- Flood risk of identified sites

The main analysis and documentation on flood risk for Hart District Council currently comprises a Level 1 SFRA, completed in December 2016. The Hart SFRA study area covers 215 km2. Within this is the River Blackwater along with the River Whitewater, River Hart and Fleet Brook which are the primary watercourses. As well as the main watercourses there are a number of smaller tributaries including Sandy Lane Ditch, Pine Grove Stream (both in Fleet), the Great Sheldon Stream, the Dorchester Stream (Hook), Tudor Stream, Cricket Hill Stream, Dungells Stream, Southwark Brook, Moulsham Copse Stream, Catsby Stream (Yateley), Cypress Stream, Bailey Stream (in Blackwater) and Green Lane Stream (Hartley Wintney). A section of the Basingstoke

Canal, which is managed by the Basingstoke Canal Authority, passes through the study area and has the potential to influence the watercourses in this study.

Current flood risk management measures are confined to localised flood bunds, bank protection, culverting, balancing ponds and sluices. On the Blackwater a number of changes and improvements have been made to the river channel in the urban area. There is the Crondall Flood Alarm on the River Hart which is a direct Alarm for flood warning and there are also three walls identified by the Environment Agency as performing a flood defence function.

As well as the larger main rivers described above, there are a further 29 smaller main rivers that pass through many of the towns, villages and built up urban areas. Due to the density of buildings and proximity to the channels many of these smaller watercourses play a locally important part in the flood risk issues across Hart.

The Local Plan for Hart and supporting guidance documents should continue to include policies to:

- Protect the functional floodplain from development;
- Direct vulnerable development away from flood affected areas taking account of all sources of flooding;
- Ensure all development is 'safe'.
- Promote the use of maintainable SuDS in all flood zones for both brownfield and greenfield sites;
- Reduce flood risk from all sources where possible.

A key consideration for any new development is whether adequate flood warning systems and procedures are in place to ensure that occupants of the site are able to act upon the warnings and are equipped to take steps to remain safe in the event of a flood. The EA operates a flood warning service to provide warnings when there is an increased risk of flooding. However, the site is not located within recognized flood plain and is considered to be within Flood Zone 1 area – very low risk of flooding, therefore, the Flood Warning Systems / Flood Evacuation Plans are not required for this proposed development.

5.3 Application of Flood Risk Policy

Based on the EA's flood maps it is possible to undertake an initial site flood risk compatibility assessment to ascertain whether the proposed development site is presently suitable for development by referring to the flood zone compatibility matrix (Table 1).

Table 1.Flood Risk Vulnerability and Flood Zone Compatibility

		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	**Zone 1**	√	√	√	√	√
	Zone 2	√	√	Exception Test required	√	√
	Zone 3a	Exception Test required	√	x	Exception Test required	√
	Zone 3b Functional Floodplain	Exception Test required	√	x	x	x

Key: √ - Development is appropriate

x - Development should not be permitted

Notes to table:

This table does not show:

- The application of the Sequential Test which guides development to Flood Zone 1 first, then Zone 2 and then Zone 3.
- Flood Risk Assessment requirements, or
- The Policy aims for each flood zone.

Table 2. Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.

	• Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent (where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure").
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities and hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable" and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (expect landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Navigations facilities. • Ministry of Defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations.

	• Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.
Water Compatible Development	• Water treatment works which do not need to remain operational during times of flood. • Sewerage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). • Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewerage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves.

5.3.1 Sequential Test

The Sequential Test is intended to direct new development to an area of a lowest probability of flood risk and ensure development is in the most appropriate flood zone.

The proposed developments extents of the site are within Flood Zone 1 and are considered to be in a non-vulnerable area, therefore, developments relocation is not required.

5.3.2 Exception Test

The Exception Test is not required as the site is located within Flood Zone 1.

5.3.3 Flood Risk Assessment Summary & Mitigation Measures

Table 3 contains a summary of the flood risks to the proposed site. Mitigation measures to address the identified risks are discussed below.

Table 3. Summary of Flood Risks

Flood Risk	Risk Level	Action Required
Tidal/Fluvial	Very Low	None
Surface Water	Very Low - High	Mitigation Required
Sewers	Low	None
Groundwater	Very Low - High	Mitigation Required
Artificial	Very Low	None
Run-off (onsite)	Low	Mitigation Required

It can be concluded that there is only a risk to flooding on the development itself. However, mitigation measures will be considered to ensure that areas affected by flooding do not adversely impact areas downstream by containing the flooding within the proposed development.

6 Drainage Strategy

6.1 Hierarchy of Disposal

Generally, the aim should be to discharge surface water run-off as high up the following hierarchy of drainage options as reasonably practicable.

- Into the ground (infiltration)
- To a surface water body
- To a surface water sewer, highway drain, or other drainage systems
- To a combined sewer

6.1.1 Infiltration

As mentioned in section 3.3 of this report, the desk study has confirmed that the site is underlain by London Clay Formation (silty clay), therefore, it is unlikely that infiltration will be suitable. According to the SUDS manual table 25.1, stiff clay would provide with an average infiltration rate of 1x10-7m/s (0.00036m/hr), which confirms the unsuitability of the ground to allow infiltration.

Furthermore, the recent provided draft site investigation results confirmed that infiltration into the ground will not be possible. This should however not preclude the use of tanked infiltration drainage techniques and will be discussed later on in the report.

6.1.2 Surface Water Sewer/Foul Water Sewer

Topographical survey information provided by Greenhatch in June 2020 and existing drainage records provided by Thames Water in June 2020 confirmed that there are existing drainage within the site development area which then connects onto existing public sewers running along northern side of the boundary along Bartley Way.

The extracts with location of the sewer can be found within the Appendix D.

6.1.3 Surface Water to a Surface Water Body

The survey and record information indicate the presence of a shallow watercourse running through the site. However, the depth to the bed level of this feature is such that it will not allow gravity surface water drainage connection to it from the new development drainage system.

6.2 Sustainable Drainage

Potential SuDS Techniques Considered for this Site:

6.2.1 Geo-cellular/Modular Systems

Modular plastic geo-cellular systems (Cellular Storage Tanks) with a high void ratio that can be used to create a below ground storage structure. Modular tanks can be used for runoff attenuation but require silt trap protection and suitable means of access for cleaning and inspection.

6.2.2 Pervious Pavements

Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic while allowing rainwater to infiltrate through the surface and into the underlying layers. This will help to store peak design flows from the site by utilising the volume available within the permeable stone (open graded material with no fines – 10-63mm aggregate) in the foundation layers (upper / lower sub-base) of the construction.

This method of surface water interception / collection will also offer water treatment facilities as the stone media under the permeable block paving will naturally capture hydrocarbon contaminants. The incorporation of a perforated pipe system will then convey the infiltrated surface water into the positive drainage system.

Ciria guidance within the new SUDS Manual V.2 (c.753 Nov.15) is referred to considering the use/construction of this type of SUDS facility.

It should not be used in the loading yard areas, due to the impact of the heavily loaded HGVs on the long-term durability of the pavement finish.

6.2.3 Allowable Surface Flooding

Additional storage of peak storm water has been incorporated into the design by allowing car-parking, access drives and soft landscaped areas to flood up to 100mm, provided this will not put the buildings, or neighbouring properties at risk of flooding. The proposed site levels should be set such that this is achieved, for the critical 1 in 100 year plus climate change storm event. Refer to proposed drainage plan within appendices.

6.2.4 Oversized Pipes

Surface water oversized pipes shall also be considered (where appropriate) within the plot drainage strategies to provide an effective means of underground storage volume.

6.2.5 Filtration / Cleaning

There will also be a natural filtering/cleaning out of any hydrocarbon pollution from the effect of surface water passing through the stone media underneath the permeable car parking.

Due to the use of new service yard at the site it is proposed that the storm water flows will pass through a by-pass oil interceptor prior to being discharged into existing ditch / watercourse. This interceptor will be subject to a stringent maintenance regime and a high level alarm will be fitted, both visual and audible in accordance with PPG3.

6.2.6 Controls

Flow control units such as hydrobrakes will be used to limit surface water discharge into existing watercourse to greenfield run off rates.

6.3 Sustainable Drainage Maintenance

The various SuDS features will remain privately owned and be maintained by Patron hook Ltd. The exact details of this arrangement will be defined with the future tenants and confirmed.

The SuDS operation and maintenance strategy will be in accordance with CIRIA C753 best practice, as detailed within the Suds Maintenance Plan report appended to this document, at Appendix D.

7 Drainage Strategy – Surface Water

7.1 Proposed Surface Water Runoff Rate

The site consists of 3.044ha of impermeable area and of 0.856ha of permeable area.

The design life for the development is 25 years. Based on the Environment Agency Guidance for climate change published in February 2016, a climate change allowance of 40% should be considered.

In accordance with the LLFA requirements, Brownfield sites should seek to discharge surface water from the redeveloped site at Greenfield rates wherever possible. At the least, betterment should be offered (in terms of reduced runoff) for all redeveloped sites.

The Brownfield run-off values have been calculated using the Modified Rational Method (MRM) with the aid of a hydraulic modelling software (Microdrainage/Causeway – Flow v8.1). The MRM formula is:

Equation 1. Modified Rational Method Equation

Q = 2.78 CV Cr I A

Where:

Q = Design event peak rate of runoff (l/s).

C = Non-dimensional runoff coefficient which is dependent on the catchment characteristics.

CV =Volumetric runoff coefficient.

CR = Dimensionless routing coefficient.

I = rainfall intensity for the design return period (in mm/hr) and for a duration equal to the time of concentration of the network.

A = Total catchment area being drained.

**Note: 2.78 is a conversion factor to address the rainfall unit being in mm/hr.*

This is based on the following characteristics:

- M5-60 Rainfall depth: 20.000mm
- ‘r’ Ratio M5-60/MS-2 day: 0.400

- Area being drained: 3.90ha
- Betterment: 20%

Table 4. Brownfield runoff rates

Return Period	Qbar	1:1 Year	1:30 Year	1:100 Year + 40% Climate Change
Existing Brownfield Runoff Rate (l/s)	N.A.	N.A.	N.A.	433.3l/s
Proposed Greenfield Runoff Rate (l/s)	49.2l/s	41.8l/s	85.4l/s	99.6l/s

Based on the above calculations the proposed discharge rate is approx. 77% lower than the existing run-off rates for 1 in 100 years storm events, therefore, it can be seen that the new proposed greenfield run-off rates provide a significant betterment compared to the current existing drainage scenario at rainfall intensity of 50mm/hr over the development area.

7.2 Proposed Attenuation Storage

Attenuation storage is provided to enable the runoff rate from the site into the receiving sewer to be limited to an acceptable rate to prevent flooding downstream. Using a hydraulic modelling software, the total required attenuation for the proposed development is approximately 1285m^3 in a 1 in 100 year plus 40% climate change event.

The attenuation storage is provided via:

- Pipework & Manholes
- Drainage Channels
- Porous Stone layer underneath the parking areas
- Cellular Storage Tanks

7.3 Proposed Surface Water Drainage Strategy

It is proposed that the rainwater from the building roofs are to discharge into the main drainage system via proposed rain water pipes.

Proposed service yard areas will collect surface water via proposed drainage channels which will provide additional volumes of attenuation before directing into the main proposed surface water drainage system.

The main means of attenuation will be porous paving areas as well as cellular storage tanks which will be designed to ensure that adequate underground storage volumes are achieved.

Levels within car parking and service yard areas have been designed such that critical 100 year plus climate change storm events are contained above ground, but safely within the site boundaries without increasing the risk to surrounding / neighbouring properties.

Storm water discharging from the developments will be attenuated and controlled using Hydrobrakes / orifice controls to demonstrate compliance with the criteria set out in Table 4.

The proposed greenfield run off rate confirmed that the proposed drainage strategy is providing a significant betterment compared to the current existing drainage scenario at rainfall intensity of 50mm/hr over the development area.

For the 1 in 100 years plus climate change event should any flooding occur at the surface level this would be of no more than 100mm in depth and be contained safely on site within proposed road, service yard, dock leveler and car parking areas, without risk to proposed or existing buildings. A copy of the proposed drainage strategy and flood routing plans can be found in Appendix B.

7.3.1 Design Analysis

We have carried out a full suite of storm simulations for different return periods and durations and these are all appended to this report at Appendix C.

The storm return periods that have been simulated are:

1 in 1 year

1 in 30 year

1 in 100 year + 40% for climate change

Durations tested ranged between:

15 minutes through to 1440 minutes for both the winter and summer profiles.

The overall drainage strategy has been split into 4 networks with each network discharging at below greenfield run off rates:

- Network 1 – Unit 1 (Greenfield run-off rates for 1 year = 6.0l/s ; 30 year = 12.3l/s; 100 year = 14.3l/s)
- Network 2 – Units 2 – 8 (Greenfield run-off rates for 1 year = 20.9l/s ; 30 year = 42.5l/s; 100 year = 49.7l/s)
- Network 3 – Unit 9 (Greenfield run-off rates for 1 year = 6.0l/s ; 30 year = 12.3l/s; 100 year = 14.3l/s)
- Network 4 – Retail unit (Greenfield run-off rates for 1 year = 8.9l/s ; 30 year = 18.3l/s; 100 year = 21.3l/s)

The simulation results show that the design is compliant with the criteria within the drainage system such that:

- no surcharging is observed for the 1 in 1 year (all 4 networks);
- no flooding for 1 in 30 (all 4 networks);
- nominal level of flooding for 1 in 100 year plus climate change (to be controlled on site without increased risk to flooding the neighbouring sites), below are the calculated flood volumes:
  Network 1 total flood volume of 9.372m3, critical storm events were noted as being: 120min winter duration for the 1 in 100 year plus 40% climate change.
  Network 2 flood volume varies between 0.008m3 – 1.322m3, critical storm events were noted as being: 15min winter duration for the 1 in 100 year plus 40% climate change.
  Network 3 flood volume varies between 6.763m3 – 7.739m3, critical storm events were noted as being: 120min winter duration for the 1 in 100 year plus 40% climate change.
  Network 4 total flood volume of 5.819m3, critical storm events were noted as being: 120min winter duration for the 1 in 100 year plus 40% climate change.

Furthermore, the Microdrainage calculations have been carried out for the exceedance storm event for 1 in 200 years plus climate change. The calculations have confirmed the total flood volumes which will be contained within the proposed site area without affecting the neighbouring sites. For exceedance event calculations refer to appendix C.

For flood routing plan for exceedance event refer Appendix B.

7.3.2 Treatment and Management Train

A surface water treatment and management train begins with source control and uses surface conveyance wherever possible to link subsequent SUDS components in series. It provides potential for interception losses

along its whole length as well as infiltration, evaporation and transpiration through the leaves of vegetation. The management train reduces the rate at which the run off flows though the site and provides treatment as it passes through each SUDS component.

SUDS components within the management train are as follow:

Source control:

- Permeable surfaces: a soft landscaping strategy has been incorporated into scheme which contributes to limiting the developments impermeable areas.
- Swales: swales have not been incorporated into the drainage strategy due to limited space on site, however, other SuDS features have been introduced which were described in above sections.
- Rainwater harvesting: Rainwater harvesting will be disproportionate in terms of cost and function in regards to the proposed development features (Toilet, sinks etc.) Therefore, rainwater harvesting has been disregarded.

Site Controls:

- Ponds / Detentions basins: the site layout does not allow the space required for any type of open feature within the surface water drainage system.
- Filtration: it is proposed that the runoff from service yards will pass through petrol interceptor prior discharging into the proposed drainage system.
- Attenuation: cellular storage tanks are proposed as a way to store backed up water on site which will manage the remaining runoff volumes on site.

Regional Controls:

- Discharge Control: The drainage strategy includes vortex controls to limit the development discharge to the greenfield runoff rates which were discussed earlier within this report.

This SUDS Treatment and Management train will be able to deal with required run-off volumes while providing enough water quality treatment.

7.3.3 SUDS Water Quality

Adequate surface water run-off treatment must be delivered in order to remove pollutants through SUDS devices which are able to provide pollution mitigation. Pollution hazards and the SUDS Mitigation have been indexed and are shown within the Ciria SUDS manual.

The pollution hazard indices are summarised in Table 26.2 – Pollution hazard indices for different land use classifications, and are shown below:

Table 5. SUDS – Pollution Hazard Indices for Different Land Use Classifications

Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other roofs (typically commercial / industrial roofs)	Low	0.3	0.2	0.05
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads / motorways	Medium	0.7	0.6	0.7

Although run-off from roof areas is considered to be uncontaminated, it is being treated by Porous Stone layers within parking areas and catchpits.

The mitigation indices of the proposed SUDS features are summarized within the Ciria SUDS Manual Table 26.3 and is shown below:

Table 6. SUDS – Indicative SUDS Mitigation Indices for Discharges to Surface Waters

Indicative SUDS Mitigation Indices for Discharges to Surface Waters			
	Mitigation Indices		
Type of SUDS component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7
Proprietary Treatment Systems (Petrol Interceptor)	Typically 0.8	Typically 0.6	Typically 0.9

The below table confirms that the surface water treatment provided by the SUDS devices is enough to remove the pollutants before discharging into the existing sewers:

Table 7. SUDS Mitigation Indices Summary Table

Proposed Hazard Treatment					
Land Use	Treatment	Pollution Hazard Level	TSS	Metals	Hydrocarbons
Roofs	Permeable pavement	Low	0.7 > 0.3	0.6 > 0.2	0.7 > 0.05
Commercial Yard / delivery areas	Proprietary Treatment Device	Medium	0.8 > 0.7	0.6 = 0.6	0.9 > 0.7

7.4 Pluvial Flooding

The Desktop report has identified an area of localised flooding to the west of the site, which is associated with the local drainage feature adjacent to the site.

The report has indicated that the maximum depth of flooding is approx. 1m in the area shown on drawing 12962 / 109. Therefore, we have carried out a volume checking exercise using ground modelling software in order to calculate the total volume of pluvial flooding currently contained on site due to existing topography, which is then compared to the proposed new site levels.

The drawing 12962 / 109 (appended to this report) illustrates that the proposed site levels have been carefully set such that the new development does not reduce the existing volume of pluvial flood water, therefore, it can be said that the existing flood volumes will not be compromised as well as new developments will not be at risk of flooding from surface water.

8 Drainage Strategy – Foul Sewerage

8.1 Proposed foul drainage strategy

It is proposed that the foul drainage should provide infrastructure to support the proposed units including its Offices and Welfare Buildings. The proposed foul network strategy is proposed to be connected to the existing manholes located within the proposed development boundary which then connects onto the public sewer owned and maintained by Thames Water.

Thames Water Pre-Planning enquiry has been submitted and the response is awaited.

A requirement for pumping station is not necessary based on currently obtained information. Should the existing outfall invert level be too shallow the design may need to be changed.

A copy of the foul drainage strategy network can be found in Appendix B.

9 Summary

The development proposes demolition of existing buildings and redevelopment of the site to provide 9No. industrial units and 1No. foodstore together with associated parking, a new vehicular access off Griffin Way South, landscaping and other associated works.

Foul water will discharge into the existing private sewers which ten connect onto existing public sewer to the north of the site development.

Surface water drainage system has been designed to cater for storm events up to 1 in 100 year plus 40% climate change. Provided SuDS features will ensure that the required attenuation volumes are provided prior surface water is discharged into the existing sewers at restricted rate.

The site will drain at greenfield runoff rates discussed earlier within this report. The required discharge rates will be achieved via a series of flow control units mentioned in Proposed Surface Water Drainage Strategy, refer to Section 7 within this report.

It is proposed the surface water run-off from service yard and road areas will pass through the petrol interceptor prior to being discharged off site at restricted greenfield run-off rates.

The surface water treatment provided by the SUDS devices (Pollution Hazard Indices) will be enough to remove the pollutants before discharging into the existing sewers.

Infiltration will not be feasible as the site is underlain by a variable thickness of made ground over London Clay Formation – silty clay.

The water quality will also be improved because of the inclusion of porous paving and oil separators.

The development is classed as Less Vulnerable usage and the proposed development is in Flood Zone 1 and meets the Sequential Test. Therefore, the Exception test is not required.

The site does not pose any increased flood risk to the site itself or adjacent developments, and is not susceptible to flooding by other means.

A further phase 2 geotechnical and geo-environmental site investigation works will be carried out and FRA report reviewed / updated upon receipt of confirmed information / results.