



BRIGHT PLAN CIVILS

**LAND AT ELETTRA AVENUE,
WATERLOOVILLE, HAMPSHIRE PO7 7XY**

PROPOSED RETAIL DEVELOPMENT

Flood Risk Assessment and Drainage
Strategy

Prepared on Behalf of

Hargreaves Management Limited

D1934/FRA1.0

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1 INTRODUCTION

1.1 Background

- 1.1.1 Bright Plan Civils (BPC) is instructed by Hargreaves Management Ltd to prepare a site-specific Flood Risk Assessment (FRA) and Drainage Strategy to support a planning application for a proposed retail development at Elettra Avenue, Waterlooville.
- 1.1.2 This report has also considered the findings of the previous Flood Risk Assessment for the Client, Hargreaves Management Limited, at the site. This was completed by Peter Brett Associates LLP in September 2013.
- 1.1.3 This FRA and Drainage Strategy has been undertaken in accordance with Planning Practice Guidance: Flood Risk and Coastal Change and National Planning Policy Framework Section 14.
- 1.1.4 The proposed development will involve construction of several retail buildings - as demonstrated within the preliminary site layout, contained within **Appendix A** of this report.
- 1.1.5 In preparing this report, BPC has referred to the following documents and information:
- Environment Agency Flood Maps for Planning
 - Long Term Flood Risk Information; Flood Risk Maps
 - Local Authorities Strategic Flood Risk Assessment
 - Southern Water and Local Authority Drainage Records
 - Site-specific Environmental Investigation Report
 - British Geological Survey & Records
- 1.1.6 This document has been prepared to assess if the proposed development is suitable for the site and confirms if mitigation is required to ensure that flood risk is not increased, and that the proposed development remains safe during its design life.
- 1.1.7 This report has been prepared for the benefit of the named Client only.

1.2 Site Location and Description

- 1.2.1 The site is situated within a retail area of Waterlooville, and consists of a car parking area for previous offices. The site is bounded by Elettra Avenue to the north and west, a recently constructed Lidl and KFC to the east, and further car parking areas to the south. The site is surrounded by retail units to the north, west and south, with residential housing and further retail units beyond to the east.
- 1.2.2 The site has a total area of 11,205 m² (1.12 Ha) – as seen in Drawing **100**.
- 1.2.3 A topographical survey of the site was undertaken by Lewis Brown Surveyors in October 2015. A copy of this survey is included in **Appendix B** of this report.

- 1.2.4 The topographical survey shows that the site falls from 37.42mAOD on the earth bund adjacent to the northeast entrance, to 34.37mAOD in the southwest of the site. The surrounding areas also generally fall from northeast to southwest.
- 1.2.5 The existing site is predominantly hardstanding, with existing retail car parking covering most of the site, other than the vegetated bunds along the boundaries. The existing site impermeable area is 7,727m² - as seen in Drawing **102**.

1.3 Ground Conditions

- 1.3.1 In the absence of a site-specific geotechnical investigation, reference has been made to the British Geological Survey (BGS) website.
- 1.3.2 The BGS geology viewer states that the bedrock geology is likely to consist of 'London Clay Formation - Clay, Silt and Sand', as seen in **Figure 1**.



Figure 1. BGS website Bedrock geology

- 1.3.3 Superficial Deposits located at the site area are recorded as 'Head - Clay, Silt, Sand and Gravel', as seen in **Figure 2**.

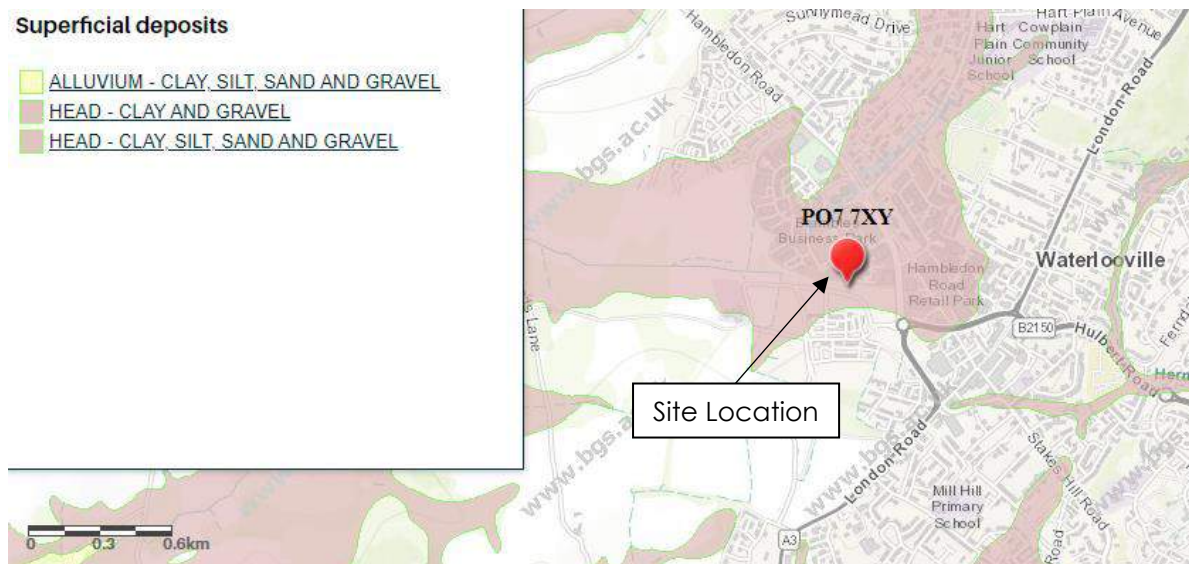


Figure 2. BGS website superficial deposits

- 1.3.4 Historic borehole records from the Single Onshore Boreholes Index (SOBI) on the BGS website have also been reviewed in the absence of a site-specific geotechnical investigation, as depicted in Figure 3.

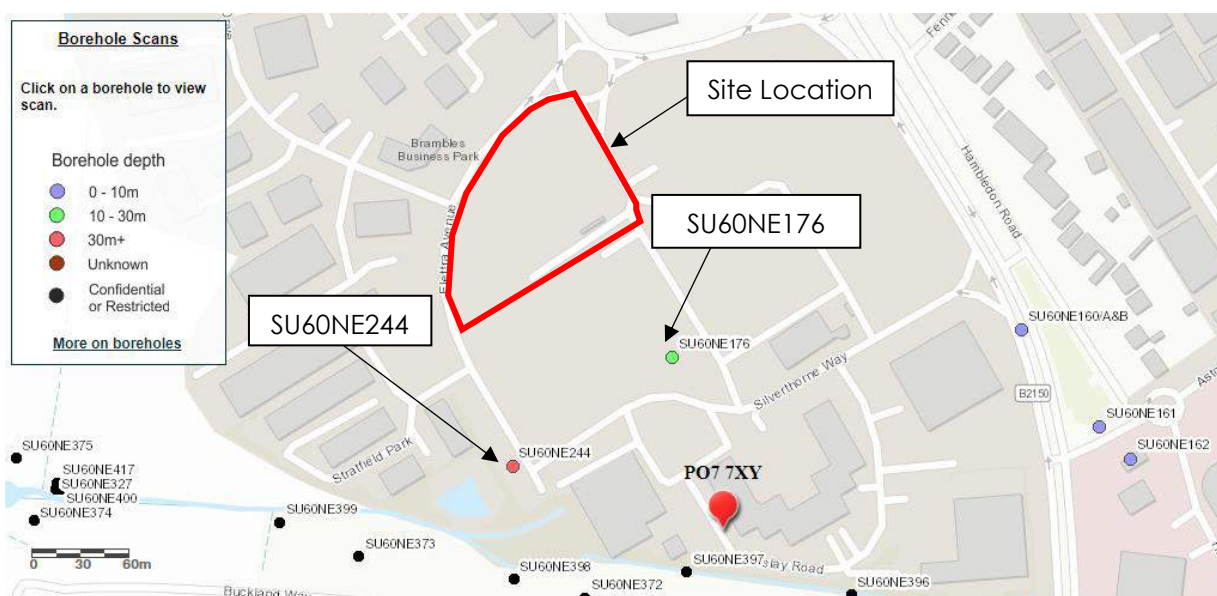


Figure 3. BGS website borehole locations

- 1.3.5 Two boreholes in relation to the site are a borehole located at SU60NE176 in the south of the site, and a borehole SU60NE244 at the southwest boundary of the site, as seen in **Figure 3**. Both boreholes have similar geotechnical strata according to the BGS online mapping.
- 1.3.6 The log at SU60NE176 states that the geological composition encountered within the borehole consisted of 'Silty Clay' to the full depth of 10.0mbgl.
- 1.3.7 The log at SU60NE244 states that the geological composition encountered consisted of 'Clay' up to a depth of 49.5mbgl.
- 1.3.8 A copy of the BGS records reviewed can be found within **Appendix C** of this report.

1.4 Groundwater

- 1.4.1 At the recorded borehole SU60NE176 from the BGS records, the borehole did not encounter groundwater up to a borehole depth of 10.0mbgl.
- 1.4.2 A review of the Hampshire County Council (HCC) Groundwater Management Plan mapping shows that the general site area is situated within an area at moderate risk of groundwater emergence, however this is not site specific. Correspondence can be found within **Appendix D**.
- 1.4.3 Mapping managed by MAGIC (magic.defra.gov.uk) provides geographic information concerning the natural environment from across government. This mapping tool has been referred to in order to confirm whether the site is located within either any groundwater source protection zones or groundwater vulnerability zones.
- 1.4.4 The site is situated within an 'Unproductive' Bedrock strata, and a 'Secondary' Superficial Drift Aquifer, as seen in **Figure 4**.
- 1.4.5 This refers to bedrock geology that is impermeable and does not contribute to water supply, and drift deposits that exhibit moderate permeability and/or provide a moderate level of water storage. The deposits may support water supply and/or river base flow on a local scale.

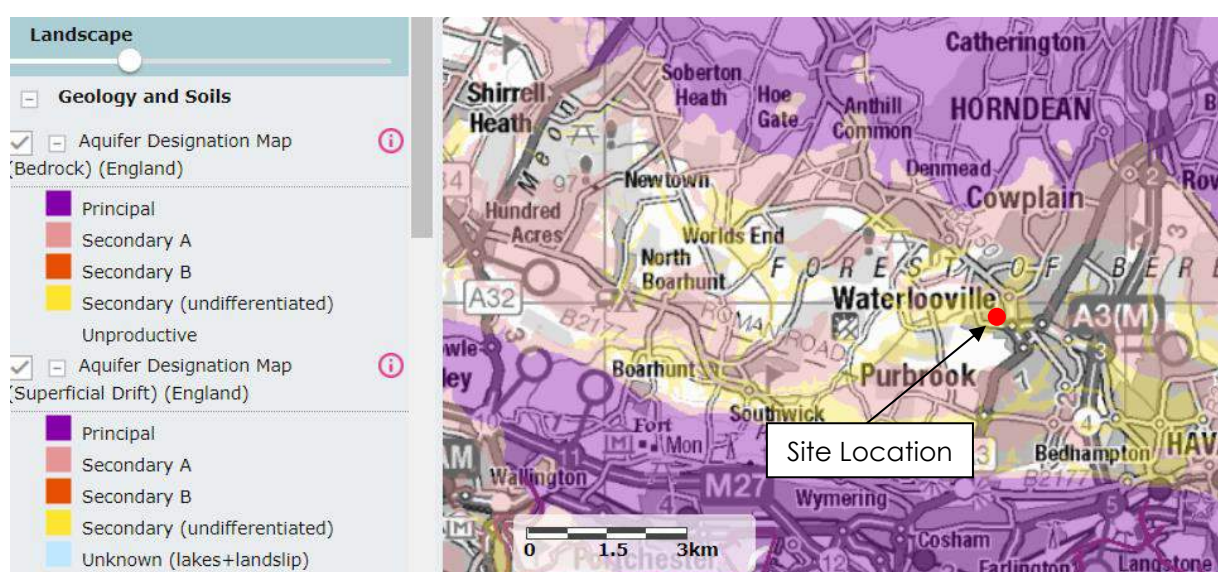


Figure 4. DEFRA Aquifer Designation Map

- 1.4.6 The Groundwater Vulnerability Map (**Figure 5**) confirms that the site falls within a 'Low' groundwater vulnerability zone. This refers to variably permeable soils with low leaching potential.

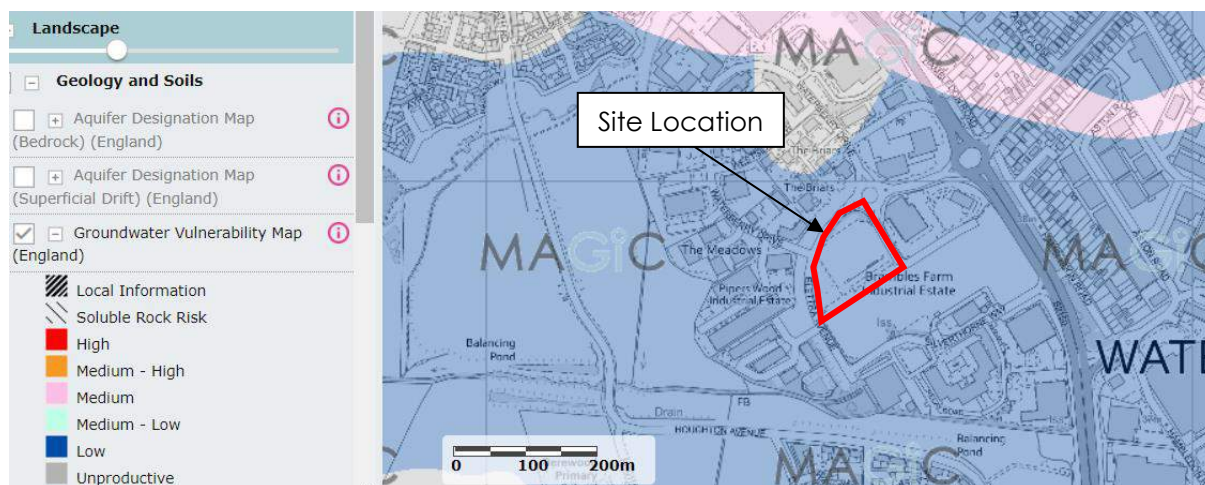


Figure 5. DEFRA Groundwater Vulnerability Map

1.5 Existing Drainage

- 1.5.1 The local sewerage authority are Southern Water, who provide sewerage services within the area. Public sewer records have been obtained from Southern Water, as contained within this report in **Appendix E**.
- 1.5.2 Surface Water:
- The topographical survey shows that the site falls from 37.42mAOD on the earth bund adjacent to the northeast entrance, to 34.37mAOD in the southwest of the site. The surrounding areas also generally fall from northeast to southwest. This influences the existing overland flow routes – as detailed in **Drawing 101**.
 - The topographic survey and existing drainage plan (**Appendix B**) shows that existing site drains via a network of highway gullies and rainwater pipes across the site, which connect into the public surface water drainage network at several points offsite, which in turn discharges to a balancing pond in the southwest corner of the site. In addition, a storm drain in the southwest corner of the site, at the low point, appears to discharge directly to the balancing pond offsite. The surface water sewer network and the balancing pond ultimately discharge to a watercourse flowing southwest away from the site.
 - Southern Water public surface water sewers are recorded to run along the north and west boundaries of the site within the public highway and discharge to the balancing pond.
 - The Southern Water public sewer records (**Appendix E**) record that there is a 1800mm diameter public surface water sewers running from northeast to southwest, adjacent to the site. This discharges into the open watercourse southwest of the site. The site is outside of the protected buffer zone associated with the sewer.

- In addition, a storm drain to the south of the site discharges directly to the balancing pond offsite. The surface water sewer network and the balancing pond ultimately discharge to the watercourse flowing southwest away from the site.
- The nearest water feature is the aforementioned watercourse to the southwest of the site, and is a designated Main River.
- Greenfield runoff rate (Q_{bar}) has been calculated to be 6.13l/s (Q_{30} is 14.09l/s, Q_{100} is 19.55l/s)
- As the existing site consists primarily of impermeable hardstanding however, the existing average peak annual runoff is calculated to be 101.2l/s, based on a 1D Hydraulic Drainage model of the existing drainage infrastructure. Existing 1 in 30 year runoff is shown to be 214.9l/s, and existing 1 in 100 year runoff is shown to be 258.5l/s. Calculations are in **Appendix G**.

1.5.3 Foul Water:

- The Southern Water public sewer records (**Appendix E**) record that there is a 225mm clay pipe foul sewer that runs along the western boundary within the public highway.
- There are no existing site connections to the public foul sewer.

1.5.4 Highway Drainage:

- Elettra Avenue and Silverthorne Way are drained by highway gullies; however the connection arrangement of the highway drainage is not confirmed.

2 PROBABILITY

2.1 Sources of Information

2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.

2.1.2 The likelihood of the site flooding has been established by reviewing the following information:

- Flood Maps for Planning
- Long Term Flood Risk Assessment Surface Water Flood Risk Maps
- Long Term Flood Risk Assessment Reservoir Flood Risk Maps
- Local Authorities Strategic Flood Risk Assessment
- Consultation with Local Authority/Lead Local Flood Authority

2.2 Flood Maps and Modelling

2.2.1 The Environment Agency's Product 4 Response provided flood maps for rivers, sea and surface water as seen in **Appendix F**.

2.2.2 The Environment Agency confirmed that the site is located within Flood Zone 1, defined as land at less than 1 in 1,000 annual probability of flooding from rivers or the sea.

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

- 2.2.3 There is an area south of the southern corner of the site within Flood Zone 2. Flood levels have been provided to assess the risk of flooding to the site. Flood levels for 3 No. nodes to the south of the site have been taken from the River Wallington Model, completed by Hyder Consulting in 2011. The modelled 1 in 100 year scenario (1% AEP) did not indicate flooding at the site. The modelled 1 in 1000 year scenario (0.1% AEP) show modelled water levels of up to 34.18m AOD south of the site.

Node Ref	Modelled Ground Level	Modelled Water Depth (Metres)		Modelled Flood Levels (mAOD)	
		1%	0.1%	1%	0.1%
1	33.76	N/A	0.05	N/A	33.81
2	33.77	N/A	0.20	N/A	33.97
3	34.02	N/A	0.16	N/A	34.18

- 2.2.4 When the modelled flood levels are assessed in comparison existing site levels, as detailed in **Drawing D1934-101**, the minimum site elevation is at 34.37. The site is therefore elevated above the predicted flood levels, considering the design flood level at 34.18mAOD.
- 2.2.5 The impact of climate change is shown to have no adverse impact on fluvial flood risk to the development, as detailed in **Section 2.3**.
- 2.2.6 The Flood Maps for Planning available on the gov.uk website correspond with the Product 4 response. **Figure 6** also shows that the site is at very low risk of flooding from rivers or sea.

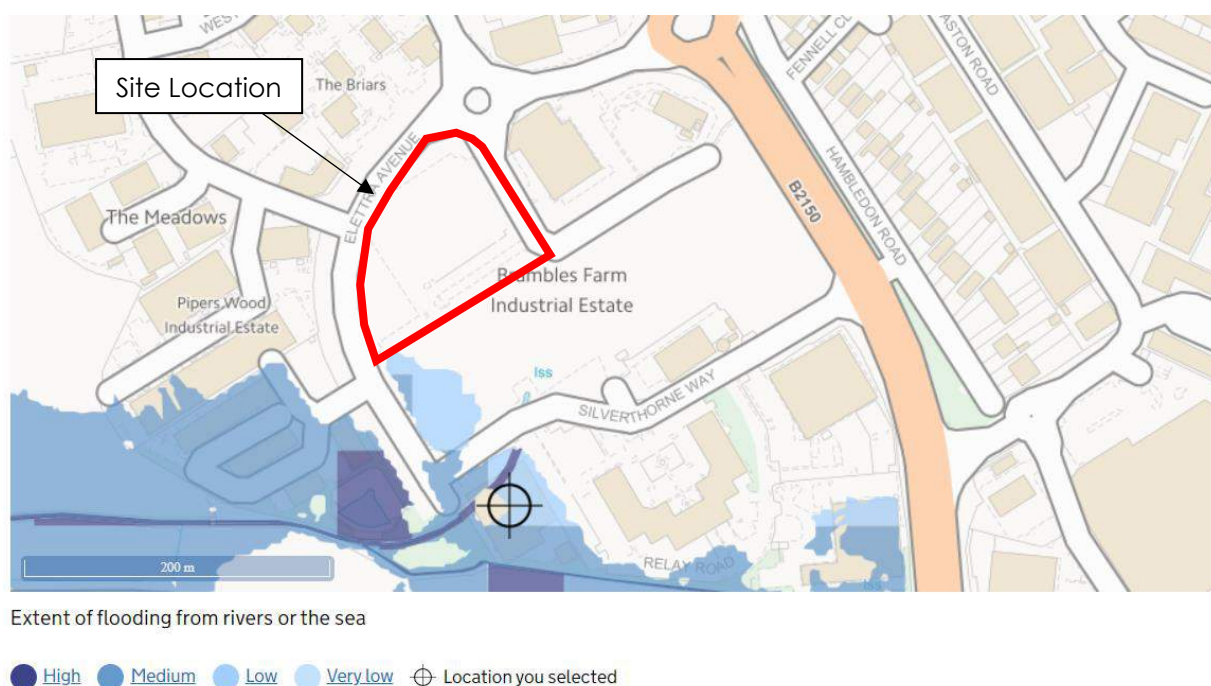


Figure 6. Long Term Flood Risk Map; Flood risk from rivers or the sea

- 2.2.7 **Figure 7**, taken from the Long Term Flood Risk Maps available on the .gov.uk website shows that the site at very low to low risk of surface water flooding. An isolated area to the south of the site is at low risk of flooding. This area represents a localised low spot in the existing car park surface. In all flood scenarios considered in the Environment Agency's online mapping, surface water flooding is shown to be below 300mm depth.

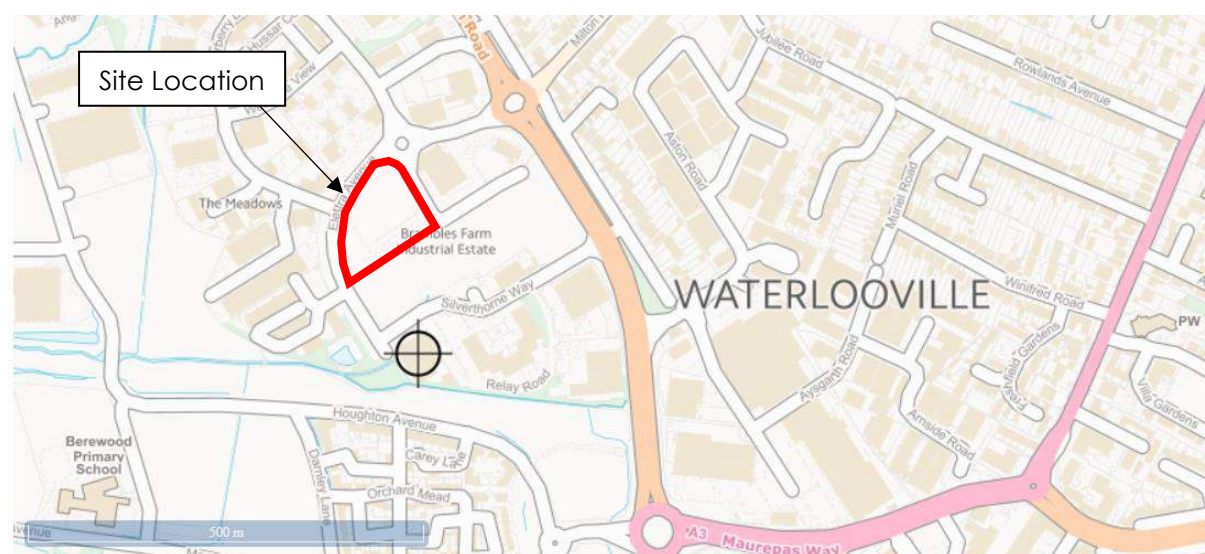


Extent of flooding from surface water

● High ● Medium ● Low ○ Very low ⊕ Location you selected

Figure 7. Long Term Flood Risk Map; Flood risk from surface water

2.2.8 **Figure 8** shows that the site is not at risk of flooding from reservoirs.



Extent of flooding from reservoirs

● Maximum extent of flooding ⊕ Location you selected

Figure 8. Long Term Flood Risk Map; Flood risk from reservoirs

2.3 Strategic Flood Risk Assessment

- 2.3.1 The site is identified within the Havant Borough Council Strategic Flood Risk Assessment (SFRA), in its assessment of local sites identified within the Local Plan, as seen in **Appendix D**. The site is proposed for less vulnerable development.
- 2.3.2 The site is not shown to be at risk of fluvial flooding. An area south of the site is shown to be at risk of fluvial flooding, however flood modelling does not show any additional flood risk in the future when taking into consideration climate change to the year 2115.
- 2.3.3 The SFRA recommends that development is acceptable at the site, and a Sequential Approach is considered for development in the wider area.

2.4 Historic Flooding

- 2.4.1 The Environment Agency confirmed that it has no records of flooding to this area.
- 2.4.2 No other records of flooding at the site from Havant Borough Council or Hampshire County Council have been identified.

2.5 Summary of Flood Risk

- 2.5.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Coastal	Very Low The site is in Flood Zone 1, and shown at very low risk of flooding from rivers and the sea. Assessment of modelling data and site topography shows that the site is elevated above predicted flood levels. Flood modelling results, as detailed within the Havant Borough Council SFRA, do not show the site at an increased risk of fluvial flooding as a result of climate change for the lifetime of the development.
Surface Water	Low The long-term flood risk for surface water varies from 'Very Low' to 'Low' at the site location. The site is at very low risk of surface water flooding, however a very small area to the south is shown to be at low risk of flooding from surface water. Flood depths are not expected to exceed 300mm.

Groundwater	Low Review of BGS records found the site to have low groundwater vulnerability. Bedrock is considered unproductive. Nearby records found presence of Clay and no groundwater up to borehole depth of 10.0mbgl. The Hampshire County Council (HCC) Groundwater Management Plan mapping indicates that general site area is situated within an area at moderate risk of groundwater emergence, however this is not site specific.
Sewers	Low Southern Water has no record of sewer flooding within the vicinity of the site, and no other records of sewer flooding have been found. In view of this information the risk of flooding from this source is deemed to be 'Low'.
Artificial Sources	None The site is now shown to be at risk of flooding in the event of a breach of a reservoir.

3 PROPOSED DEVELOPMENT

3.1 Description of Development

- 3.1.1 The proposed development comprises the construction of a 1,315m² retail unit and two further smaller drive through units in the north west of the site, as shown on drawing '1618_SK72_P8' included in **Appendix A**.
- 3.1.2 The type of development falls within the 'Less Vulnerable' classification (Flood Risk and Coastal Change Table 2). The development is solely located in the north west of the site, within Flood Zone 1 and outside of areas of existing and future fluvial flood risk as detailed in **Section 2**.
- 3.1.3 Less vulnerable development is appropriate within Flood Zone 1 (Flood Risk and Coastal Change Table 3).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test Required	✓	✓	✓
Flood Zone 3a†	Exception Test Required †	✗	Exception Test Required	✓	✓
Flood Zone 3b*	Exceptions Test Required *	✗	✗	✗	✓*
✓ = Development is appropriate ✗ = Development should not be permitted					

- 3.1.4 The proposed development will increase the impermeable area of the site. The post-development impermeable area has been determined to be 9,889m² (0.99Ha).
- 3.1.5 The use of Sustainable Drainage System (SuDS) methods and techniques (where site conditions and constraints allow) within the bounds of the site (whilst adhering to the SuDS hierarchy as stated within Building Regulations (Part H) and The CIRIA SuDS Manual C753) will be used to ensure no increase in surface water run-off compared to the existing site.
- 3.1.6 The specific Surface Water and Foul Water drainage proposals are detailed in **Section 4** of this report.

4 PROPOSED DRAINAGE STRATEGY

4.1 Surface Water

4.1.1 The SUDS manual and Building Regulations set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The hierarchy favours infiltration methods of disposal over other methods such as watercourse and sewers, as detailed below;

- i. Utilise infiltration techniques.
- ii. Attenuate rainwater in ponds or open water features for gradual release.
- iii. Attenuate rainwater by storing in tanks or sealed water features for gradual release.
- iv. Discharge rainwater direct to a watercourse.
- v. Discharge rainwater to a surface water sewer/drain.
- vi. Discharge rainwater to a combined sewer.

SUDS Technique	Suitable	Comments
Living Roof	Yes	No initial constraints but not suitable due to client construction specification.
Basins and Ponds	Yes	No initial constraints but not suitable due to the limited space available with the proposed layout.
Filter strips and swales	No	No initial constraints but not suitable due to the limited space available with the proposed layout.
Infiltration Devices (Soakaways, Infiltration trenches and basins)	No	The site is underlain by clay and not suitable for infiltration techniques.
Permeable surfaces and filter drains (Gravelled areas, solid paving blocks and porous pavers)	Yes	The site is underlain by clay and not suitable for infiltration techniques. Tanked permeable paving would capture, treat, and attenuate runoff.

Tanked systems (Oversized pipes and cellular tanks)	Yes	SuDS systems would be depth limited due to the necessity to connect into the existing drainage system.
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- 4.1.2 As discussed in **Section 1.5**, the existing site is drained by a surface water drainage system that discharges into the Southern Water attenuation pond west of Elettra Avenue. The existing attenuation pond is estimated to have a capacity of between a current 1-in-30 to 1-in-50 year event, as detailed in the previous Flood Risk Assessment for the Client, Hargreaves Management Limited, at the site. This was completed by Peter Brett Associates LLP in September 2013.
- 4.1.3 Following the principles set out in the Peter Brett Associates FRA, it is proposed to provide surface water attenuation on site to ensure runoff does not exceed existing 1-in-30 year discharge rates. The existing average peak annual runoff is 101.2l/s, based on a 1D Hydraulic Drainage model of the existing drainage infrastructure. Existing 1 in 30 year runoff is shown to be 214.9l/s, and existing 1 in 100 year runoff is shown to be 258.5l/s. Calculations are in **Appendix G**.
- 4.1.4 It is proposed that the parking bays are constructed using tanked permeable paving along with some non-trafficked areas. This would provide a plan area of permeable paving totalling 2,762m², and have a sub-base thickness of 450mm providing a storage volume of 397.7m³. Surface level design would direct run off from the car parking area to the permeable paving. Attenuated flows would be directed to the surface water drainage system via diffuser units and perforated pipes laid at the base of the subbase.
- 4.1.5 Further storage will be provide using a 64.0 square metre, 1.2 metre deep geocellular storage tank. The tank will be wrapped with an impermeable membrane and provide a volume of 73.0m³.
- 4.1.6 Polypipe (Permatreat) Permachannel drains will collect runoff at low points not served by proposed permeable pavement, to collect runoff and intercept pollutants.
- 4.1.7 A Vortex style Flow Control will restrict runoff to the Southern Water surface water sewer on Elettra Avenue to 100.0l/s. This represents a betterment compared to the existing average peak annual runoff and would ensure no increase in runoff to the existing balancing pond up to the design event.
- 4.1.8 A S106 application will be required in order to establish connection to the surface water sewer.
- 4.1.9 The proposed drainage strategy has been designed to accommodate the 100 year design storm event with an allowance for 40% climate change. This is shown in the 1D Hydraulic Design Model Calculations provided in **Appendix G**.
- 4.1.10 The strategy above will ensure that there is no increase in the rate of run-off leaving the site, therefore no increase in the risk of flooding from this source.

4.2 Treatment

- 4.2.1 The use of permeable paving will ensure that run-off from the site receives a level of treatment required by the SuDS manual, with hydrocarbons being filtered by the aggregate and geotextile layers.
- 4.2.2 Polypipe Permatreat (formerly known as Permachannel) is a linear channel drain that functions as a combined run-off collection, silt and oil interceptor and treatment system. Runoff discharges from the system after passing through a weir and baffle arrangement, which separates oil and silt, preventing it from progressing further into the drainage system. It is understood that the product is suitable for a range of sites and is site-specific to meet mitigation indices and comply with treatment criteria.
- 4.2.3 In accordance with the CIRIA SuDS Manual C753 regarding methods for managing pollution risks, the risk posed by surface water runoff to the receiving environment depends on the pollution hazard at the site (the source), SuDS treatment techniques (the pathway), and the sensitivity of the environment (the receptor).
- 4.2.4 The simple index approach considers whether SuDS techniques are appropriate for the site. The states that for SuDS components to deliver adequate treatment, the total pollution mitigation index for each contaminant type should equal or exceed the pollution hazard index.
- 4.2.5 The SuDS Manual outlines three categories of pollution hazard identification, which vary depending on proposed land use, which are as follows:
- Total Suspended Solids (TSS).
 - Metals (M).
 - Hydrocarbons (H).
- 4.2.6 In accordance with C753 Table 26.2, the proposed land uses at the site are categorised as follows:
- Non-residential car parking with frequent change e.g. retail - TSS=0.7/M=0.6/H=0.7
 - Commercial yard and delivery areas - TSS=0.7/M=0.6/H=0.7
- 4.2.7 In accordance with C753 Table 26.3 and manufacturer supplied information, the values of SuDS Mitigation indices are provided:
- Permeable Pavement – TSS=0.7/M=0.6/H=0.7
 - Permatreat Channel Drain – TSS=0.8/M=0.4/H=0.9
 - Geocellular Storage Tank with treatment geotextile - TSS=0.5/M=0.2/H=0.5
- 4.2.8 Runoff will be captured by permeable pavement or Permatreat channel drains and attenuated within a geocellular storage tank. As the pollution hazard index does not exceed any pollution mitigation index for any contaminant type, for any proposed land use, the proposed SuDS methods will provide sufficient treatment for the residential areas.

4.3 Foul Water Drainage

- 4.3.1 It is proposed to connect the foul discharge to the existing Southern Water Public Foul Sewer [on Elettra Avenue](#). Connections to the public sewer network can be established by the developer, subject to approval.
- 4.3.2 Recent changes to infrastructure and connection charges (OFWAT Charging Rules) place the onus on the sewerage undertaker to reinforce their network should there no longer be sufficient capacity to serve the new development. Funding for this is provided by revised charging arrangements for infrastructure and connection charges for each dwelling constructed comprising a Network Reinforcement Charge and Site-Specific Charges. The revised charging arrangement (funded by the developer) covers alterations to the Existing Sewer Network and the sewerage undertaker remains responsible for the cost of reinforcing their Strategic Assets. The developer is responsible for connecting the development to the public sewer network.
- 4.3.3 The foul drainage from the development will discharge by gravity to the public sewer located in Elettra Avenue. The proposed point of connection is shown on Drawing **200** (Drainage Strategy).
- 4.3.4 Based on the design guidance provided in Design Construction and Guidance B3.1, the proposed foul flow to the public foul sewer will be 0.67 l/s.
- 4.3.5 A S106 application will be required in order to establish connection to the existing foul sewer.

4.4 Urban Creep

- 4.4.1 As the proposed retail site comprises proposed hardstanding across almost the entirety of the site, an allowance for urban creep is not necessary within the proposed drainage calculations.

4.5 Climate Change

- 4.5.1 NPPF sets out percentage increases to be applied to the peak rainfall intensity values used in the design of a surface water drainage system to allow for the effects of climate change.
- 4.5.2 The design flood levels provided by the Environment Agency, as a result of fluvial flooding of the watercourse do not include an allowance for climate change. The Havant Borough Council SFRA report, supported by further modelling analysis, does not show an increased risk of flooding to the site area as a result of climate change however. In addition, the proposed level design shows that the site is elevated at least 1.0 metre above the predicted flood levels.
- 4.5.3 In accordance with NPPF 'climate change allowances' update 16 March 2020, an increase of 20% should be applied for this development and a review should be undertaken to determine the impact of an increase of 40%.
- 4.5.4 A 40% level of climate change has been accounted for within the overall drainage strategy for the site.

5 RESIDUAL RISK AND MITIGATION

5.1 Residual Risk

5.1.1 The following residual risks have been identified in relation to the proposed development:

- i. Increased flow through watercourses as a result of climate change causing flooding to the site.
- ii. Extreme rainfall events that exceed the design criteria used for the drainage system causing surface water flooding.
- iii. Blockage/failure of the proposed drainage system causing flooding to the site.
- iv. Groundwater flooding to the site caused by groundwater levels exceeding the ground surface level.
- v. Surface water flooding of proposed buildings

5.2 Mitigation

5.2.1 Consideration has been taken to the residual risks stated in Section 5.1, and the following mitigation measures are proposed:

- i. The proposed development is located sequentially with respect to the development area referred to in the SFRA, and avoids the area in the south at risk of fluvial flooding. The proposed site levels are elevated at least 1.0m above the existing flood levels. The SFRA flood modelling indicates the site area is not at an increased risk of fluvial flooding as a result of climate change.
- ii. The drainage strategy has been developed to capture runoff up to a 1 in 100-year critical rainfall event, with 40% allowance for climate change and release it at a restricted rate. However, should a more extreme rainfall event occur, there is the potential for the capacity of the drainage system to be exceeded. The existing topography of the site has been reviewed and the existing overland flow routes assessed. Overland Flows will follow the existing topography, falling to the south and west towards the watercourse. The floor levels of the buildings have been set generally at least 150mm higher than the surrounding areas in the case of an exceedance event.
- iii. The proposed drainage system will attenuate and store runoff up to the design event. Blockage of the drainage system has the potential to cause flooding on the site. Exceedance flows will travel overland to the existing drainage system and watercourse, however maintenance measures proposed in Chapter 8 will mitigate the risk of the system becoming blocked.

- iv. As detailed in **Section 1.4** shallow groundwater is not expected. If groundwater flooding were to occur however, it would flow away from the proposed buildings into the existing drainage gullies and the watercourse ditch, or via the proposed drainage system. The floor levels of the buildings have been set generally at least 150mm higher than the surrounding areas.
- v. The site is situated in an area of predominantly very low risk of surface water flooding. The risk of surface water flooding will be mitigated by raised finished floor levels to provide freeboard and design of levels to convey overland flow away from buildings.

6 SEQUENTIAL AND EXCEPTION TESTS

6.1.1 The site is located in Zone 1, the Sequential Test is therefore not required.

7 FLOOD RISK MANAGEMENT

7.1 Safe Access and Egress

- 7.1.1 Access is available to the west and east and ultimately to the north, away from areas of significant flood risk. Safe and dry access and egress is therefore available for vehicles and pedestrians alike.

7.2 Flood Warning

- 7.2.1 The site is not at risk of fluvial and surface water flooding therefore there is no need for a Flood Evacuation Plan (FEP) or Flood Warning System.

8 MAINTENANCE

8.1 Proposed Maintenance Regime

- 8.1.1 Maintenance is required to ensure the long-term operational performance of the proposed surface water drainage system.
- 8.1.2 The drainage system has been designed to minimise maintenance requirements; however a number of key tasks will need to be undertaken so that the system remains in optimal condition. These operations are summarised in the table below, along with the required frequency of works.

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Permeable Paving	Surface sweeping to reduce silt and debris accumulation.	Every 8 to 12 weeks
	Removal / management of weed growth	At least once a year
	Silt removal from permeable surfaces, possibly involving raking out of joints, redressing, removal and remedial works.	As required / to be specified by manufacturer
Permatreat	Inspections for blockages or oil spillage	Every 3 months
	Removal of litter and blockages	As required
	Inspection of chambers for silt and oil build up and sweep external surfaces	Every 12 months
	Remove silt	As required, at least every year
Diffuser units & catch pits, gully sumps and drains	Inspection and additional cleansing as required.	Annual
	Desilting	Year 1, Year 3, then every 5 years
Pipework	Jetting to clear blockages	As required
Hydrobrake	As specified by manufacturer	As specified by manufacturer

- 8.1.3 The responsibility of maintenance regime will be determined by the Developer, by agreed appointment.

Permeable Paving / Diffuser Units

- 8.1.4 The areas of permeable paving are designed to allow infiltration of surface water run-off through the joints in the block paving surface course and into the subbase below. The water is then collected and discharged into the positive drainage system.
- 8.1.5 As part of the permeable paving system, diffuser units are used to discharge surface water run-off from roof areas into the sub-base, as well as forming links between areas of permeable paving. These diffuser units are small heavy-duty cellular units which allow more efficient discharge of surface water into the sub-base base of the permeable paved areas.
- 8.1.6 The areas of permeable paving will require additional maintenance measures to ensure they operate as designed. Failure in carrying out this maintenance, could increase the risk of flooding. The additional measures are as follows:

- Periodic surface sweeping to reduce silt and debris accumulation. The permeable surfaces should be swept at least every 8 to 12 weeks with additional sweeps in the autumn to clear fallen leaves.
- Removal / management of weed growth, as required. Typically, once or twice a year for regularly used areas.
- Periodic silt removal from permeable surfaces as described by the manufacturer. If any areas are showing signs of ponding, they shall be dealt with by raking out the joints and redressing. The entire surface shall be monitored and when there are signs of excessive siltation resulting in poor drainage over the whole area, the blocks shall be taken up and a replacement of bedding layer and geotextile shall be undertaken.
- Redressing of joints on the block paving as required
- Catchpits upstream of diffuser units, should be emptied and inspected on the same regime as all catchpits specified previously set out in this document.

Permatreat System

- 8.1.7 The Permatreat sustainable drainage system should be inspected regularly and correctly maintained. This includes routine maintenance and a pre-handover inspection and clean.
- 8.1.8 In accordance with the Permatreat Technical Manual, maintenance should include:
- Inspection of systems
 - Removal of silts
 - Decanting of oils and hydrocarbons
 - Manual clearance of excess silt or debris.
 - Removal / management of weed growth, as required. Typically, once or twice a year for regularly used areas.
- 8.1.9 Further detail of maintenance tasks and regularity required should be established with the manufacturer according to their system requirements.

Vortex Style Flow Control

- 8.1.10 The flow control device has two measures to aid maintenance. The first is a valve situated in the front of the unit itself, this can be operated from the surface by a release cable situated just under the manhole cover which closes under its own weight and does not require any mechanism to operate. The second is a high-level overflow pipe situated with the flow control manhole. Both measures allow the system to drain down freely, until the blockage can be cleared.
- 8.1.11 The flow control chamber will require additional maintenance measures to ensure it operates as

designed. The additional measures are as follow:

- The sump within the flow control chamber should be monitored for build-up of silts and should be emptied, as a minimum, on the same regime as specified for catchpits previously within this document.
- The drain down door located on the centre of the unit will require inspection and opening annually, to ensure it is operating as intended.

Remedial/Repair Actions

- 8.1.12 Significant storm events may cause considerable damage to SuDS and their associated components. As such, it may be necessary to inspect and carry out essential recovery works to return the feature to full working order.
- 8.1.13 Resetting of uneven blocks by lifting block area, removing bedding material and relaying to match original design are all actions which may need to be undertaken.

Accidental Spillages

- 8.1.14 It is not envisaged that any materials are to be stored onsite once the development has been completed, which could cause major spills and potential pollution issues within the drainage system. If this situation alters in the future consultation with a specialist will be required in order to confirm if any upgrades to the existing system are necessary.
- 8.1.15 Minor spillages of fuels and oils from motor vehicles will be dealt with by the permeable paving and deep trapped gullies, by bio-degrading and collecting the hydrocarbons, respectively.
- 8.1.16 With respect to areas drained by the Permatreat system, as soon as a spillage is identified, the drain inlets in that area should be covered to prevent pollution entering the system.
- 8.1.17 The pollution should then be cleared from the road or car park surface. The Permatreat system receiving the spillage should be emptied of all pollution that has entered.

Future Alterations to the Development

- 8.1.18 Any future alterations to the permeable paving should be confirmed by a specialist. Where possible any future services are to avoid being located through areas of permeable paving. If new services are required to run through areas of permeable paving, services should be installed below the depth of permeable paving with the permeable system reinstalled above.

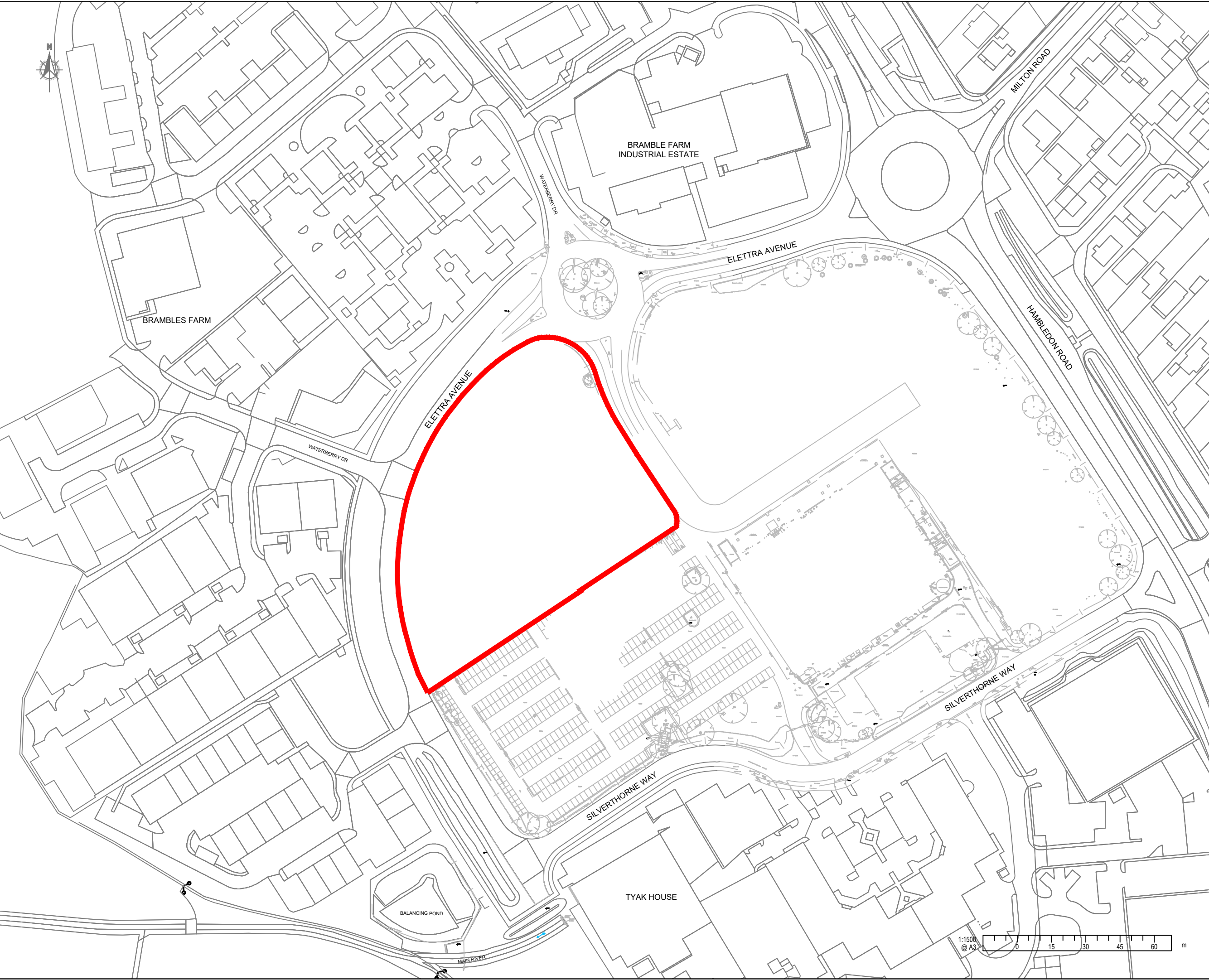
9 OFFSITE IMPACTS

- 9.1.1 The proposed development ensure no increase in discharge to the surface water sewer via attenuation within sustainable drainage systems, and a controlled outfall of 100.0l/s.
- 9.1.2 Post development foul water flows will contribute an increase to the sewer network compared to the previous use – it is expected that the foul sewer flow will be 0.67l/s.
- 9.1.3 The effects of climate change have been considered in the design of the proposed surface water drainage system, to ensure there is no off-site impact.

10 SUMMARY

- 10.1.1 This site-specific flood risk assessment is based on Flood Maps, the Local Authority's Strategic Flood Risk Assessment and Public Sewer Records.
- 10.1.2 The site is currently a car parking area with mainly hardstanding impermeable area.
- 10.1.3 The development lies within Flood Zone 1 and is assessed to be at low or very low risk of flooding from all sources.
- 10.1.4 The existing run-off from the site is collected by gullies and channel drains and discharged un-controlled to the surface water sewer, ultimately discharging into a balancing pond.
- 10.1.5 Post-development surface water run-off will be managed through sustainable drainage measures, with the installation of permeable paving, geocellular storage and a controlled outfall meaning overland flows can be attenuated on site and released to the surface water sewer at 100.0l/s, up to the design event. This is a betterment compared to the existing average peak annual runoff rate, without causing surface water flooding on site.
- 10.1.6 The wastewater from the proposed development will discharge to the public foul sewer on Elettra Avenue.
- 10.1.7 The completion of the development will not increase flood risk on or off the site.
- 10.1.8 This Flood Risk Assessment and Drainage Strategy report is compliant with the HCC Surface Water Checklist, as seen in **Appendix H**.
- 10.1.9 In conclusion, this development is suitable with regards to flood risk and surface water drainage.

DRAWINGS



- 1. This drawing is to be read in conjunction with all other BPC drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
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- 3. Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.
- 4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

-KEY-

Site Boundary (11,205m² - 1.12Ha)

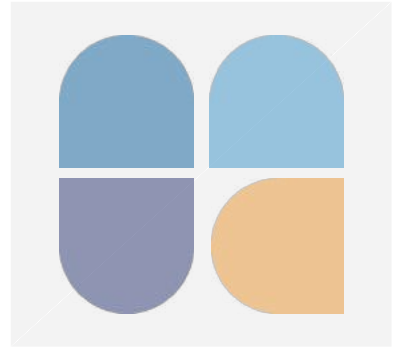
Site Grid Reference: SU 67517 09896

PLANNING

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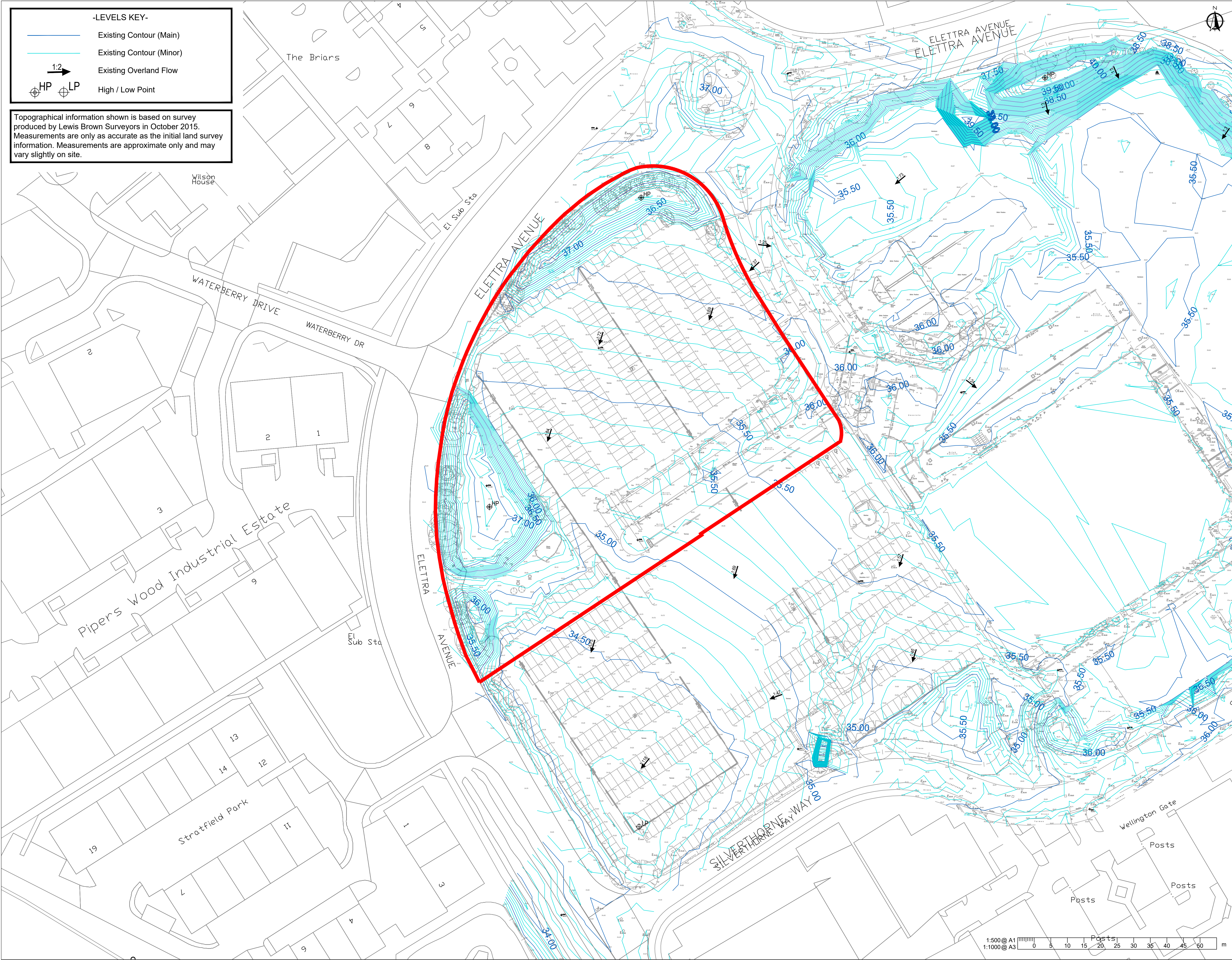
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Rev.	Amendments	Date



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Drawing Status	PLANNING		
Client	Hargreaves Management Ltd		
Project	Land at Elettra Avenue Waterlooville PO7 7XY		
Drawing Title	Site Location Plan		
Scale	1:1500 @ A3	Date Jan 2021	Drawn By DJL Checked By LDF
Drawing No.	D1934-100		Rev. -



NOTES

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Original Issue	22/01/2021
Rev	Amendments



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Drawing Status	PLANNING
Client	Hargreaves Management Ltd
Project	Land at Elettra Avenue Waterlooville PO7 7XY
Drawing Title	Existing Topographical Survey & Flow Routes
Scale	1:500
Date	Jan 2021
Drawn By	DJL
Checked By	LDF
Drawing No.	D1934-101
Rev.	-

-KEY-

Site Boundary (1,013m² - 0.101Ha)

Existing Impermeable Area (7,727m² - 0.77Ha)

New Impermeable Area (9,889m² - 0.99Ha)

Topographical information shown is based on survey produced by Lewis Brown Surveyors in October 2015. Measurements are only as accurate as the initial land survey information. Measurements are approximate only and may vary slightly on site.

This map shows the existing site catchment area for a development at Elettra Avenue. The site boundary is outlined in red. The existing impermeable area, which includes the current building and parking spaces, is shaded in light purple. The map also shows surrounding residential streets, including Elettra Avenue and a nearby road labeled 'RY DRIVE'. A north arrow is located in the top right corner. A scale bar at the bottom indicates a scale of 1:500 at A1 and 1:1000 at A3, with markings from 0 to 50 meters.

This map shows the proposed site catchment area for the same development at Elettra Avenue. The site boundary is outlined in red. The proposed impermeable area, which includes the new building layout and parking spaces, is shaded in light pink. The map shows the same surrounding residential streets and topographical features as the existing map. A north arrow is located in the top right corner. A scale bar at the bottom indicates a scale of 1:500 at A1 and 1:1000 at A3, with markings from 0 to 50 meters.

NOTES

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Rev.	Amendments	Date

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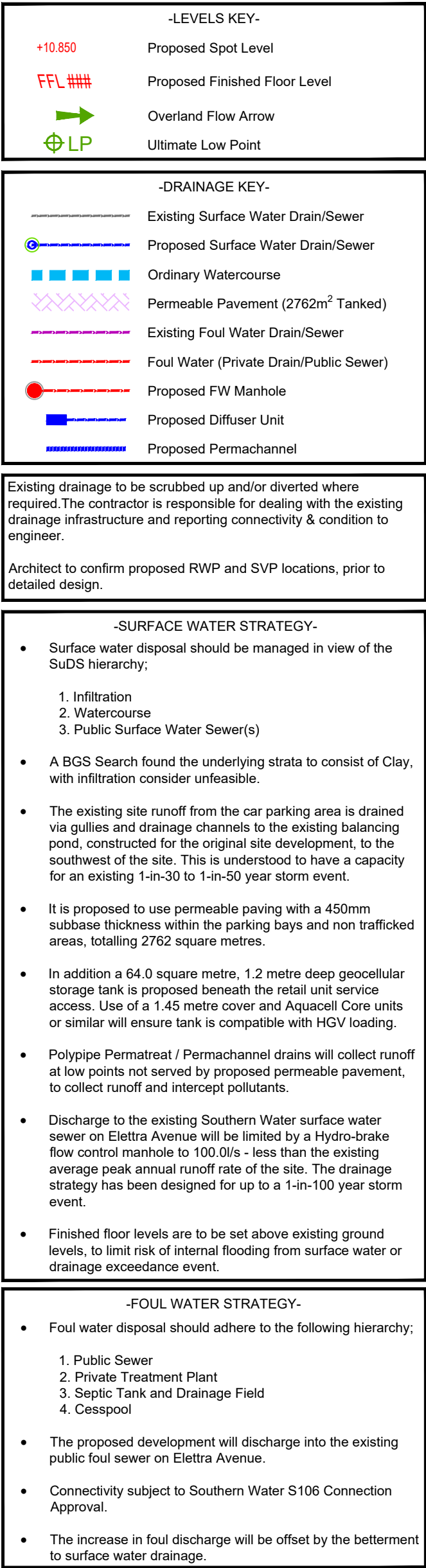
Transport Planning and Infrastructure Design Consultants

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Drawing Status	PLANNING
Client	Hargreaves Management Ltd
Project	Land at Elettra Avenue Waterlooville P07 7XY
Drawing Title	Impermeable Areas
Scale	1:500
Date	Jan 2021
Drawn By	DJL
Checked By	LDF
Drawing No.	D1934-102
Rev.	-



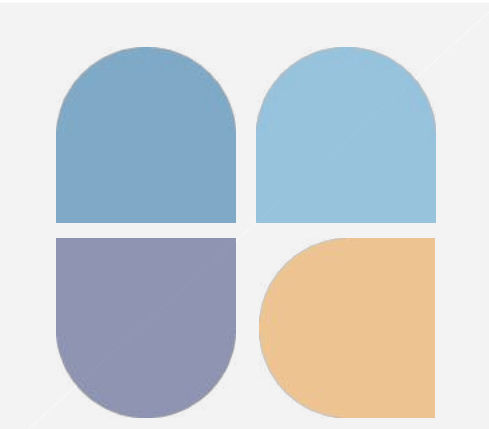
1. This drawing is to be read in conjunction with all other Bright Plan Civils drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
2. Bright Plan Civils accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.

3. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, including the local authority, and is not a warranty.
4. The electronic information from this drawing can not be guaranteed to be accurate. All measured dimensions must be used for setting out and detailing. British Plan Civils logos and company information must be removed from copies if information is re-used.
5. The main contractor is responsible for the design of all temporary works, and is also responsible for the safe maintenance and stability of all structures at all times.
6. The main contractor is responsible for dealing with all occurrences of ground water during the construction period.
7. The contractor must comply with all current legislation relating to health & safety.
8. All products specified shall be installed in strict accordance with the manufacturers recommendations and instructions. If there are discrepancies between that information and the details on any BPC drawing, the manufacturers instructions must be used.
9. Contractor to confirm all invert levels where connections are made to sewerage or stormwater drains. Contractor to commence drainage works at the point of discharge.

10. All pipe works to be constructed in strict accordance with specification of the local authority, building regulations, **Design and Construction Guidance** and latest British Standards.
11. For location and setting out of building drainage pipes refer to architect.
12. All pipe runs within buildings to comply with the Building Regulations Part D. Where a pipe is within 1m of a foundation the trench shall be filled with class GENS concrete up to the lowest level of the foundation. Where the trench is further than 1m from the foundation the trench shall be filled with class GENS concrete up to a level below the lowest level for the foundation equal to the distance from the foundation less 150mm. In both cases the pipe shall be bedded and surrounded in 150mm thick class GENS concrete.
13. Where pipes, external to the structures, have a depth to soffit from ground of less than 150mm they shall have a class GENS concrete encasement (150mm thick).
14. Where a pipe, under a carriageway, has a depth of cover of less than 1.2m the pipe shall be laid with a concrete bed and surround.
15. In any circumstances where pipes are bedded and surrounded in concrete flexible joints should be provided. Compressible bands (fibreglass or polyethylene) shall be provided at a maximum of 8m between joints. Pipes with a depth to soffit of 150mm or more shall use pipe diameter and to a height and width equal to the concrete cover. A board thickness of 18mm for pipes up to 450mm nominal diameter and 30mm for pipes over 450mm nominal diameter.
16. All private building drainage shall be constructed in strict accordance with British Standards unless otherwise specified building drainage shall be 100mm diameter and shall be laid at a minimum gradient of $(1/16 = 1 \text{ in } 400 = 1 \text{ in } 80)$ for foul drains and $1 \text{ in } 100$ for surface water drains.
17. All pipes, bends and junction for private building drainage shall be made in accordance to British Standards and shall be made in accordance with the manufacturer's specification.
18. All gully connections other than at manholes to be 'Y' junctions. All road gully connections to be 150mm diameter.
19. All cast stubs to be fitted with air admittance valves where branch drain exceeds 12m except at the end of the run. Sol vent pipes located at the head of a run to terminate to fresh air.
20. All connections to be soffit to soffit unless otherwise noted.
21. All concrete and all pipe and pipe products to be in accordance with BRE 363 for suppliers.
22. The locations and sizes of all valves and traps shall be cross referenced against the architects drawings during setting out.
23. The precise depth and location and size of existing pipes or manholes to be connected to or diversion or dropped out shall be confirmed and reported to the engineer prior to commencement.

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-	Original Issue	25/01/20
Rev.	Amendments	Date



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Drawing Status **PLANNING**

Client **Hargreaves Management Ltd**

Project Land at Elettra Avenue
Waterlooville PO7 7XY

Drawing title

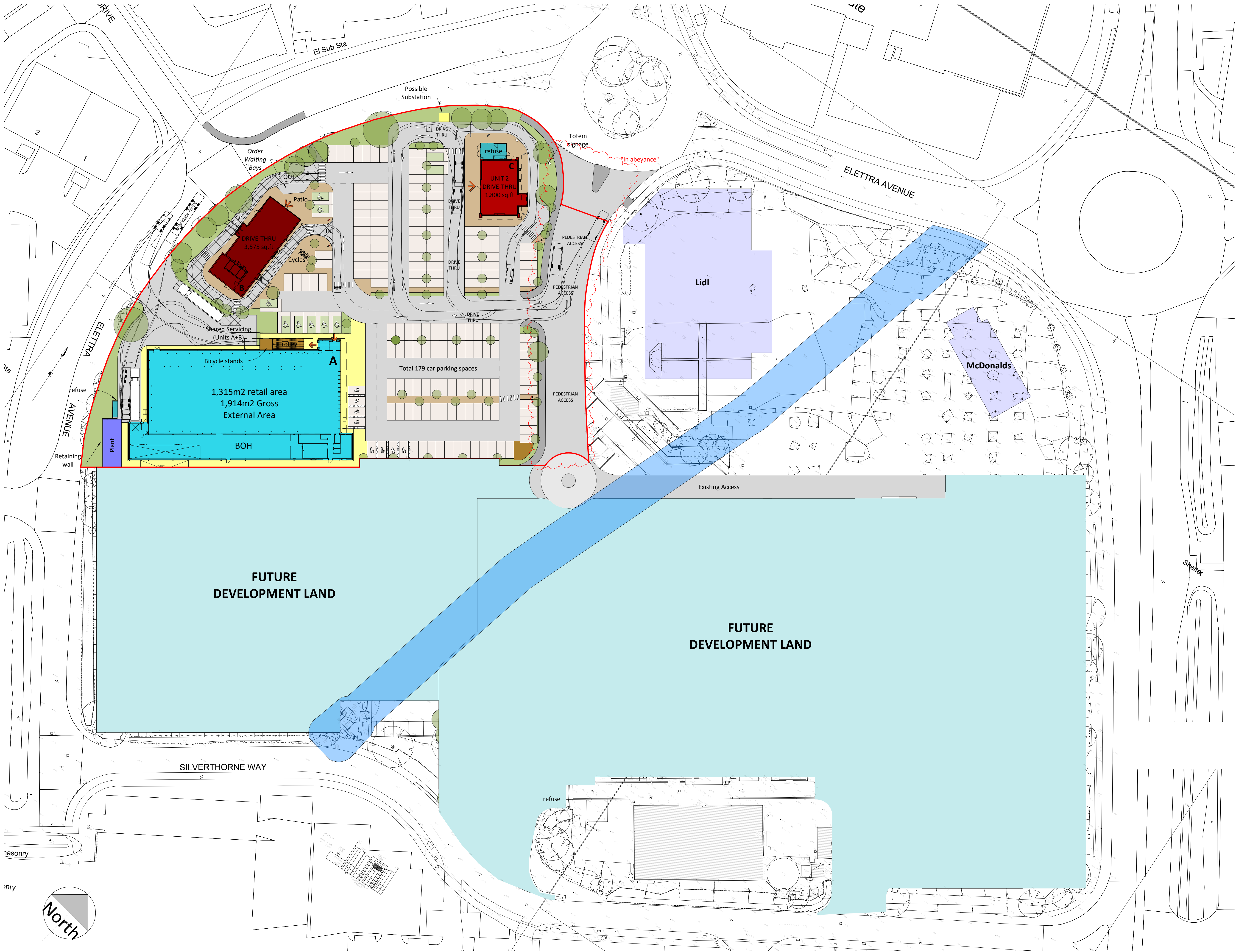
Foul & Surface Water
Drainage Design

Scale 1:500	Date Jan 2021	Drawn By DJL	Checked LDF
----------------	------------------	-----------------	----------------

Drawing No.	Rev
D1934-200	-

APPENDICIES

Appendix A Preliminary Site Layout



Figured dimensions only are to be used. All dimensions to be checked onsite. Differences between drawings and between drawings and specification or bills of quantities to be reported to the LDA Group.

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Revisions:	Drawn / Chd:	Date:
P1 Updated to client's email 22/04/20	MAS	06/05/2020
P2 Totem signage updated to client's requirements	MAS	11/05/2020
P3 Updated to client's email 21/05/2020	MAS	27/05/2020
P4 Updated to agents email 01/06/2020	MAS	01/06/2020
P5 Updated to KFC requirements email 02/06/2020	MAS	03/06/2020
P6 Updated to Aldi comments email 17/06/2020	MAS	19/06/2020
P7 Updated to David Tucker Associates requirements (drawings no.19235-04 & 19235-04-2)	DF/MAS	08/12/2020
P8 Information Issue	DF/MAS	06/01/2021

Note: Site Plan based upon topographic survey data prepared by Lewis Brown Chartered Land Surveyors (ref: T12034_SX_A)

Preliminary Issue

Client:
HARGREAVES



Project:
**WATERLOO PARK
WATERLOOVILLE**

24 Church St. West,
Woking, Surrey,
GU21 6HT
01483 494 350

lda@ldaarchitects.co.uk
www.ldaarchitects.co.uk

Drawing Title:
**PROPOSED SITE PLAN
(ALDI STORE) OPT 04**

Architecture
Planning
Space Planning
Interior Design

Scale @ A1: 1:500
Checked by: MAS
Date: 23.09.2019

Job No: 1618
Stage_Drawing No: SKE_072
Rev: P8

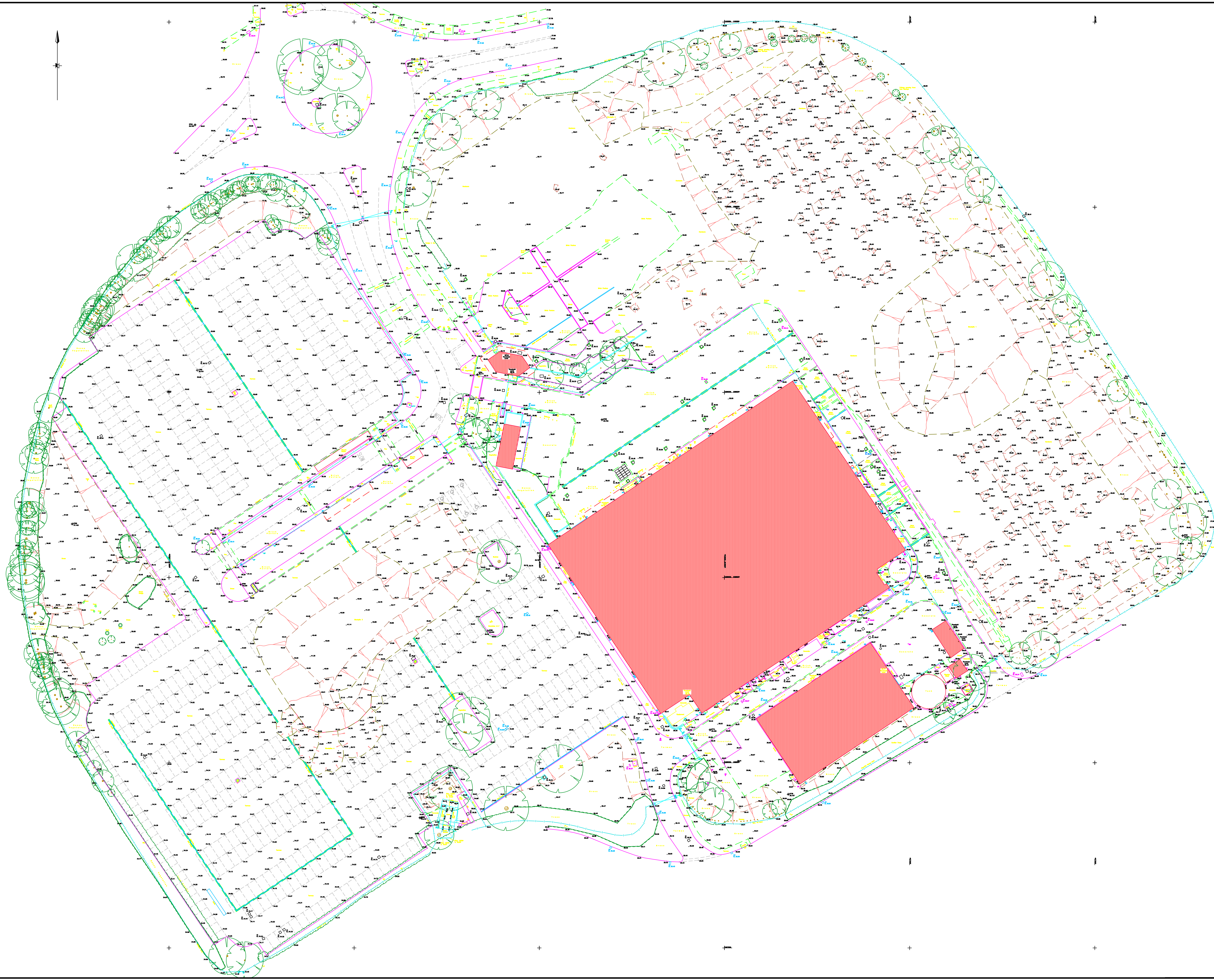
Issue Status:
Construction ☐ Preliminary ☒
Information ☐ Approval ☐
Tender ☐

Offices
Woking

LDA CHARTERED ARCHITECTS

07/01/2021 16:42:43

Appendix B Topographical Survey & Existing Drainage



LEVEL INFORMATION
 Heights in Metres
 Datum Derived From: GPS Derived
 O.S.B.M. Location: N/A
 Value: N/A
 Active Station Locations: POOL,SOTN.SAND,HUNG,HARD,FARB
 Conversions Used: OSTN02, OSGM02;

COORDINATE INFORMATION
 Values in Metres
 All Coordinates are: TRUE NATIONAL GRID
 Scale Factor: 0.99964438

STN	TYPE	EASTINGS	NORTHINGS	LEVEL
STA1	PKN	467625.179	109956.622	35.953
STA1A	PKN	467607.115	109979.184	36.181
STA2	PKN	467607.115	109979.184	36.181
STA3	PKN	467584.828	109923.217	36.005
STA3A	PKN	467571.340	109924.212	36.078
STA4	PKN	467585.278	109920.788	36.156
STA5	PKN	467585.278	109920.788	36.156
STA6	PKN	467661.055	109992.374	35.752
STA7	PKN	467704.314	109850.303	35.588
STA7A	PKN	467704.314	109850.303	35.588
STA7B	WP	467662.218	109971.483	36.107
STA8	PKN	467728.437	109832.240	35.615
STA9	PKN	467728.437	109832.240	35.615
STA9A	PKN	467773.740	109861.318	35.827
STA10	PKN	467723.991	109836.803	35.475
STA11	PKN	467723.991	109836.803	35.475
STA12	PKN	467535.564	109801.375	34.942
STA13	PKN	467732.623	109811.5035	35.612
STA14	PKN	467732.623	109811.5035	35.612
STA15	PKN	467756.750	109785.143	34.916

[illegible]

NOTES

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SCALE
Information has been gathered for the quoted scale.
Any enlargement should be verified on site.

DRAINAGE
Pipe sizes and connections are determined from surface level inspection and service records where available.

UNDERGROUND SERVICES
Any underground services shown on this survey are from information on service enquiries and tracing with Electrolocation equipment.
Some underground services may not be visible, e.g. non-conductive pipes or cables and therefore NOT SHOWN

CONTOURS
Any contours depicted on this drawing have been interpolated from surveyed points, levels and features.
The contour line positions have been generated by ground modelling software and are INDICATIVE only.

SHEET DIAGRAM

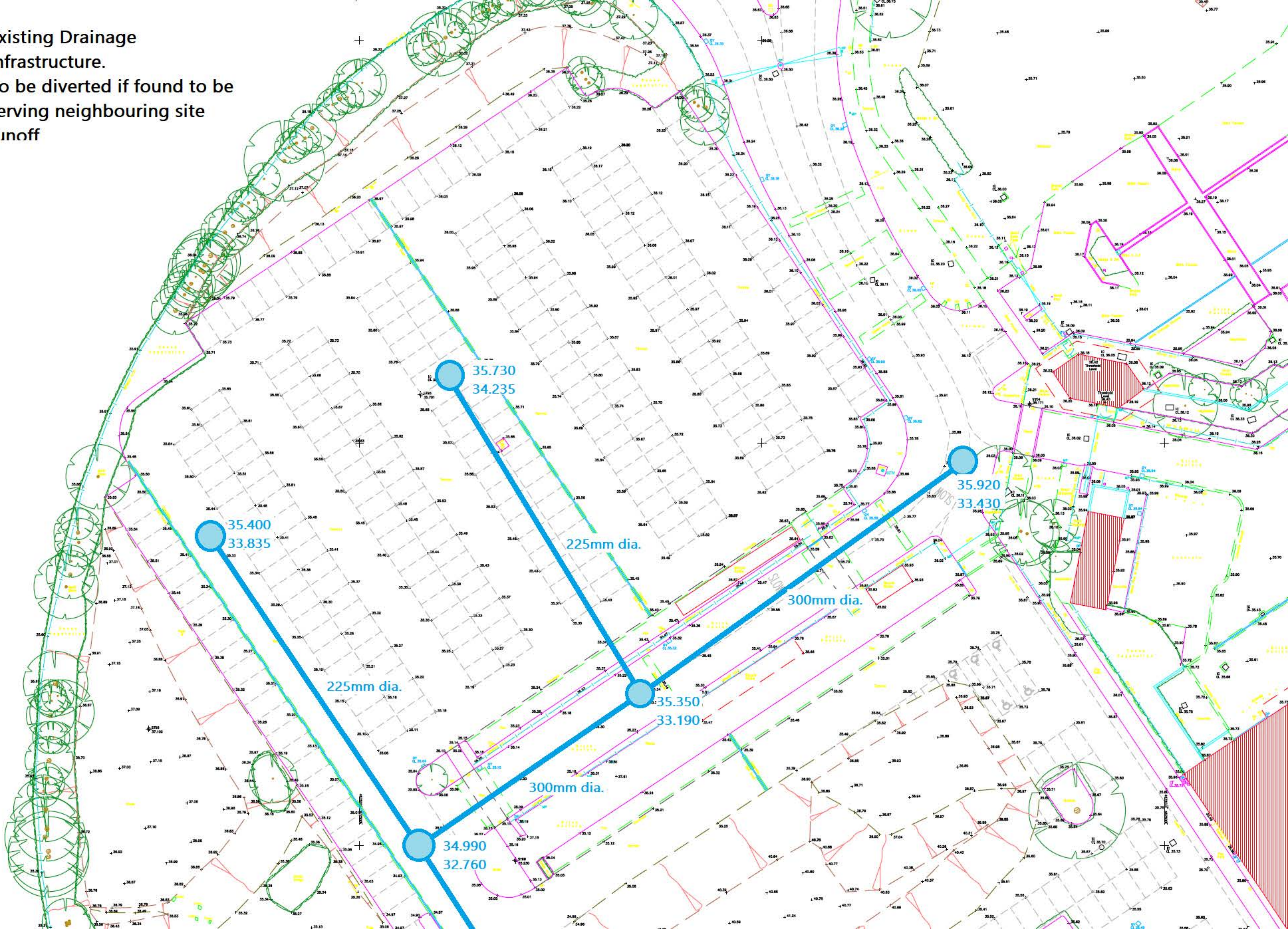
Rev.	Date	Amendments

CLIENT:
HARGREAVES CONSTRUCTION COMPANY
RUSTINGTON HOUSE
WORTHING ROAD
RUSTINGTON
WEST SUSSEX

TITLE: SYSTEMS TECHNOLOGY PARK
WATERLOOVILLE
HAMPSHIRE
TOPOGRAPHICAL SURVEY

Drawing Number: W15306_SX		Revision:
Scale: NTS	Sheet: —	Survey Date: 10/2015
Drawn: MM/SBB	Checked: DIL	Project Number: W16306

Existing Drainage Infrastructure.
To be diverted if found to be serving neighbouring site runoff



Appendix C Geotechnical Information

GROUND EXPLORATIONS LTD. SU 60 NE/176

BOREHOLE NO. 2

MANAGER DC
FILE
50/04/71/65

Contract Name Waterloooville

Report No. 8768/WAS/RF

Client H. L. Waterman & Partners

Site Address

Address 46/47 Blackfriars Road

Brambles Farm

London SE1 8FN

Waterloooville

Standing Water Level Dry

Method of Boring Shell and clay cutter

Water Struck -

Diameter 150mm

Ground Level 35.4 M.O.D.

Start 19/2/82 Finish 19/2/82

Perforated Casing

Remarks

(m) JARS		(m) CORES		BULK	
J1	1.0	U1	0.5		
J2	2.0	U2	1.5		
J3	3.0	U3	2.5		
J4	4.0	U4	3.5		
J5	5.0	U5	4.5		
J6	6.5	U6	6.0		
J7	8.0	U7	7.5		
J8	10.0	U8	9.5		
Description				Thickness (m)	Depth (m)
TOPSOIL				0.2	0.2
Firm to stiff mottled yellow / brown / grey silty CLAY with claystone at 4m				4.1	4.3
Stiff grey fissured silty CLAY				5.7	10.0
TOTALS				10.0	10.0

Notes 1. Descriptions are in accordance with B.S. Code of Practice C.P. 2001

Clients are requested to compare with samples submitted.

2. Core samples are nominally 102mm diameter and 460mm long.

Drone

22/3/82

Southern L.S.
Southern E.A.

**K Wardle Water Wells
Borehole Record and Drilling Log**

NN 990068
316
SU60/65
SUGONE

LOWER HARTLE GROUNDWATER INVESTIGATIONS STAGE 2 OVERVIEW

A: SITE DETAILS

Borehole drilled for	Portsmouth Water PLC	SITE 8
Location	Brambles Farm Industrial Estate Waterlooville	
NGR (8 fig)	SU 6750 0973	
Ground level (if known)		
Borehole drilled by	K Wardle Water Wells	
Date of drilling	December 1999 - January 2000	

B: CONSTRUCTION DETAILS

Borehole Datum (point from which all measurements of depth are taken e.g. G.L., flange, edge of chamber)

G.L.

Diameter drilled	diameter	depths			
Preparation for Artesian	444.50	mm from	G.L.	to	11 m/depth
	311.15	mm from	11	to	88.50 m/depth
	150.00	mm from	88.50	to	138.50 m/depth
		mm from		to	m/depth

Casing material(type/size/depths)

type	diameter	depths			
Mild steel casing / welded / grouted	323.85	mm from	- 0.60	to	11.00 m/depth
Mild steel casing to BS 879 square thread	168.00	mm from	- 0.60	to	88.50 m/depth
flush butt joints / grouted		mm from		to	m/depth
		mm from		to	m/depth

Water struck at Base of casing & m/depth below datum

below m/depth below datum

Rest water level on completion Artesian m/depth below datum

C: TEST PUMPING DETAILS

Test Pumping datum (point from which all measurements of depth are taken e.g. G.L., flange, edge of chamber)

See Attached yield test results

Pump suction depth	m/below flange
Water level(start of test)	m/depth below datum
Water level(end of test)	m/depth below datum
Pumping rate	m/hr
For	hours
Recovery to	m/depth below datum
Within	
Date of measurements	

K Wardle Water Wells Borehole Record and Drilling Log

D:STRATA LOG

[illegible]

Appendix D Lead Planning Authority and Lead Local Flood Authority Consultation

Former BAE Systems Park – Site Ref: BD54

Basic Information



The Site: The site is located within the Brambles Business Park to the south of Elettra Avenue in Watlingtonville.

Site Area: 5.7ha

Allocation Proposal: Commercial / Leisure ('less vulnerable')

Flood Risk Information

Source / Pathway: The dominant source of flooding to this site will be fluvial flooding.

Level of Flood Risk: Currently, a small part in the south western corner of the site is affected by Flood Zones 2 and 3. The PUSH SFRA does not show any additional flood risk in the future.



Current Day Zones 2 & 3 vs Climate Change 2115. Source: EA Flood Map and PUSH SFRA

Sequential Approach - Can areas of flood risk be avoided?

Yes, the small area in the south western part of the site could be avoided.

If flood risk cannot be avoided, what is the preferred approach?

n/a

Conclusion on prospect of safe development in light of flood risk

Avoid area at risk of flooding; note flood risk in policy and stipulate that area must be avoided.

Implications for Local Plan 2036

Allocation acceptable.

Appendix E Public Sewer Records

Appendix F Environment Agency Product 4 Response

Flood Map for Planning (Rivers and Sea) - Centred on Land at Elettra Avenue, Waterlooville, Hampshire PO7 7XY - Created 7 January 2020



1: 5,000

0 Metres 125



Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

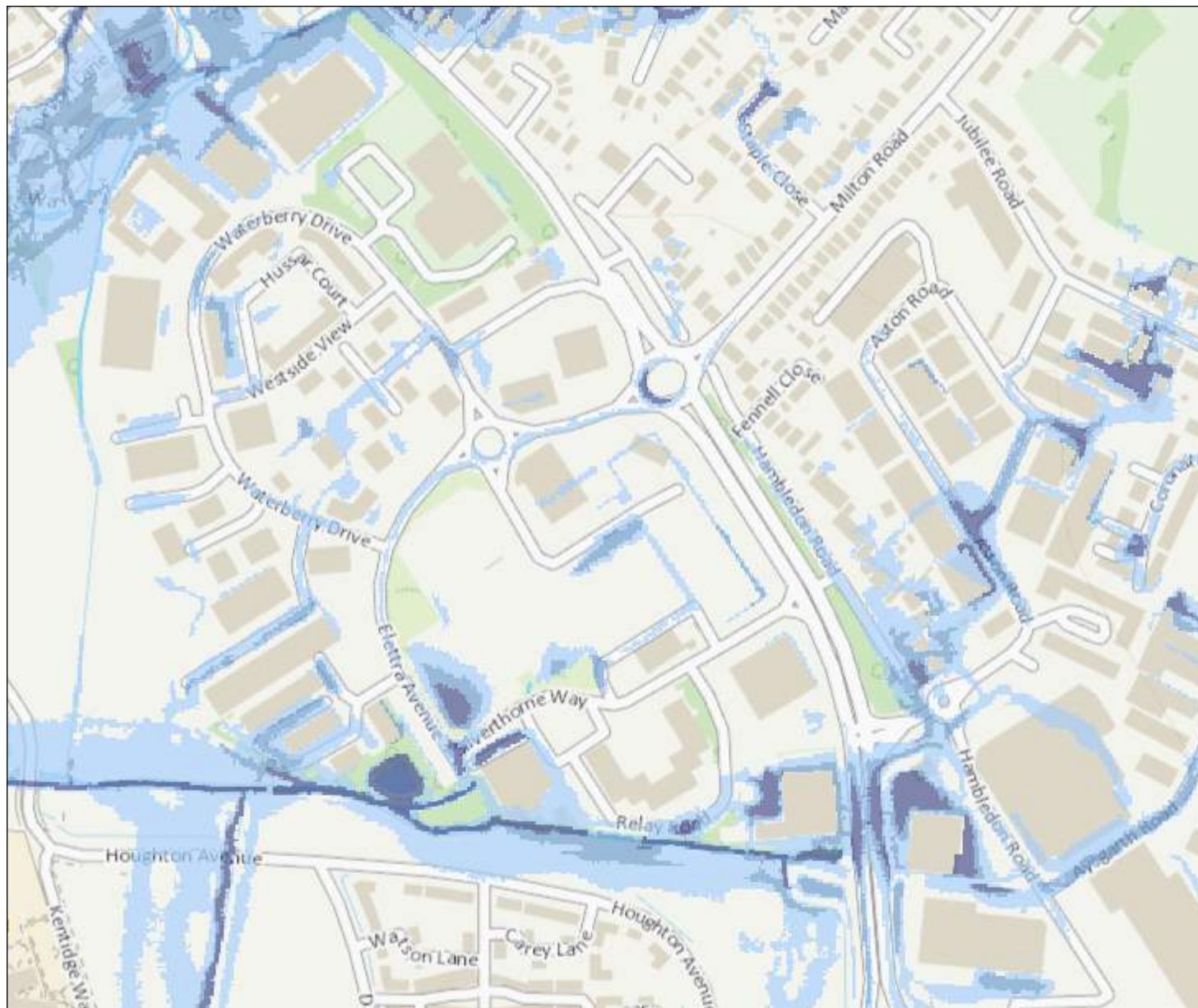
Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Risk of flooding from Surface Water - Centred on 8 Hazel Road, Woolston, Southampton, SO19 7RF - Created 7 January 2020



1: 5,000

0 Metres 125



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium (3.3% - 1%)
- Low (1% - 0.1%)
- Very Low
- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000

Likelihood of flooding from Surface Water

- High:** Greater than or equal to 3.3% (1 in 30) chance in any given year
- Medium:** Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- Low:** Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- Very Low:** Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

Flood Levels Map centred on land at Elettra Avenue, Waterloooville



Legend

 Location Points

1 IN 100 Year Flood Levels

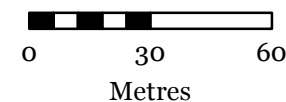
Value

 High : 4.8648

 Low : 0

1:1,874 *

*when printed at A4.



Water Depths & Levels for Land at Elettra Avenue, Waterloooville

	Water Depth (Metres)		Water Surface Level (mAOD*)		
Point	1% Annual Probability/1 in 100 Year (Flood Zone 3)	0.1% Annual Probability/1 in 1000 Year (Flood Zone 2)	1% Annual Probability/1 in 100 Year (Flood Zone 3)	0.1% Annual Probability/1 in 1000 Year (Flood Zone 2)	Ground Level
1	N/A	0.05	N/A	33.81	33.76
2	N/A	0.20	N/A	33.97	33.77
3	N/A	0.16	N/A	34.18	34.02

* Levels in metres above Ordnance Datum Newlyn

Appendix G Existing and Proposed Surface Water Drainage Calculations

Calculated by:	Daniel Lytton
Site name:	Land at Elettra Avenue
Site location:	PO7 7XY

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

Site Details

Latitude:	50.88471° N
Longitude:	1.04163° W
Reference:	2633669441
Date:	Jan 22 2021 13:50

Runoff estimation approach

Site characteristics

Total site area (ha):	1.12
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Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	779	779
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	6.13	6.13
1 in 1 year (l/s):	5.21	5.21
1 in 30 years (l/s):	14.09	14.09
1 in 100 year (l/s):	19.55	19.55
1 in 200 years (l/s):	22.92	22.92

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	250.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
6	0.155	5.00	35.400	1200	467481.879	109887.993	1.565
5	0.155	5.00	35.900	1200	467574.443	109897.326	2.470
4	0.155	5.00	35.750	1200	467510.944	109907.991	1.515
3	0.155	5.00	35.350	1200	467534.935	109868.609	2.160
2	0.155	5.00	35.000	1350	467507.172	109850.022	2.240
1			34.750	1350	467556.694	109774.496	2.650

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.002	2	1	90.314	0.600	32.760	32.100	0.660	136.8	375	7.06	60.1
3.000	6	2	45.624	0.600	33.835	32.910	0.925	49.3	225	5.41	67.9
1.001	3	2	33.410	0.600	33.190	32.835	0.355	94.1	300	6.08	64.4
1.000	5	3	48.842	0.600	33.430	33.190	0.240	203.5	300	5.74	66.2
2.000	4	3	46.114	0.600	34.235	33.265	0.970	47.5	225	5.40	67.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.002	1.547	170.8	138.8	1.865	2.275	0.775	0.0
3.000	1.867	74.2	31.4	1.340	1.865	0.155	0.0
1.001	1.621	114.6	89.3	1.860	1.865	0.465	0.0
1.000	1.098	77.6	30.6	2.170	1.860	0.155	0.0
2.000	1.902	75.6	31.4	1.290	1.860	0.155	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.002	90.314	136.8	375	Circular	35.000	32.760	1.865	34.750	32.100	2.275
3.000	45.624	49.3	225	Circular	35.400	33.835	1.340	35.000	32.910	1.865
1.001	33.410	94.1	300	Circular	35.350	33.190	1.860	35.000	32.835	1.865
1.000	48.842	203.5	300	Circular	35.900	33.430	2.170	35.350	33.190	1.860

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.002	2	1350	Manhole	Adoptable	1	1350	Manhole	Adoptable
3.000	6	1200	Manhole	Adoptable	2	1350	Manhole	Adoptable
1.001	3	1200	Manhole	Adoptable	2	1350	Manhole	Adoptable
1.000	5	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable

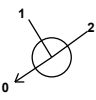
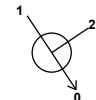


Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.000	46.114	47.5	225	Circular	35.750	34.235	1.290	35.350	33.265	1.860

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	4	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	467481.879	109887.993	35.400	1.565	1200		0	3.000	33.835 225
5	467574.443	109897.326	35.900	2.470	1200		0	1.000	33.430 300
4	467510.944	109907.991	35.750	1.515	1200		0	2.000	34.235 225
3	467534.935	109868.609	35.350	2.160	1200		1 2 0	2.000 1.000 1.001	33.265 33.190 33.190 300
2	467507.172	109850.022	35.000	2.240	1350		1 2 0	3.000 1.001 1.002	32.910 32.835 32.760 375
1	467556.694	109774.496	34.750	2.650	1350		1	1.002	32.100 375

Simulation Settings

Rainfall Methodology FSR FSR Region England and Wales M5-60 (mm) 20.000 Ratio-R 0.400 Summer CV 0.750 Analysis Speed Normal	Skip Steady State x Drain Down Time (mins) 240 Additional Storage (m³/ha) 20.0 Check Discharge Rate(s) x Check Discharge Volume x
--	---

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	0	0	0



Results for 1 year Critical Storm Duration. Lowest mass balance: 99.83%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	6	10	33.917	0.082	20.8	0.2549	0.0000	OK
15 minute summer	5	10	33.534	0.104	20.8	0.2472	0.0000	OK
15 minute summer	4	10	34.316	0.081	20.8	0.2576	0.0000	OK
15 minute summer	3	11	33.353	0.163	61.8	0.4190	0.0000	OK
15 minute summer	2	11	32.972	0.212	100.8	0.5959	0.0000	OK
15 minute summer	1	11	32.304	0.204	101.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	6	3.000	2	20.2	1.584	0.273	0.5848	
15 minute summer	5	1.000	3	20.3	0.682	0.261	1.4791	
15 minute summer	4	2.000	3	20.7	1.558	0.274	0.6177	
15 minute summer	3	1.001	2	60.9	1.612	0.531	1.2614	
15 minute summer	2	1.002	1	101.2	1.615	0.593	5.6602	44.9



Results for 30 year Critical Storm Duration. Lowest mass balance: 99.83%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	6	11	33.973	0.138	51.0	0.4279	0.0000	OK
15 minute summer	5	12	34.102	0.672	51.0	1.6030	0.0000	SURCHARGED
15 minute summer	4	11	34.382	0.147	51.0	0.4676	0.0000	OK
15 minute summer	3	12	34.023	0.833	141.2	2.1367	0.0000	SURCHARGED
15 minute summer	2	12	33.474	0.714	222.8	2.0109	0.0000	SURCHARGED
15 minute summer	1	12	32.433	0.333	214.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	6	3.000	2	50.4	1.715	0.680	1.4869	
15 minute summer	5	1.000	3	45.7	0.803	0.589	3.4394	
15 minute summer	4	2.000	3	49.9	1.631	0.660	1.5514	
15 minute summer	3	1.001	2	128.2	1.820	1.119	2.3527	
15 minute summer	2	1.002	1	214.9	1.951	1.258	9.6547	110.4



Results for 100 year Critical Storm Duration. Lowest mass balance: 99.83%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	6	12	34.582	0.747	66.1	2.3240	0.0000	SURCHARGED
15 minute summer	5	12	34.961	1.531	66.1	3.6538	0.0000	SURCHARGED
15 minute summer	4	12	35.303	1.068	66.1	3.3946	0.0000	SURCHARGED
15 minute summer	3	12	34.835	1.645	158.6	4.2203	0.0000	SURCHARGED
15 minute summer	2	12	34.049	1.289	259.3	3.6281	0.0000	SURCHARGED
15 minute summer	1	12	32.450	0.350	258.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	6	3.000	2	57.5	1.675	0.775	1.8145	
15 minute summer	5	1.000	3	52.5	0.812	0.676	3.4394	
15 minute summer	4	2.000	3	56.6	1.646	0.748	1.8340	
15 minute summer	3	1.001	2	153.2	2.176	1.337	2.3527	
15 minute summer	2	1.002	1	258.5	2.344	1.513	9.8204	143.3



Bright Plan Civils
2 West Barn
Norton Lane
Chichester PO20 3AF

File: D1934 Drainage Design.pfd
Network: S1
Dan Lytton
25/01/2021

Page 1
Surface Water Drainage Design
Land at Elettra Avenue
Waterlooville

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	250.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
19	0.040	5.00	35.650	1200	467469.293	109883.143	1.550
18	0.092	5.00	35.400	1200	467464.553	109846.268	2.130
17	0.050	5.00	35.500	1200	467537.038	109850.718	1.450
16	0.050	5.00	35.500	1200	467516.997	109880.988	1.813
15	0.067	5.00	35.350	1200	467473.401	109852.126	2.186
14	0.014	5.00	35.650	1200	467487.308	109900.700	1.300
13	0.103	5.00	35.500	1200	467486.187	109882.940	1.574
12	0.072	5.00	35.300	1200	467539.798	109856.852	1.350
11	0.082	5.00	35.350	1200	467532.016	109868.597	1.712
10	0.078	5.00	35.450	1200	467522.632	109882.772	2.098
9	0.022	5.00	36.050	1200	467495.093	109924.339	1.300
8	0.053	5.00	36.150	1200	467540.263	109927.482	1.350
7	0.018	5.00	35.850	1200	467551.556	109910.325	1.396
6	0.047	5.00	35.750	1200	467544.052	109905.356	1.523
5	0.103	5.00	35.600	1200	467530.710	109896.524	1.642
4	0.058	5.00	35.500	1200	467518.750	109888.606	2.421
3			35.375	1200	467485.117	109866.339	2.974
2			35.400	1500	467467.764	109860.641	3.531
1			35.450	1500	467452.737	109856.197	3.613

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.006	2	1	15.670	0.600	31.869	31.837	0.032	489.7	525	6.52	62.4
7.000	19	2	22.554	0.600	34.100	33.704	0.396	57.0	150	5.28	68.6
5.002	15	2	10.212	0.600	33.164	33.062	0.102	100.0	225	6.26	63.6
1.005	3	2	18.265	0.600	32.401	32.094	0.307	59.5	300	6.19	63.9
4.001	13	3	16.635	0.600	33.926	33.646	0.280	59.4	225	5.46	67.6
1.004	4	3	40.336	0.600	33.079	32.401	0.678	59.5	300	6.04	64.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.006	1.005	217.6	176.5	3.006	3.088	0.949	0.0
7.000	1.335	23.6	8.2	1.400	1.546	0.040	0.0
5.002	1.307	52.0	49.1	1.961	2.113	0.259	0.0
1.005	2.042	144.3	123.9	2.674	3.006	0.650	0.0
4.001	1.700	67.6	23.6	1.349	1.504	0.117	0.0
1.004	2.042	144.3	102.7	2.121	2.674	0.533	0.0



Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.002	10	4	7.008	0.600	33.352	33.154	0.198	35.4	225	5.40	68.0
2.000	9	4	42.854	0.600	34.750	34.029	0.721	59.4	100	5.71	66.3
1.003	5	4	14.344	0.600	33.958	33.717	0.241	59.5	225	5.67	66.5
1.002	6	5	16.000	0.600	34.227	33.958	0.269	59.5	225	5.53	67.2
1.001	7	6	9.000	0.600	34.454	34.302	0.152	59.2	150	5.38	68.1
1.000	8	7	20.540	0.600	34.800	34.454	0.346	59.4	150	5.26	68.7
3.001	11	10	17.000	0.600	33.638	33.352	0.286	59.4	225	5.35	68.3
3.000	12	11	14.089	0.600	33.950	33.713	0.237	59.4	150	5.18	69.2
4.000	14	13	17.795	0.600	34.350	34.051	0.299	59.5	100	5.30	68.5
6.000	18	15	10.611	0.600	33.270	33.164	0.106	100.0	225	5.14	69.5
5.001	16	15	52.284	0.600	33.687	33.164	0.523	100.0	225	6.13	64.2
5.000	17	16	36.303	0.600	34.050	33.687	0.363	100.0	225	5.46	67.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
3.002	2.206	87.7	47.0	1.873	2.121	0.232	0.0
2.000	1.001	7.9	4.3	1.200	1.371	0.022	0.0
1.003	1.698	67.5	43.8	1.417	1.558	0.221	0.0
1.002	1.699	67.5	23.7	1.298	1.417	0.118	0.0
1.001	1.309	23.1	14.4	1.246	1.298	0.071	0.0
1.000	1.308	23.1	10.9	1.200	1.246	0.053	0.0
3.001	1.699	67.6	31.3	1.487	1.873	0.154	0.0
3.000	1.307	23.1	14.9	1.200	1.487	0.072	0.0
4.000	1.000	7.9	2.9	1.200	1.349	0.014	0.0
6.000	1.307	52.0	19.1	1.905	1.961	0.092	0.0
5.001	1.307	52.0	19.1	1.588	1.961	0.100	0.0
5.000	1.307	52.0	10.1	1.225	1.588	0.050	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.006	15.670	489.7	525	Circular	35.400	31.869	3.006	35.450	31.837	3.088
7.000	22.554	57.0	150	Circular	35.650	34.100	1.400	35.400	33.704	1.546
5.002	10.212	100.0	225	Circular	35.350	33.164	1.961	35.400	33.062	2.113
1.005	18.265	59.5	300	Circular	35.375	32.401	2.674	35.400	32.094	3.006
4.001	16.635	59.4	225	Circular	35.500	33.926	1.349	35.375	33.646	1.504
1.004	40.336	59.5	300	Circular	35.500	33.079	2.121	35.375	32.401	2.674
3.002	7.008	35.4	225	Circular	35.450	33.352	1.873	35.500	33.154	2.121
2.000	42.854	59.4	100	Circular	36.050	34.750	1.200	35.500	34.029	1.371

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.006	2	1500	Manhole	Adoptable	1	1500	Manhole	Adoptable
7.000	19	1200	Manhole	Adoptable	2	1500	Manhole	Adoptable
5.002	15	1200	Manhole	Adoptable	2	1500	Manhole	Adoptable
1.005	3	1200	Manhole	Adoptable	2	1500	Manhole	Adoptable
4.001	13	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.004	4	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
3.002	10	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
2.000	9	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.003	14.344	59.5	225	Circular	35.600	33.958	1.417	35.500	33.717	1.558
1.002	16.000	59.5	225	Circular	35.750	34.227	1.298	35.600	33.958	1.417
1.001	9.000	59.2	150	Circular	35.850	34.454	1.246	35.750	34.302	1.298
1.000	20.540	59.4	150	Circular	36.150	34.800	1.200	35.850	34.454	1.246
3.001	17.000	59.4	225	Circular	35.350	33.638	1.487	35.450	33.352	1.873
3.000	14.089	59.4	150	Circular	35.300	33.950	1.200	35.350	33.713	1.487
4.000	17.795	59.5	100	Circular	35.650	34.350	1.200	35.500	34.051	1.349
6.000	10.611	100.0	225	Circular	35.400	33.270	1.905	35.350	33.164	1.961
5.001	52.284	100.0	225	Circular	35.500	33.687	1.588	35.350	33.164	1.961
5.000	36.303	100.0	225	Circular	35.500	34.050	1.225	35.500	33.687	1.588

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.003	5	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.002	6	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.001	7	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.000	8	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
3.001	11	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
3.000	12	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
4.000	14	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
6.000	18	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
5.001	16	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
5.000	17	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
19	467469.293	109883.143	35.650	1.550	1200		0	7.000	34.100	150
18	467464.553	109846.268	35.400	2.130	1200		0	6.000	33.270	225
17	467537.038	109850.718	35.500	1.450	1200		0	5.000	34.050	225
16	467516.997	109880.988	35.500	1.813	1200		1	5.000	33.687	225
							0	5.001	33.687	225
15	467473.401	109852.126	35.350	2.186	1200		1	6.000	33.164	225
							2	5.001	33.164	225
							0	5.002	33.164	225
14	467487.308	109900.700	35.650	1.300	1200		0	4.000	34.350	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
13	467486.187	109882.940	35.500	1.574	1200	 1 0	4.000	34.051	100
12	467539.798	109856.852	35.300	1.350	1200	 0 0	4.001	33.926	225
11	467532.016	109868.597	35.350	1.712	1200	 0 1	3.000	33.950	150
10	467522.632	109882.772	35.450	2.098	1200	 0 1	3.001	33.713	150
9	467495.093	109924.339	36.050	1.300	1200	 0 0	3.001	33.638	225
8	467540.263	109927.482	36.150	1.350	1200	 0 0	3.002	33.352	225
7	467551.556	109910.325	35.850	1.396	1200	 1 0	2.000	33.352	225
6	467544.052	109905.356	35.750	1.523	1200	 1 0	0	34.750	100
5	467530.710	109896.524	35.600	1.642	1200	 1 0	0	34.800	150
4	467518.750	109888.606	35.500	2.421	1200	 1 0	1.000	34.454	150
3	467485.117	109866.339	35.375	2.974	1200	 1 0	1.001	34.454	150
2	467467.764	109860.641	35.400	3.531	1500	 1 0	1.001	34.302	150
1	467452.737	109856.197	35.450	3.613	1500	 1 0	1.002	34.227	225



Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	31.869	Product Number	CTL-SHE-0362-1000-3400-1000
Design Depth (m)	3.400	Min Outlet Diameter (m)	
Design Flow (l/s)	100.0	Min Node Diameter (mm)	

Node 4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	34.950	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	5	Depth (m)	0.450
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.32	Length (m)	31.500		

Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	35.050	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	3	Depth (m)	0.450
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.32	Length (m)	41.500		

Node 6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	35.200	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.450
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.32	Length (m)	19.000		

Node 7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	35.300	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	3	Depth (m)	0.450
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.32	Length (m)	15.000		



Node 9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	35.500	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.450
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.32	Length (m)	17.500		

Node 10 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	34.900	Slope (1:X)	108.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	9	Depth (m)	0.450
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.32	Length (m)	32.500		

Node 11 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	34.800	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	13	Depth (m)	0.450
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.32	Length (m)	38.500		

Node 12 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	34.750	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	18	Depth (m)	0.450
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.32	Length (m)	80.000		

Node 13 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	34.950	Slope (1:X)	300.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	5	Depth (m)	0.450
Safety Factor	2.0	Width (m)	12.000	Inf Depth (m)	
Porosity	0.32	Length (m)	12.000		

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	32.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	43

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	64.0	0.0	1.200	64.0	0.0	1.201	0.0	0.0



Results for 2 year Critical Storm Duration. Lowest mass balance: 99.11%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	19	10	34.158	0.058	7.3	0.0960	0.0000	OK
15 minute winter	18	10	33.359	0.089	16.8	0.1768	0.0000	OK
15 minute winter	17	10	34.113	0.063	9.1	0.1142	0.0000	OK
15 minute winter	16	11	33.777	0.090	18.0	0.1507	0.0000	OK
15 minute winter	15	11	33.349	0.185	45.9	0.3225	0.0000	OK
15 minute winter	14	10	34.390	0.040	2.6	0.0535	0.0000	OK
15 minute winter	13	10	34.017	0.091	21.3	0.2223	0.0000	OK
15 minute winter	12	10	34.035	0.085	13.1	0.1876	0.0000	OK
15 minute winter	11	10	33.743	0.105	27.8	0.2188	0.0000	OK
15 minute winter	10	10	33.479	0.127	41.7	0.2386	0.0000	OK
15 minute winter	9	11	34.800	0.050	4.0	0.0736	0.0000	OK
15 minute winter	8	10	34.867	0.067	9.7	0.1289	0.0000	OK
15 minute winter	7	10	34.540	0.086	12.9	0.1199	0.0000	OK
15 minute winter	6	10	34.315	0.088	21.2	0.1542	0.0000	OK
15 minute winter	5	10	34.093	0.135	39.8	0.3222	0.0000	OK
15 minute winter	4	11	33.308	0.229	94.8	0.3690	0.0000	OK
15 minute winter	3	12	33.075	0.674	112.4	0.7625	0.0000	SURCHARGED
15 minute winter	2	14	32.909	1.040	162.7	14.5682	0.0000	SURCHARGED
15 minute summer	1	1	31.837	0.000	99.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	19	7.000	2	7.1	1.153	0.303	0.1397	
15 minute winter	18	6.000	15	16.5	0.701	0.318	0.2608	
15 minute winter	17	5.000	16	8.9	0.763	0.172	0.4282	
15 minute winter	16	5.001	15	17.6	0.699	0.339	1.2975	
15 minute winter	15	5.002	2	45.4	1.386	0.873	0.3334	
15 minute winter	14	4.000	13	2.5	0.878	0.318	0.0507	
15 minute winter	13	4.001	3	21.0	1.452	0.310	0.2402	
15 minute winter	12	3.000	11	12.9	1.295	0.558	0.1401	
15 minute winter	11	3.001	10	27.5	1.336	0.408	0.3505	
15 minute winter	10	3.002	4	41.4	1.917	0.472	0.1819	
15 minute winter	9	2.000	4	3.9	0.992	0.491	0.1668	
15 minute winter	8	1.000	7	9.6	1.054	0.414	0.1864	
15 minute winter	7	1.001	6	12.6	1.272	0.544	0.0894	
15 minute winter	6	1.002	5	21.0	1.072	0.311	0.3143	
15 minute winter	5	1.003	4	39.1	1.675	0.579	0.3355	
15 minute winter	4	1.004	3	91.9	1.713	0.636	2.5850	
15 minute winter	3	1.005	2	110.2	1.747	0.764	1.2862	
15 minute winter	2	Hydro-Brake®	1	99.9				81.3



Results for 30 year Critical Storm Duration. Lowest mass balance: 99.11%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	19	10	34.185	0.085	13.8	0.1402	0.0000	OK
15 minute winter	18	11	33.706	0.436	31.8	0.8692	0.0000	SURCHARGED
15 minute winter	17	10	34.138	0.088	17.3	0.1602	0.0000	OK
15 minute winter	16	11	33.830	0.143	34.3	0.2407	0.0000	OK
15 minute winter	15	11	33.654	0.490	84.0	0.8553	0.0000	SURCHARGED
15 minute winter	14	10	34.408	0.058	4.8	0.0778	0.0000	OK
15 minute winter	13	10	34.061	0.135	40.3	0.3298	0.0000	OK
15 minute winter	12	13	34.799	0.849	24.9	2.2485	0.0000	SURCHARGED
15 minute winter	11	12	34.688	1.050	41.8	2.1936	0.0000	SURCHARGED
15 minute winter	10	12	34.590	1.238	60.1	2.3218	0.0000	SURCHARGED
15 minute winter	9	12	34.835	0.085	7.6	0.1246	0.0000	OK
15 minute winter	8	13	34.946	0.146	18.3	0.2799	0.0000	OK
15 minute winter	7	12	34.839	0.385	24.6	0.5342	0.0000	SURCHARGED
15 minute winter	6	12	34.733	0.506	39.1	0.8849	0.0000	SURCHARGED
15 minute winter	5	12	34.672	0.714	69.4	1.7026	0.0000	SURCHARGED
15 minute winter	4	12	34.462	1.383	134.7	2.2258	0.0000	SURCHARGED
15 minute winter	3	14	33.872	1.471	167.4	1.6633	0.0000	SURCHARGED
15 minute winter	2	17	33.634	1.765	260.8	59.9432	0.0000	SURCHARGED
15 minute summer	1	1	31.837	0.000	99.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	19	7.000	2	13.5	1.349	0.573	0.2261	
15 minute winter	18	6.000	15	30.0	0.755	0.577	0.4220	
15 minute winter	17	5.000	16	17.0	0.893	0.328	0.7383	
15 minute winter	16	5.001	15	32.0	0.895	0.616	1.7356	
15 minute winter	15	5.002	2	83.2	2.091	1.600	0.4061	
15 minute winter	14	4.000	13	4.7	1.026	0.599	0.0816	
15 minute winter	13	4.001	3	39.8	1.687	0.588	0.4554	
15 minute winter	12	3.000	11	19.0	1.371	0.823	0.2480	
15 minute winter	11	3.001	10	38.3	1.327	0.566	0.6761	
15 minute winter	10	3.002	4	54.8	1.946	0.624	0.2787	
15 minute winter	9	2.000	4	7.4	1.094	0.937	0.3194	
15 minute winter	8	1.000	7	18.4	1.157	0.798	0.3602	
15 minute winter	7	1.001	6	22.8	1.379	0.985	0.1584	
15 minute winter	6	1.002	5	35.9	1.140	0.532	0.6363	
15 minute winter	5	1.003	4	64.3	1.781	0.952	0.5705	
15 minute winter	4	1.004	3	129.1	1.834	0.895	2.8404	
15 minute winter	3	1.005	2	164.4	2.335	1.139	1.2862	
15 minute winter	2	Hydro-Brake®	1	99.9				152.1



Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.11%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	19	21	35.201	1.101	22.6	1.8133	0.0000	SURCHARGED
30 minute winter	18	22	35.390	2.120	44.8	4.2287	0.0000	FLOOD RISK
30 minute winter	17	22	35.500	1.450	24.4	2.6405	0.2768	FLOOD
30 minute winter	16	22	35.474	1.787	45.4	3.0080	0.0000	FLOOD RISK
30 minute winter	15	22	35.350	2.186	102.7	3.8117	0.0000	FLOOD RISK
30 minute winter	14	24	35.166	0.816	9.5	1.0986	0.0000	SURCHARGED
30 minute winter	13	25	35.131	1.205	55.6	10.3593	0.0000	SURCHARGED
30 minute winter	12	35	35.118	1.168	37.1	24.2809	0.0000	FLOOD RISK
30 minute winter	11	32	35.128	1.490	47.5	27.6509	0.0000	FLOOD RISK
30 minute winter	10	29	35.129	1.777	65.5	12.4423	0.0000	SURCHARGED
15 minute winter	9	14	35.574	0.824	13.8	1.8615	0.0000	SURCHARGED
15 minute winter	8	12	36.039	1.239	33.2	2.3736	0.0000	FLOOD RISK
15 minute winter	7	14	35.494	1.040	38.2	4.9066	0.0000	SURCHARGED
15 minute winter	6	15	35.296	1.069	47.5	4.0974	0.0000	SURCHARGED
30 minute winter	5	27	35.230	1.272	87.9	13.3502	0.0000	SURCHARGED
30 minute winter	4	27	35.133	2.054	142.1	11.3636	0.0000	SURCHARGED
30 minute winter	3	24	35.106	2.705	184.1	3.0592	0.0000	FLOOD RISK
30 minute winter	2	23	35.085	3.216	291.9	78.7043	0.0000	SURCHARGED
15 minute summer	1	1	31.837	0.000	99.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	19	7.000	2	19.5	1.451	0.826	0.3971	
30 minute winter	18	6.000	15	38.9	0.977	0.748	0.4220	
30 minute winter	17	5.000	16	22.4	0.905	0.431	1.4438	
30 minute winter	16	5.001	15	35.1	0.894	0.675	2.0794	
30 minute winter	15	5.002	2	97.6	2.454	1.878	0.4061	
30 minute winter	14	4.000	13	6.2	1.082	0.789	0.1392	
30 minute winter	13	4.001	3	48.6	1.733	0.719	0.6616	
30 minute winter	12	3.000	11	37.4	2.125	1.620	0.2480	
30 minute winter	11	3.001	10	60.6	1.523	0.896	0.6761	
30 minute winter	10	3.002	4	61.9	1.938	0.706	0.2787	
15 minute winter	9	2.000	4	6.9	1.090	0.872	0.3353	
15 minute winter	8	1.000	7	27.5	1.564	1.191	0.3616	
15 minute winter	7	1.001	6	22.5	1.373	0.974	0.1584	
15 minute winter	6	1.002	5	37.6	1.147	0.556	0.6363	
30 minute winter	5	1.003	4	61.6	1.774	0.913	0.5705	
30 minute winter	4	1.004	3	136.2	1.934	0.943	2.8404	
30 minute winter	3	1.005	2	179.8	2.553	1.246	1.2862	
30 minute winter	2	Hydro-Brake®	1	99.9				363.6

Appendix H HCC Surface Water Checklist

This document should be read in conjunction with the Surface Water Checklist Guidance document located on our website

SURFACE WATER SUBMITTED INFORMATION

Some applications have a considerable number of documents associated with them. To make sure we are reviewing the correct documentation, please ensure the following table is completed.

Document / Drawing Title	Document / Drawing Reference (and revision)
D1934 BPC FRA 1.0	

PRE-APPLICATION / PREVIOUS PLANNING APPLICATIONS

If this site was subject to a previous planning application i.e. an outline application in relation to a wider strategic site, pre-application enquiry or if you are reliant on information previously submitted, please provide the relevant reference numbers below.

Planning / Pre-app Titles	Reference Number

ORDINARY WATERCOURSE CONSENTING – to be completed and signed by the applicant

I confirm that I have reviewed the site and there are no watercourses / ditches / flow routes that will be affected or amended by the works. I understand that works to any of these features without consent constitutes a criminal offence and breaches the Land Drainage Act 1991.

Or (delete as appropriate).

I confirm that I have reviewed the site and there are watercourses / ditches / flow routes that will be affected or amended by the works. I understand that these works require Ordinary Watercourse Consent under the Land Drainage Act 1991 and confirm that applications will be made for these works prior to works starting on site.

Name: Dan Lytton

Job Title: Engineer – Drainage Consultants

Signature:



26/01/2020

SURFACE WATER CHECKLIST

Site Name		Land at Elettra Avenue, Waterloooville		Planning ref		-	
Ref	SURFACE WATER REQUIREMENTS		PLANNING STAGE		SUBMISSION CHECKLIST		
			OUTLINE PLANNING	DETAILED PLANNING	Included Yes/Not	DOCUMENT Ref	
	EXISTING INFORMATION		X	X			
1	Topographical Survey.		X	X	Y		
2	Existing Drainage		X	X	Y		
3	Discharge Rates and Volumes		X	X	Y		
4	Existing Overland Flow Paths		X	X	Y		
5	Site Investigations		X	X	Y		
	OUTLINE DRAINAGE STRATEGY						
6	Confirmation of a discharge location		X	X	Y		
7	Outline Surface Water Calculations		X				
8	Flood Risk Assessment / Drainage Strategy		X	X	Y		
9	Potential Flood Risk		X	X	Y		
10	Outline Drainage Layout Plan		X				
	DETAILED DRAINAGE STRATEGY			X			
11	Detailed Drainage Assessment			X	Y		
12	Detailed Drainage Layout Drawings			X	Y		
13	Detailed Hydraulic Calculations			X	Y		
14	Water Treatment			X	Y		
15	Exceedance Flows			X	Y		
16	Urban Creep			X	Y		
17	Maintenance			X	Y		