Proposed Redevelopment

Former Nestlé Factory, Hayes

Flood Risk Assessment & Drainage Strategy (Residential Scheme)

Final Report for

BARRATT LONDON

May 2017

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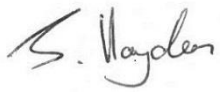
Prepared – Drainage		John Hayden BEng(Hons) *Principal Engineer – Civil Engineering*	
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APPENDICES

1.0 INTRODUCTION

This report has been prepared by Hydrock on behalf of Barratt London in support of a planning application to be submitted to London Borough of Hillingdon Council for the proposed redevelopment of the former Nestlé Factory complex in Hayes.

The proposed redevelopment of the former Nestlé Factory complex comprises the 'Part-demolition of existing factory buildings and associated structures, and redevelopment comprising 120,487m^2 (GEA) of residential floorspace to provide 1,381 dwellings (Use Class C3), office, retail, community and leisure uses (Use Classes A1/A3/A4/B1/B8/D1/D2), 2,986m^2 (GEA) of non-residential floorspace, 22,663m^2 (GEA) commercial floorspace (Use Classes B1c/B2/B8) and Data Centre (sui generis)), amenity and playspace, landscaping, access, service yards, associated car parking and other engineering works'.

This report relates solely to the proposed residential led portion of the scheme in the western portion of the complex, whilst Capita has prepared a parallel report for the commercial part of the scheme in the eastern part of the complex. This report was undertaken in consideration of Capita's report to ensure a consistent assessment approach and mitigation measures have been adopted, particularly with regard the delivery of a coordinated drainage strategy, and so both reports should be read in conjunction.

For the avoidance of doubt and purposes of this report, the term 'complex' refers to the overall Nestlé Factory complex which comprises both the proposed residential and commercial (industrial) portions of the scheme, whilst 'site' refers solely to the proposed residential led element of the scheme, i.e. the western portion of the complex.

This Flood Risk Assessment and Drainage Strategy report has been prepared to address the requirements of the *National Planning Policy Framework* (*NPPF*), through:

- Assessing whether the site is likely to be affected by flooding.
- Assessing whether the proposed development is appropriate in the suggested location.
- Presenting any flood risk mitigation measures necessary to ensure that the proposed development and occupants will be safe, whilst ensuring flood risk is not increased elsewhere.

The report considers the requirements for undertaking a Flood Risk Assessment as detailed in the *NPPF*.

2.0 SITE INFORMATION

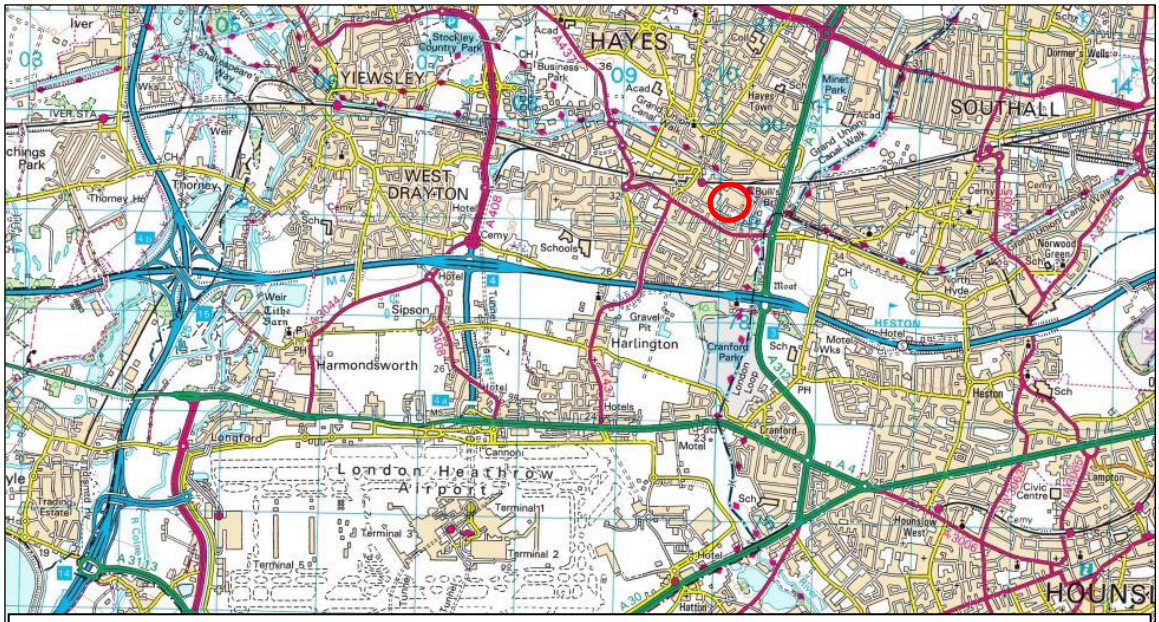
2.1 Location

Table 1: Site Referencing Information

Site Address	Former Nestlé Factory, Nestles Avenue, Hayes, UB3 4RF
Grid Reference	TQ 10000 79208

The site is located within the southern portion of Hayes, West London. The location of the site is shown in Figure 1 below.

Figure 1: Site Location Plan



2.2 Existing Use & Setting

The overall complex currently comprises the former Nestlé Factory complex, which ceased operations in 2014 and extends to approximately 12.3ha. The proposed scheme occupies the western portion of the complex, totalling 7.16ha, and is predominately occupied by buildings and hardstanding areas. The remainder of the complex to the east is to be developed separately for commercial (industrial) uses.

The northern boundary is demarcated by the Grand Union Canal and the Great Western Railway. The remainder of the Nestlé Factory complex bounds the site to the east. North Hyde Gardens defines the southern boundary of the site. To the west is a trading estate located off Nestle Avenue.

2.3 Topography

The site is relatively level, with a slight gradient falling southeastwards across the site from around 31.4m AOD in the northwestern corner of the site to approximately 30.1m AOD in the southeastern corner.

A topographical survey of the site is included in Appendix A.

2.4 Proposed Development

The scheme proposes the 'Part-demolition of existing factory buildings and associated structures, and redevelopment comprising 120,487m^2 (GEA) of residential floorspace to provide 1,381 dwellings (Use Class C3), office, retail, community and leisure uses (Use Classes A1/A3/A4/B1/B8/D1/D2), 2,986m^2 (GEA) of non-residential floorspace, 22,663m^2 (GEA) commercial floorspace (Use Classes B1c/B2/B8) and Data Centre (sui generis)), amenity and playspace, landscaping, access, service yards, associated car parking and other engineering works'.

As before, this report relates solely to the proposed residential led portion of the scheme in the western portion of the complex, i.e. those elements underlined above. Capita has prepared a parallel report for the commercial part of the scheme in the eastern part of the complex, and so both reports should be read in conjunction.

Proposed scheme drawings are included in Appendix A. The 'Proposed Drainage Catchment Areas' drawing (C151867/C/101) in Appendix C indicates the extent of the complex to which this report refers.

3.0 ASSESSMENT OF FLOOD RISK

3.1 Fluvial and Tidal Flooding

3.1.1 Flood Zone Mapping

The entirety of the site is shown to be within the Environment Agency's (EA's) Flood Zone 1, which comprises land assessed as having <1 in 1,000 annual probability (0.1%) of fluvial or tidal flooding in any year.

A copy of the EA's Flood Zone mapping is included in Appendix B.

3.1.2 Fluvial – River Crane

The River Crane flows southwards approximately 300m to the east of the site. The River flows in open channel adjacent to the site, passing beneath the Grand Union Channel in a brick arch culvert.

Flood modelling data, provided by the EA and included in Appendix B, indicates a 1 in 1,000 year flood level adjacent to the site of 26.638m AOD. This level is around 1.9m below the lowest site ground level. As such, the site is concluded to be at low risk of flooding from the River Crane.

This conclusion is supported by floodplain mapping, also included in Appendix B, which likewise shows the entirety of the site to be outside the 1 in 1,000 year floodplain of the River Crane.

3.1.3 Tidal – River Thames

The River Thames is located approximately 7km to the southeast of the site at its closest point, at which point it is tidal. The floodplain extent of the River Thames is not shown to extend to the site based on the EA's Flood Zone mapping, and as such the site is concluded to be at low risk of flooding from the River Thames.

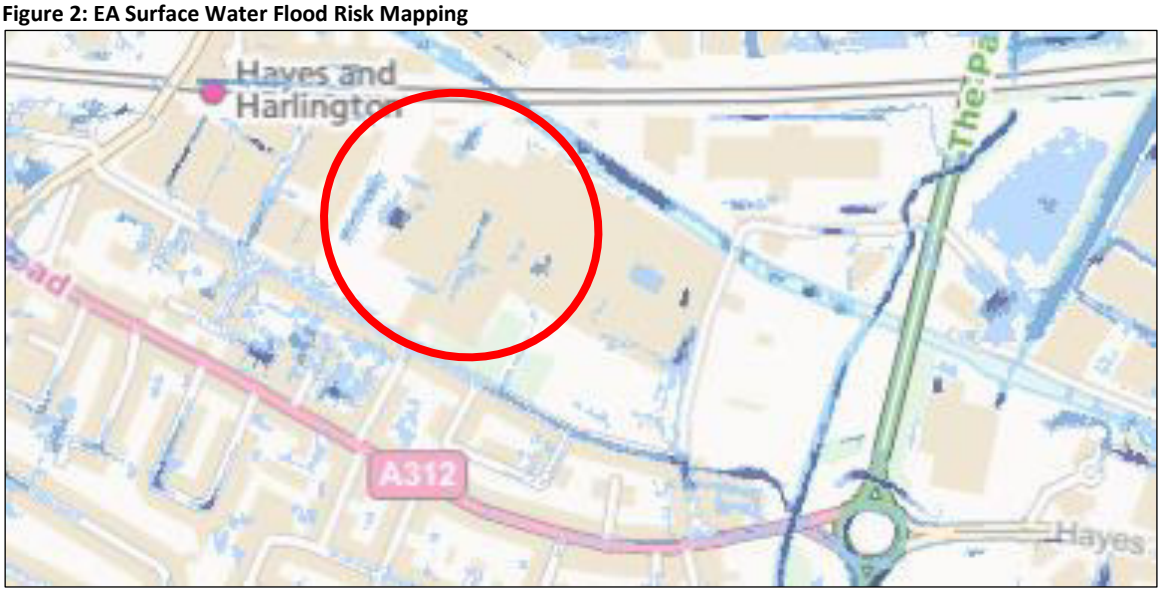
3.2 Surface Water

The gravel-lined railway and Canal land uses 'uphill' of the site are not expected to generate significant surface water run-off. It is also noted that the topography of the site and surrounding area means that if any overland flows were generated within the vicinity of the site, these will likely be directed southeastwards along adjacent highways and by-pass the site.

This analysis is supported by the EA's Surface Water Flood Risk mapping, as shown in Figure 2 below, and the *London Borough of Hillingdon Preliminary Flood Risk Assessment* (*PFRA*), mapping from which is included in Appendix B. Neither mapping source records any previous surface water flooding incidents within the immediate vicinity of the site, or, shows significant surface water overland flow routes directed onto the site.

The mapping does though indicate potential surface water flooding within the site. However, these areas are isolated, suggesting localised 'ponding' within low-spots as opposed to significant overland flow routes. Such potential flooding though could potentially pose a risk of localised surface water flooding within the site.

Figure 2: EA Surface Water Flood Risk Mapping



3.3 Groundwater

The most recent Geo-environmental Investigation and Assessment for the site (Capita, November 2014) recorded a geological sequence beneath the site of: Hard Surfacing (concrete); Made Ground; Langley Silt / Brickearth; Lynch Hill Gravel Member; and, London Clay Formation.

Groundwater levels were measured at between 0.7 – 2.9m bgl, with a predominately southeasterly flow direction.

Noting the geological succession beneath the site, there is the potential for a 'perched' groundwater table within the superficial Lynch Hill Gravel Member deposits. This appears to be corroborated based on the groundwater depths identified.

The groundwater flow direction identified suggests that sub-surface flows are directed towards the River Crane. As such, groundwater within the area is likely to be in hydraulic connectivity with water levels within the River Crane and therefore groundwater depths are ultimately controlled by channel water levels within the River. Adopting therefore the 1 in 1,000 year flood level within the River Crane adjacent to the site of 26.638m AOD as indicative of the worst-case groundwater emergence flood scenario, indicates that whilst there is a relatively high groundwater level beneath the site, the risk of groundwater emergence is low, based on the 'controlling' River Crane channel flood level being around 1.9m below the lowest site ground level.

This conclusion is supported by the *PFRA*, which does not record any previous groundwater flooding incidents within the immediate vicinity of the site. Mapping from the *PFRA* is included in Appendix B.

3.4 Infrastructure Failure

The *PFRA* does not record any previous sewer flooding incidents within the vicinity of the site, as shown in Appendix B. Furthermore, any surcharged sewer overland flows generated within the

vicinity of the site will likely be directed southeastwards along adjacent highways and by-pass the site.

The EA's Reservoir mapping shows the site to be outside the maximum extent of any potential reservoir failure scenarios.

The water level within the Grand Union Canal is at a lower level adjacent to the site by around 1m. The Canal wall adjacent to the site comprises a combination of a sheet pile, masonry and concrete construction wall with a concrete capping beam topped with a timber fence. The wall height to the top of the concrete capping beam is around 0.3m above adjacent site levels. Based on the incised construction of the Canal at this point, there is considered minimal risk of a catastrophic breach adjacent to the site.

Water levels within the Canal are managed via a series of overflow structures. One such structure is located approximately 360m east of the site, whereupon a weir structure allows excess water within the Canal to overflow into the River Crane. The crest level of the weir was measured at 29.46m AOD, meaning that water levels within the Canal are not anticipated to exceed this level. Given that this level is below the Canal bank levels adjacent to the site, by around 1m, the risk of the Canal overtopping into the site is therefore considered low.

As such, the site is considered to be at low risk of infrastructure failure flooding.

4.0 *NPPF* REQUIREMENTS

4.1 Sequential and Exception Tests

The site is on land designated as Flood Zone 1 by the EA's Flood Zone Mapping.

The *NPPF Planning Practice Guidance* Flood Risk Vulnerability and Flood Zone Compatibility matrix (Table 3) indicates that all types of development are appropriate in Flood Zone 1, and as such the proposed redevelopment of the site is concluded to meet the requirements of the Sequential Test.

Whilst an Exception Test is not explicitly required under the *NPPF*, where a site has been demonstrated to pass the Sequential Test, as is the case here, the following section details any measures necessary to mitigate any residual flood risks, to ensure that the proposed development and occupants will be safe and that flood risk will not be increased elsewhere, akin to the requirements of the second part of the Exception Test.

4.2 Mitigation Measures

4.2.1 Resistance and Resilience of Buildings

The only significant flood risk identified within the site is the risk of localised surface water 'ponding'. It is anticipated that this risk will be largely mitigated through the proposed redevelopment of the site, i.e. removal of existing artificially created low spots associated with the previous site use, such as loading bays; and, the design and construction of a positive surface water drainage system.

However, in order to afford the proposed scheme additional protection from surface water flooding, and other residual risks, the proposed layout allows for 'design exceedance' overland flow routes through the site. This comprises a proposed layout which offers potential overland flow routes along proposed infrastructure thoroughfares, with adjacent buildings suitably elevated. In terms of a recommended 'freeboard' between building finished floor levels and adjacent infrastructure thoroughfare levels, there is no set value given the generally low risk of flooding identified, however a minimum 'standard' threshold of 150mm will be adopted, where practicable.

4.2.2 Safe Access and Egress

Based on the EA's flood risk mapping, and this site specific assessment, dry access and egress is shown to be available to and from the site.

4.2.3 Flood Risk within Catchment

The proposed development and facilitating works are not considered to increase flood risk within the catchment through loss of floodplain storage (as the site has been demonstrated as being outside a functioning floodplain).

In accordance with the *London Borough of Hillingdon Strategic Flood Risk Assessment* (*SFRA*), a minimum 5.0m 'undeveloped buffer strip' has been incorporated into the proposed site layout

between the Grand Union Canal and proposed development. This is to permit inspection and maintenance access of the Canal.

Communication will also be sought with the Canal and River Trust, at the detailed design stage, to ascertain any other specific requirements regarding proposed construction works adjacent to the Canal.

Details regarding the measures to manage surface water run-off as a result of the proposed development are detailed in Chapter 5.0.

5.0 SURFACE WATER DRAINAGE

5.1 Existing

Currently, the site is served by a positive surface water drainage system, with the northern portion of the site draining to the adjacent Grand Union Canal, whilst surface water run-off from the southern portion of the site discharges to the Thames Water sewer network in Nestles Avenue.

5.2 Proposed

5.2.1 Strategy

The drainage hierarchy specified within Policy 5.13 of the *London Plan* establishes the preference for managing surface water run-off. The hierarchy and feasibility of employing each level is summarised in Table 2 below.

Table 2: Drainage Hierarchy

Level	Description	Utilised	Justification
1	Store water for later use	✓	Green roofs to be used within the new build areas, with water reused for vegetation.
2	Infiltration	X	Infiltration testing in accordance with BRE 365 has shown the infiltration rate to be insufficient for infiltration methods.
3	Attenuate in open water features for gradual release	X	Open water features such as ponds and swales compromise the proposed site layout effecting the developable space.
4	Attenuate in tanks or sealed water features for gradual release	✓	To be included via the use of permeable paving and below ground attenuation crates.
5	Discharge to watercourse	✓	Surface water from the northern portion of the site to be discharged at an agreed gradual release rate to the Grand Union Canal.
6	Discharge to surface water sewer	✓	Surface water from the southern section of the site to be discharged at an agreed gradual release rate to the existing Thames Water sewer system.
7	Discharge to combined sewer	X	Not required.

Based on the above, it is proposed to retain the existing broad drainage strategy for the site, effectively splitting the drainage catchment, with the northern half of the site draining to the Canal and the southern half to the existing Thames Water surface water sewer system. Drawings showing the proposed drainage catchments, attenuation locations and overall drainage strategy are included in Appendix C.

An application has been made to the Canal and River Trust (C&RT) to obtain permission to drain to the Canal, based on a number of outfalls that currently enter the Canal from the site. An existing flow rate was calculated in accordance with the *Code of Practice for Works Affecting the Canal & River Trust Parts 1 and 2.* Through this process, consent to discharge a maximum 85.9l/s

to the Canal has been obtained for all storm events, based on the equivalent existing total peak discharge rate from the site to the Canal. The proposed discharge will be restricted to a maximum velocity of 0.3m/s, as stipulated by the C&RT. Correspondence with the C&RT is included in Appendix C.

In accordance with Clause 3.4.10 of the *London Plan Supplementary Planning Guidance*, it is proposed to drain the southern section of the site to Nestles Avenue at a rate of three times the equivalent 'greenfield' run-off rate from the site. This is a particular allowance for previously developed sites. The total discharge to the Thames Water sewer network will therefore be restricted to 74.7l/s (24.9l/s x 3) during a 1 in 2 year storm event, 192.3l/s (64.1l/s x 3) during a 1 in 30 year storm event, and 270.6l/s (90.2l/s x 3) during a 1 in 100 year + 40% storm event. The discharge will be divided between three outfalls. The MicroDrainage 'greenfield' run-off rate calculations are included in Appendix C.

The surface water drainage networks has been modelled using MicroDrainage. The networks has been modelled for a 1 in 2 year, 1 in 30 year and 1 in 100 year + 40% storm events. Due to the proposed scheme being predominately residential, the drainage network has been designed to not flood in a 1 in 100 year + 40% storm event. Complex flow controls will be used to restrict the flows to the given rates. Proposed network model MicroDrainage calculations are included in Appendix C.

5.2.2 Water Quality

Sustainable Drainage System (SUDS) solutions have been considered during the design process. Table 3 below states which SUDS features have been incorporated and which have been excluded, and the justification for such decisions.

Table 3: SUDS Utilisation

Description	Utilised	Justification
Swales	X	The site is to be extensively developed, which does not allow space for swales to be incorporated without wholesale changes to the site redevelopment.
Infiltration	X	Infiltration testing in accordance with BRE 365 has shown the infiltration rate to be insufficient for infiltration methods.
Permeable paving	✓	Permeable paving to be incorporated within the design, it will be a tanked system as infiltration is not possible.
Attenuation ponds	X	The size of ponds required will compromise the developable space.
Green roofs	✓	Green roofs to be used within the new build areas.

With reference to *The SUDS Manual*, the water treatment benefits offered by the components provided within the proposed drainage network have been considered in parallel with the risk of pollution posed by the nature of the site and its proposed usage.

The site shall be frequented mainly by cars, though delivery and refuse vehicles will also visit the site. The use of permeable paving is known to provide water quality enhancement and therefore negates the need for light liquid separators. As such, permission will be sought during the detailed design stage to preclude the use of light liquid separators in areas of proposed permeable paving.

Where permeable paving is not proposed, and the catchment has in excess of 50 proposed parking spaces, a Class 1 bypass light liquid separator will be used, in accordance with *PPG 3*. The interceptor shall be fitted with high level audible and visual alarms which will alert the need for maintenance. Separators will be inspected every six months as per the manufacturer's instructions.

Further treatment shall be provided with the use of catch pits and trapped gullies located close to source which will reduce suspended solids within the network.

5.2.3 Maintenance

To ensure the proposed drainage network / treatment process operates as intended, a maintenance strategy is required, as summarised in Table 4 below.

Table 4: Maintenance Strategy

Drainage Component	Actions	Frequency	Responsibility
External areas	• Site to be generally kept free from litter and debris which may enter the drainage system.	• On-going	Site management
Permeable paving	• Brush. • Remove weeds. • Inspect for poor operation. • Inspect silt accumulation within upstream catchpits. • Remedial works to depressions/ cracked blocks.	• Annually • As required • Three monthly • Annually • As required	Site management
Green roofs	• Inspect substrate, all components and vegetation. • Remove debris and litter to prevent clogging. Replace dead plants, remove nuisance plants. Mow/ prune as required. • Stabilise any erosion channels.	• Annually • Six monthly • As required	Site management
Attenuation	• Inspect inlet /outlets for condition and remove silt if needed. • CCTV survey the attenuation internally, remove sediment as required.	• Annually • Every 5 years	Site management
Bypass separator	• Inspect, remove litter/ debris and sediment. • Change filter. • Remove oils/ grease etc.	• 6 monthly, more regularly for first 6 months to establish sediment build up rate • As recommended by manufacturer • 6 monthly or after spill. Frequency may be varied dependant on finding of inspections.	Site management
General network	• Manholes covers to be lifted and inspected for sediment build up, remove as required.	• Yearly	Site management

6.0 FOUL WATER DRAINAGE

Foul water from the site will discharge by gravity into the existing Thames Water sewer network in Nestles Avenue, as per the existing situation. Thames Water have been contacted with regards to this proposal, who have confirmed that they shall require a Foul Water Capacity Assessment, which is currently ongoing at the time of preparing this report.

Drawings showing the proposed overall drainage strategy are included in Appendix C.

7.0 CONCLUSIONS

This Flood Risk Assessment and Drainage Strategy report has been prepared in support of a Planning Application for the 'Part-demolition of existing factory buildings and associated structures, and redevelopment comprising 120,487m^2 (GEA) of residential floorspace to provide 1,381 dwellings (Use Class C3), office, retail, community and leisure uses (Use Classes A1/A3/A4/B1/B8/D1/D2), 2,986m^2 (GEA) of non-residential floorspace, 22,663m^2 (GEA) commercial floorspace (Use Classes B1c/B2/B8) and Data Centre (sui generis)), amenity and playspace, landscaping, access, service yards, associated car parking and other engineering works'.

This report relates solely to the proposed residential led portion of the scheme in the western portion of the complex, i.e. those elements underlined above. Capita has prepared a parallel report for the commercial part of the scheme in the eastern part of the complex, and so both reports should be read in conjunction.

This report has considered the flood risk posed to the proposal site from a variety of sources of flooding, and identified that the entirety of the site is shown to be within Flood Zone 1, and generally at low risk of flooding. A potential risk of localised surface water 'ponding' has been identified within the site. However, this risk is anticipated to be largely mitigated through the proposed redevelopment of the site, i.e. removal of existing artificially created low spots associated with the previous site use such as loading bays; and, the design and construction of a positive surface water drainage system.

The site is concluded to meet the requirements of the Sequential Test and measures have been proposed to afford the proposed scheme additional protection from surface water flooding, and other residual risks. These measures comprise 'design exceedance' overland flow routes through the site, and the adoption of a 'standard' finished floor level threshold of 150mm, where practicable.

The proposed development has also been demonstrated to provide a dry access and egress route to and from the site, and not increase flood risk within the catchment.

Indicative surface and foul water drainage strategies have also been proposed. The strategies effectively retain the existing broad drainage solutions for the site, with surface water being discharged to the Canal and Thames Water surface water sewer network, and foul water being disposed to Thames Water's foul water sewer network. All discharges are to be attenuated according to C&RT and Thames Water's requirements, with the surface water drainage network designed to ensure no flooding of the site up to the 1 in 100 year + 40% storm event.

This report therefore demonstrates that the proposed scheme:

- Is suitable in the location proposed.
- Will be adequately flood resistant and resilient.
- Will not place additional persons at risk of flooding, and will offer a safe means of access and egress.

- Will not increase flood risk elsewhere as a result of the proposed development through the loss of floodplain storage or impedance of flood flows.
- Will put in place measures to ensure surface water is appropriately managed.

As such, the proposed residential led portion of the application is concluded to meet the flood risk requirements of the *NPPF*.

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APPENDIX A – SITE DRAWINGS

Drawing No.	Title
065 – A0-500	Existing Plan
LG 101	Landscape Overview Masterplan
LG 102	Landscape Overview Masterplan

NOTE

0 5 10 25 50m

DATE	REV	DESCRIPTION	CHK
160922	1	REV A - DWG plan issued as presented on DTM	AA
160610	2	REV B - Massing Development	AA

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SEGRO

KEY PLAN

NORTH

NFH

065 - A0-500

EXISTING PLAN

SCALE 1 : 500 @ A0

REVISION P2