GeoSmart Information

FloodSmart Plus

Flood Risk Assessment

Site Address

New Zealand House
160 Abbey Foregate
Carshalton
SM5 3EH

Grid Reference

520291, 260888

Report Prepared for

Mr John Smith
Design House
Architect Road
Plan City
SY63 87X

Date

September 2020

Report Status

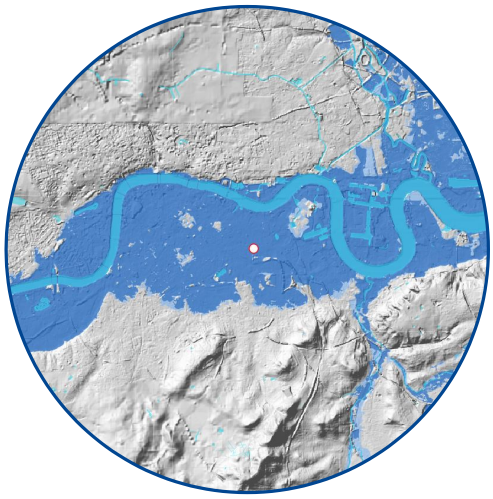
FINAL

Site Area

0.05 ha

Report Reference

FloodSmart Plus Example



Risk – Very Low

The Site is located within a tidal Flood Zone 3 (high probability), but benefits from the presence of flood defences. The risk of flooding from rivers and sea is mitigated to a Very Low risk. The Site is at a Very Low risk of pluvial flooding and a Negligible risk of groundwater flooding.

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1. Executive summary

The National Planning Policy Framework (2019) and Planning Practice Guidance (2014) require that flood risk assessments review flooding from all potential sources. A review has been undertaken of national environmental data sets to assess the potential flood risk to the Site. The review is provided within this concise interpretative report written by an experienced GeoSmart flood risk consultant.

Site analysis

Source of Flood Risk	Baseline	After Mitigation
River (fluvial) and Sea (coastal/tidal)	Very Low	Very Low
Surface water (pluvial) flooding	Very Low	N/A
Groundwater flooding	Negligible	N/A
Other flood risk factors present	Yes	N/A
Is any other further work recommended?	Yes	Yes (see below)

N/A = mitigation not required

Summary of existing and proposed development

The Site is currently used within a residential capacity. Development proposals comprise the of two flats alongside the current property

Summary of flood risks

The flood risks from all sources have been assessed as part of this report and are as follows:

- According to the Environment Agency's (EA) Flood Map for Planning Purposes, the Site is located within a tidal Flood Zone 3 (High probability).
- The Site benefits from the presence of flood defences, 1 km away in good condition, designed to provide a 1 in 1000 year event standard of protection.
- According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map, which considers the type, condition and crest height of flood defences, the Site has a Very Low risk of flooding from Rivers and the Sea.

- Modelled flood data obtained from the EA has been analysed in line with the most up to date guidance on climate change (EA, 2020), to confirm a maximum "design" flood level at the Site.

During a 1 in 200 year 2100 scenario tidal flood event, where a breach in the tidal flood defences occurred, the flood level at the Site would be 5.15 mAOD.

During this event, flood depths in the area proposed for development could be between 0.15 to 1.15 m. Flood mitigation measures are included in the next section.

Emergency evacuation routes are available to the south. In the event of a flood, safe refuge can be taken on the 1st floor levels and above.

- According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a very low risk of pluvial flooding.
- Groundwater Flood Risk screening data indicates there is a Negligible risk of groundwater flooding at the surface in the vicinity of the Site during a 1 in 100 year event.
- The risk of flooding from artificial (man-made) sources such as reservoirs, sewers and canals has been assessed:
    - The EA's Risk of Flooding from Reservoir map confirms the Site is not at risk of reservoir flooding.
    - Ordnance Survey (OS) data confirms there are no canals near to the Site.
    - A sewer flooding history search was undertaken with the utility provider and using the Strategic Flood Risk Assessment (AECOM, 2015). This confirms no recorded incidences of sewer flooding at or within the vicinity of the Site.

In accordance with paragraphs 157, 164 and footnote 51 of the NPPF (2019), as the development proposals are comprised of additional buildings within Flood Zone 3 and the Site has not been allocated within the Councils Local Plan, a Sequential Test should be undertaken separately to compare flood risk at the Site with other available sites to find out which has the lowest flood risk.

Recommendations / Next steps

Recommendations for mitigation are provided below, based upon the proposed development and the flood risk identified at the Site:

- As there is a risk of flooding from tidal sources, where flood depths could be up to 1.15 m in the area proposed for development, Finished Floor Levels (FFL) of the proposed development should be set to 5.45 mAOD[1] Standard flood resilient design measures should be incorporated;
- Occupants of the Site should be signed up to receive EA Flood Alerts and Flood Warnings;
- A Flood Warning and Evacuation Plan (FWEP) is recommended to ensure persons using the Site can evacuate safely on receipt of a Flood Warning; and

[1] 300mm above the 1 in 100 year plus climate change flood level of 5.15 mAOD.

- A Sustainable Drainage Strategy (SuDS) should be developed for the Site, for effective management of surface water runoff over the lifetime of the proposed development.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

2. Introduction

Background and purpose

This assessment has been undertaken by firstly compiling information concerning the Site and the surrounding area. The information which is gathered is then used to construct a 'conceptual site model', including an understanding of the appropriateness of the development as defined in the NPPF (2019) and the source(s) of any flood risk present. Finally, a preliminary assessment of the steps that can be taken to manage any flood risk to the development is undertaken.

This report has been prepared with reference to the National Planning Policy Framework (NPPF, 2019).

"The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied" (NPPF, 2019).

The National Planning Policy Framework promotes a sequential, risk based approach to the location of development.

"This general approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim should be to keep development out of medium and high risk flood areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible" (NPPG, 2014).

The purpose of this report is to provide clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at the Site.

Report scope

A thorough review of a commercially available flood risk report and Environment Agency supplied data indicating potential sources of flood risk to the Site from rivers and coastal sources, surface run-off (pluvial), groundwater and reservoirs, including historical flood information and modelled flood extent. Appropriate measures are recommended to manage and mitigate the flood risk to the property.

Local rainfall data for the 1 in 100 year rainfall event is used to support site run-off calculations if there is an increase in impermeable area as a result of the development. The effects of climate change will also be included in these calculations, using industry standard advice.

Information obtained from the Environment Agency and a review of the local Strategic Flood Risk Assessment (SFRA) is used to ascertain local flooding issues and, where appropriate, identify information to support a Sequential and/or Exception test required as part of the National Planning Policy Framework (NPPF, 2019).

Using the available data, the existing and future flood risks to and from the Site from all flood sources will be assessed in line with current best practice.

An indication of potential flood risk from the Site to downstream receptors is provided where the proposed development increases run-off from the Site, above the Greenfield run-off rates.

Datasets

The following table shows the sources of information that have been consulted as part of this report:

Table 1. Datasets consulted to obtain confirmation of sources of flooding and risk

Source of flooding	Datasets consulted				
	Commercial Flood Maps (Appendix B)	SFRA	Environment Agency (Appendix B)	Thames Water (Appendix C)	OS Data
Historical	X	X	X		
Fluvial/tidal	X	X	X		
Surface water (pluvial)	X	X	X		
Groundwater	X	X			
Sewer		X		X	
Culvert/bridges		X			X
Reservoir		X	X		

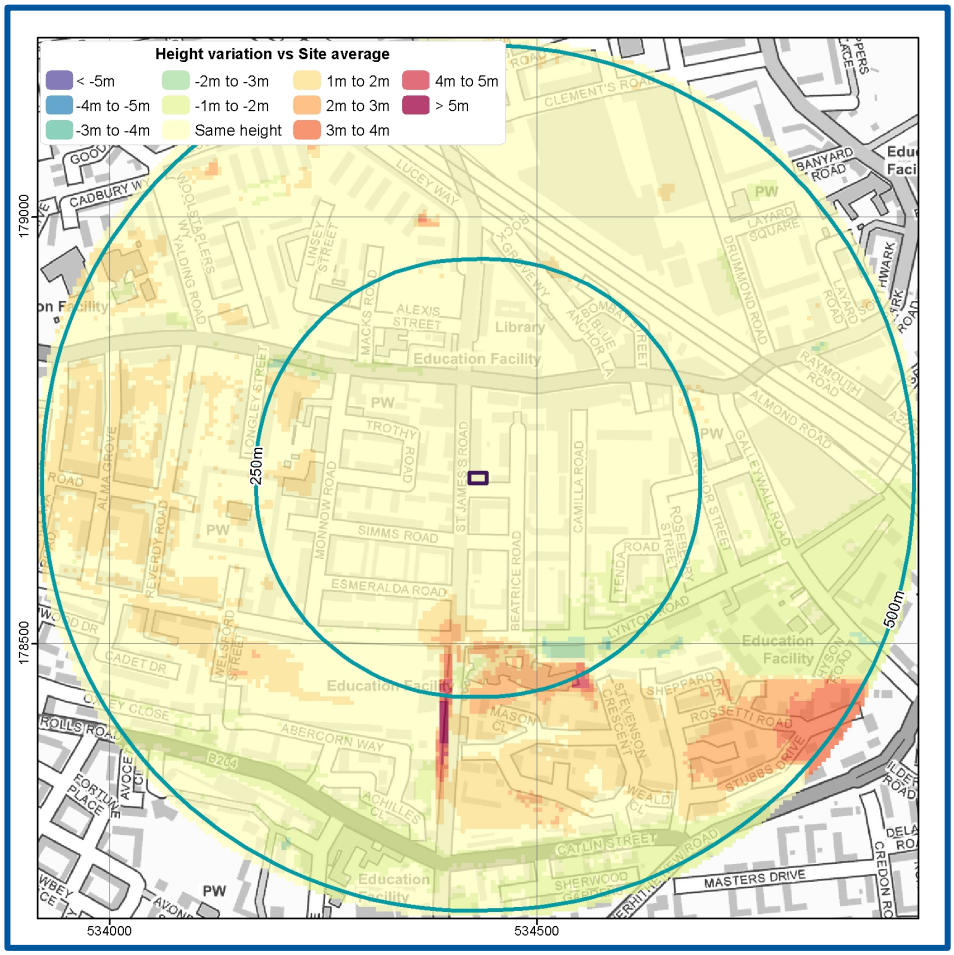
*The SFRA and local guidance has been used to inform this report as referenced in Section 6.

3. Site analysis

Site information

The Site is located in Carshalton in a setting of commercial and residential use, National Grid Reference (NGR) TL 20291 60888 (see Figure 1). According to OS data the immediate area surrounding the Site is relatively flat between 1-5 mAOD. Using a 500 m buffer around the Site, it is noted that, to the north across the River Thames, land rises to c.20 mAOD. To the west land remains between 1-5 mAOD, to the east land rises to c. 10 mAOD and to the south remains between 1 – 5 mAOD. Site specific elevations provided by the client and LiDAR data relative to ordnance datum indicate that the general level of the Site is between 4 and 5 mAOD.

Figure 1. Site Location and Relative Elevations (GeoSmart, 2020)



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Development

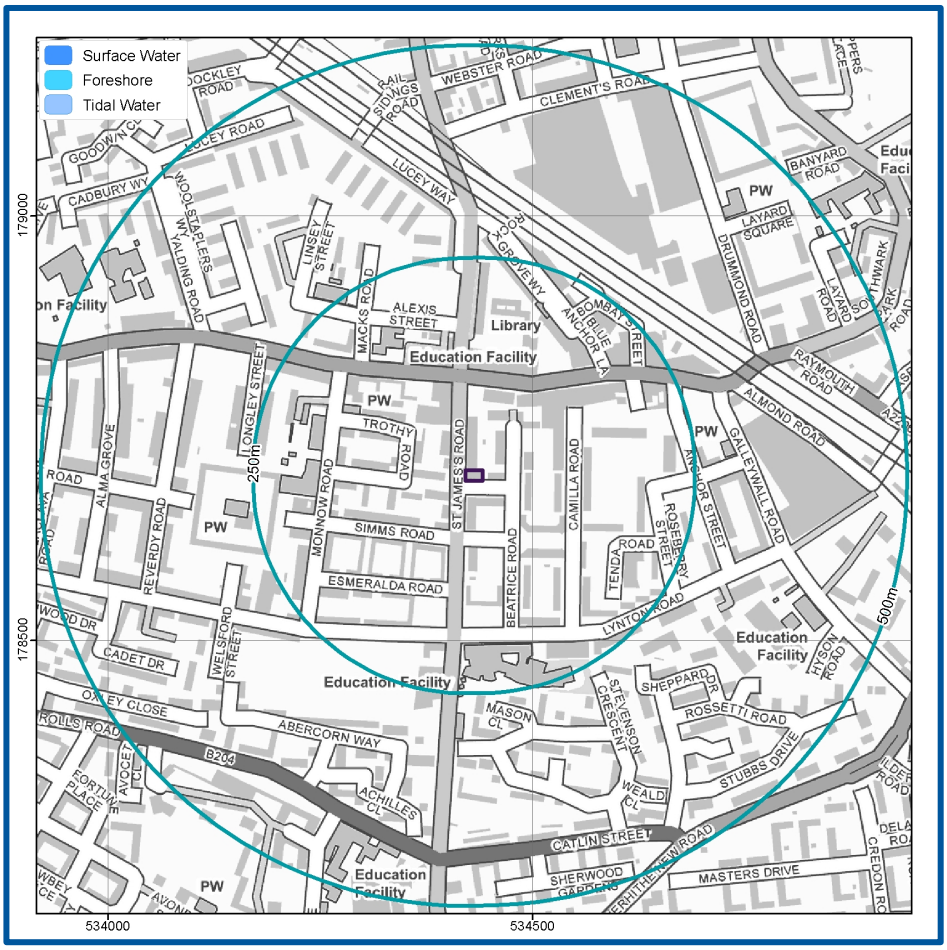
The Site is currently used within a residential capacity. Development proposals comprise the of two flats alongside the current property (see Appendix A).

The effect of the overall development will result in an increase in number of occupants and/or users of the building but will not result in the change of use, nature or times of occupation. According to Table 2 of the NPPG (2014), the vulnerability classification of the existing development is More Vulnerable and proposed development is More Vulnerable. The estimated lifespan of the development is 100 years.

Hydrological features

There are no mapped surface water features within 500 m of the Site (Figure 2).

Figure 2. Surface water features



Watercourses/surface water features within 1km of the site:

The River Thames is located approximately 1km north of the site.

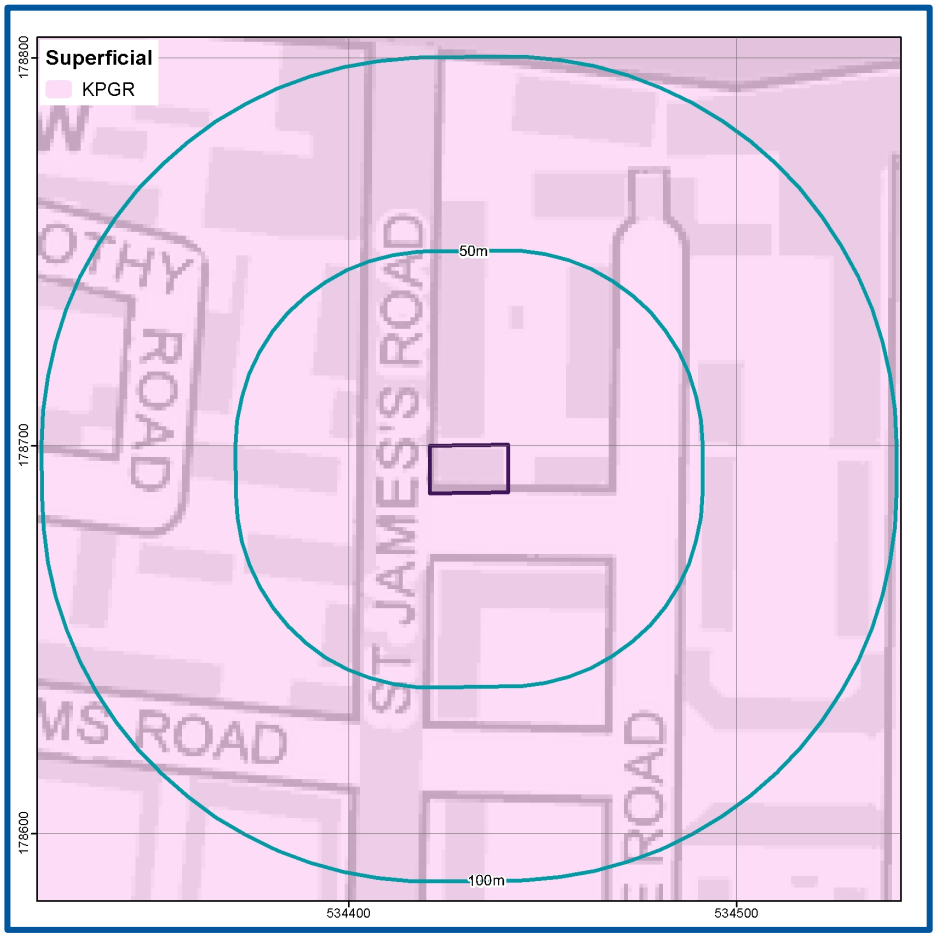
Proximity to relevant infrastructure:

The nearest flood defences are located approximately 1km north of the Site along the River Thames.

Hydrogeological features

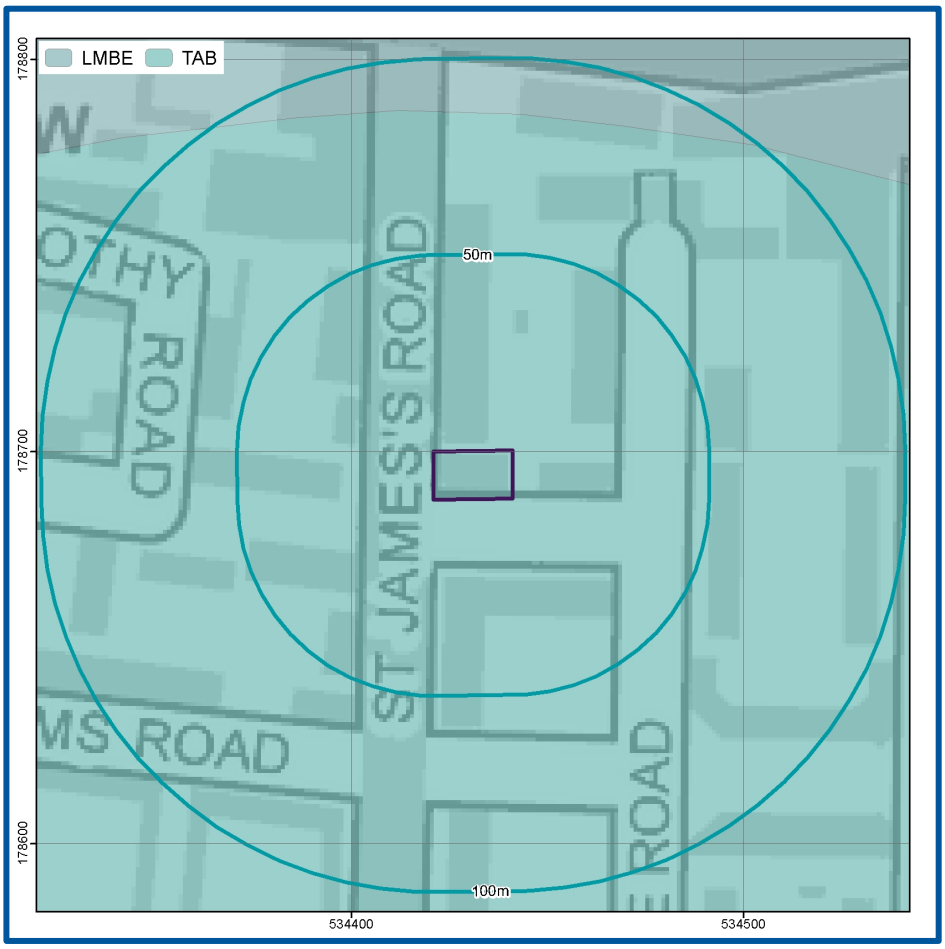
British Geological Survey (BGS) mapping indicates the underlying superficial geology (Figure 3) consists of Kempton Park Gravel Member - Sand and Gravel (KPGR) (BGS, 2020) and is classified as a Secondary (A) Aquifer (EA, 2020).

Figure 3. Superficial Geology (BGS, 2020)



BGS mapping indicates the underlying bedrock geology (Figure 4) consists of the Thanet Formation - Sand (TAB) (BGS, 2020) and is classified as a Secondary (A) Aquifer (EA, 2020).

Figure 4. Bedrock Geology (BGS, 2020)



The Site does not lie within a groundwater Source Protection Zone (SPZ) (EA, 2020).

The nearest and most relevant borehole (ref: TQ37NW1917) is 30 metres to the northwest of the Site boundary at an elevation of 7.6 mAOD, and indicates 0.8 m thickness of made ground underlain by flood plain gravel to a depth of 9.3m bgl overlying Thanet Sand to a depth of 13m bgl where the borehole ends. Groundwater levels are not recorded.

The hydrogeological characteristics suggest there is potential for a groundwater table beneath the site.

Groundwater levels may rise in the bedrock and superficial aquifers in response to high tidal events subject to hydraulic continuity between the driving water level, the groundwater system and the Site as well as in response to prolonged rainfall recharge which may cause an unusually high peak in groundwater levels during some years, subject to hydraulic continuity between the groundwater system and the Site.

4. Flood risk to the development

Historical flood events

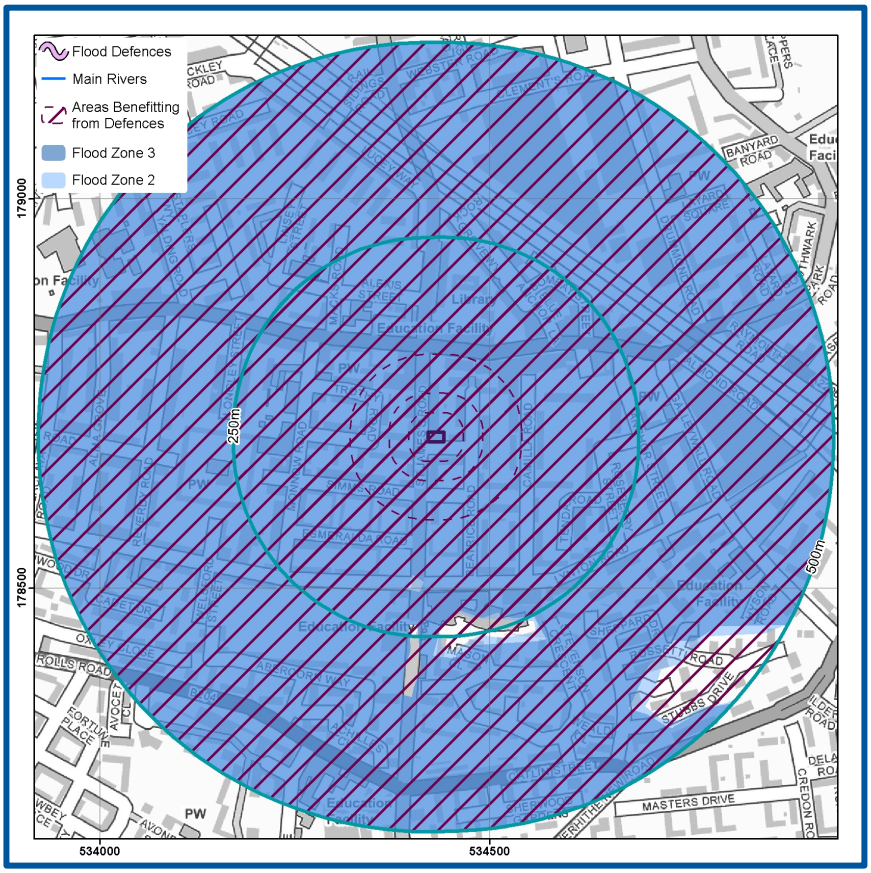
Historic flood events have been recorded at the Site (EA, 2017 and AECOM, 2015). The Site was affected by a flood in January 1928 due to overtopping during a storm surge that coincided with high fresh water flows. The approximate level in the River Thames at the time was 4.5 mAOD. Flood defences have been upgraded since this event.

The purpose of historical flood data is to provide information on where and why flooding may have occurred in the past. The absence of any recorded events does not mean flooding has never occurred on Site or that flooding will never occur at the Site.

Rivers (fluvial) / Sea (coastal/tidal) flooding

According to mapping and data provided by the Environment Agency (Figure 5), the Site is located within an Environment Agency (defended) Flood Zone 3 and is classified as being at high risk of fluvial flooding from the River Thames. The Site is protected by flood defences and is not within an area considered as the functional flood plain.

Figure 5. EA Flood Map for Planning Purposes (EA, 2020)



Guidance

As defined in the NPPF (2019):

Ignoring the presence of any defences, land located in a Flood Zone 3 is considered to be at high risk of flooding with a 1 in 100 year or greater annual probability of fluvial flooding or a 1 in 200 or greater annual probability of coastal flooding in any one year.

Development of "Water-Compatible" and "Less Vulnerable" land uses are suitable for this zone with "More Vulnerable" and "Essential Infrastructure" requiring an Exception test to be passed prior to development taking place. (see glossary for terminology).

Flood defences

Guidance

Sites that are located close to flood defences are likely to be zones where rapid inundation will occur in the event of the flood defences being overtopped or breached. A Site located close to flood defences (within 250 m) may require a more detailed FRA subject to local topography.

- The Site is in an area which benefits from flood defences.
- There nearest formal flood defences are located 1km north of the Site along the River Thames.

Information from the EA relating to the flood defences is outlined below.

- According to the EA (2020) the flood defences in place for this area are designed to defend up to a 1 in 1000 year flood event.
- The nearest and most applicable formal flood defences are raised, man-made and privately owned with a minimum crest level of 5.41 mAOD.
- The EA inspects the defences twice a year and classifies their current condition as "good (Condition Grade: 2)".

Thames Estuary 2100 (TE2100)

The Thames Barrier requires regular maintenance and with additional closures the opportunity for maintenance will be reduced. When this happens, river levels - for which the Barrier would normally shut for the 2008 epoch - will have to be allowed through to ensure the barrier is not shut too often. For this reason, levels upriver of the barrier will increase and the tidal walls will need to be heightened to match.

Model data

As the Site is located within the EA's tidal floodplain, modelled flood elevation data was obtained from the EA and has been used to assess flood risk and to provide recommendations for mitigation for the proposed development. The data is provided below and included with Appendix B.

Thames Tidal Defences Study (Halcrow, 2006) and Thames Estuary 2100 Study (HR Wallingford, 2008)

In-channel flood level data has been taken from the nearest and most relevant node point (point 2.27) to the Site. When compared with the existing (2008) and proposed (2100) defence raising, the data confirms even if the water level in the River Thames rises due to climate change, the defences are going to be raised too and therefore the Site will always be defended (EA, 2020).

Residual Tidal Flood Risk

The tidal flood assessment in the "Rivers (fluvial) / Sea (Coastal) flooding" section represents the likelihood of flooding from overtopping at the Site, where flood defences are in good condition and are fully maintained. The Site is not at risk of overtopping, however there is a residual risk related to a breach in the Thames flood defences.

Thames Tidal Downriver Breach Inundation Modelling Study (2018)

Modelled breach flood level data has been taken from the Thames Tidal Downriver Breach Inundation Modelling Study (Atkins, 2018) to assess flood risk and provide recommendations for mitigation measures.

The breach flood level data has been taken from the 2D node points located on Site; 1, 2, 3 4,5, 6 and 7, and have been used to assess breach flood levels.

The mapped data indicates the Site would flood in the 2014 and 2100 breach flood scenarios.

Table 2. Modelled Breach Flood Levels

Node Point	2014	2065	2100
1	3.6	4.05	4.21
2	3.5	4.04	4.21
3	Nil return	4.05	4.21
4	4.31	4.92	5.13

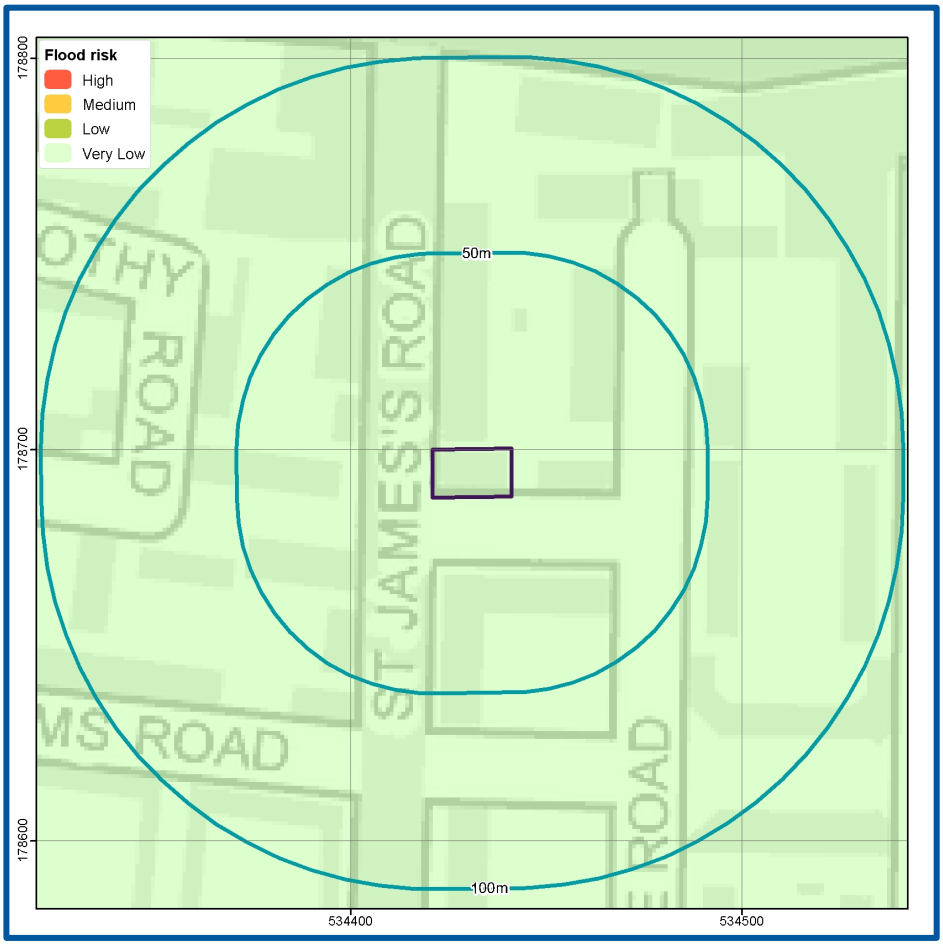
5	Nil return	Nil return	5.15
6	3.83	4.18	4.28
7	Nil return	4.05	4.21

Flood risk including the benefit of defences

The type and condition of existing flood defences influence the 'actual' risk of fluvial flooding to the Site, albeit the long-term residual risk of flooding (ignoring the defences) should be considered when proposing new development.

According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) mapping (Figure 6), which considers the crest height, standard of protection and condition of defences, the flood risk from Rivers and the Sea is Very Low.

Figure 6. Risk of Flooding from Rivers and Sea map (EA, 2020)



Surface water (pluvial) flooding

Surface water flooding occurs when intense rainfall exceeds the infiltration capacity of the ground and overwhelms the drainage systems. It can occur in most locations even at higher elevations and at significant distances from river and coastal floodplains.

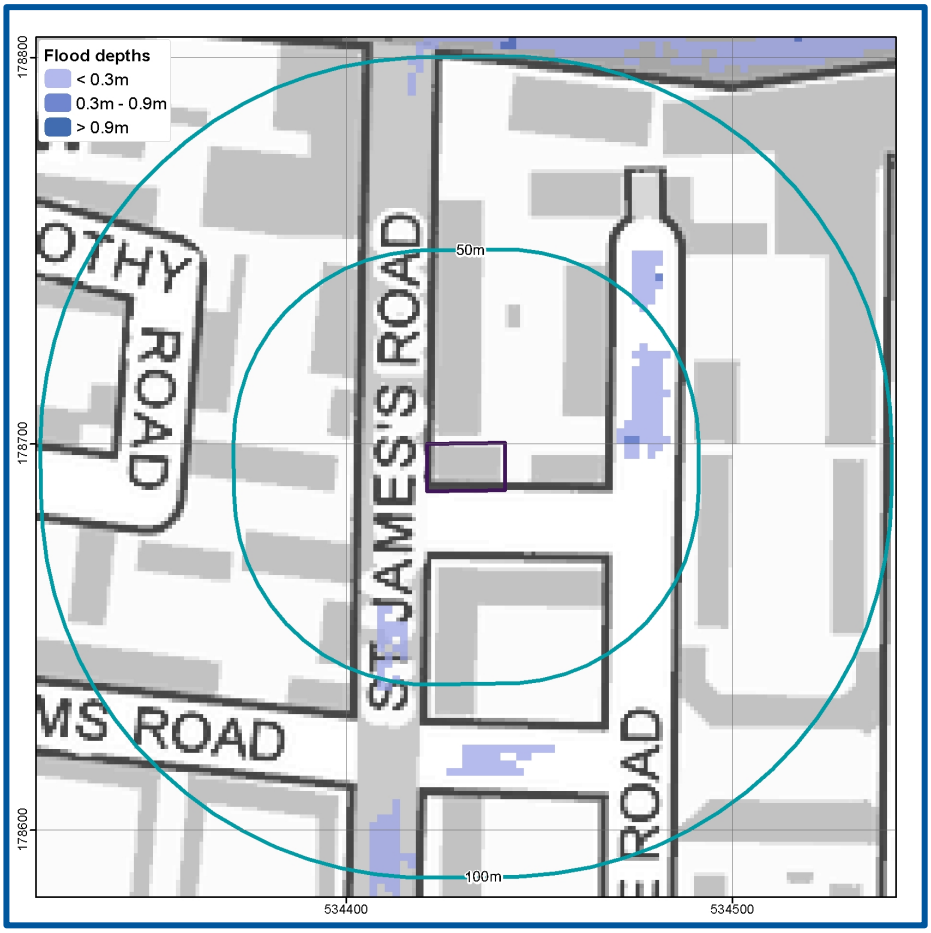
According to the EA's Risk of Flooding from Surface Water (pluvial) mapping, there is a Very Low risk of pluvial flooding at the Site.

Guidance

According to EA's surface water flood risk map the Site is at:

- Very Low risk - chance of flooding of less than 1 in 1000 (0.1%).

Figure 7. EA Medium surface water flood risk map (EA, 2020)



Analysis of OS mapping, ground elevation data and the EA's pluvial flow route mapping in the 1 in 100 year event confirms the Site is not located on a potential overland flow route during a medium risk scenario.

A review of the site plans, topography and the EA's Risk of Flooding from Surface Water Direction mapping indicates any overland flows on the Site would not be obstructed by the proposed development and occur across nonessential areas of the site. Localised depressions and accumulations cover a very small area of the site in non-essential areas.

The SFRA does not indicate reported incidents of historical surface water flooding within 100 m of the Site (AECOM, 2015). The SFRA confirms the Site is not located within a Critical Drainage Area (CDA)[2] (AECOM, 2015).

Climate change may lead to an increase in rainfall intensity which affects river levels, land and urban drainage systems. Rainfall intensity for small and urban catchments may increase from 5 to 20% (central estimate) or 10% to 40% (Upper estimate) over the period to 2115 (EA, 2020). The increase in surface water flood risk is best represented by the 1 in 1000 year pluvial flood extent but according to the mapping this is unlikely to impact the Site.

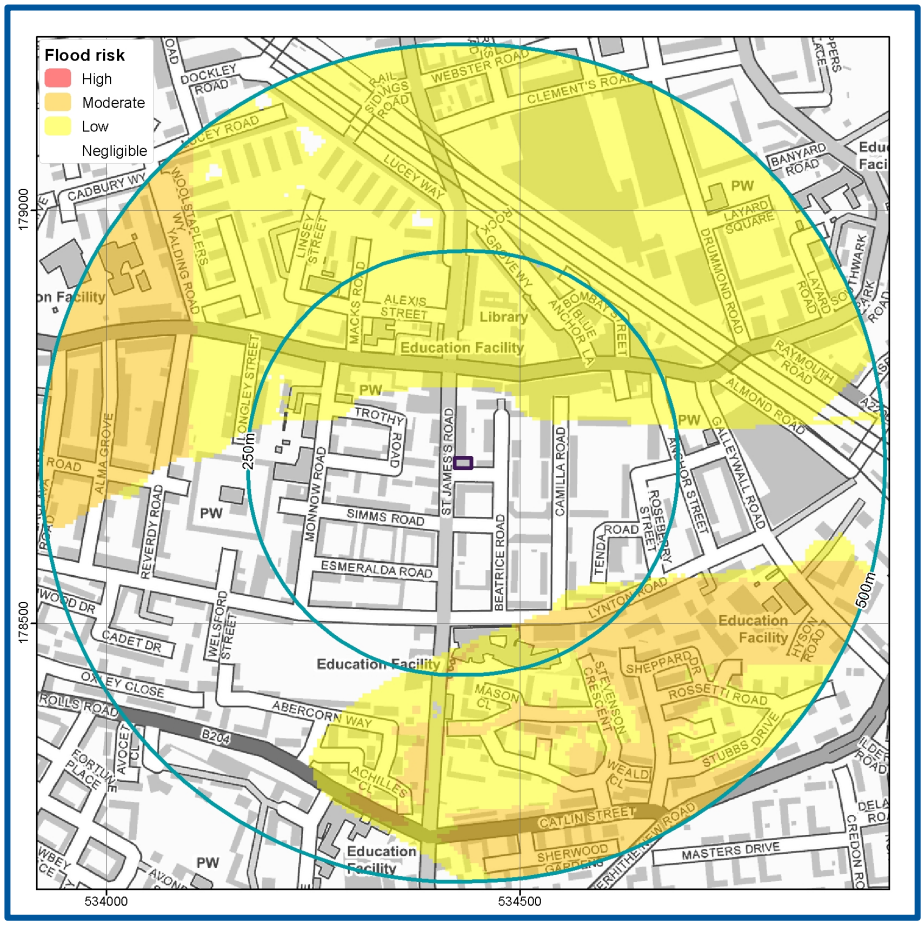
[2] A Critical Drainage Area (CDA) is an area that has critical drainage problems and which has been notified to the local planning authority as such by the Environment Agency in line with the National Planning Policy Framework (NPPF, 2019). CDA's are specific to Flood Zone 1, defined as areas where runoff can and may have historically contributed to flooding downstream, although they are not necessarily areas where flooding problems may occur. Where a Site is located in Flood Zone 1 and within a CDA, a Flood Risk Assessment (FRA) is required and the Council may also request Sustainable Drainage Scheme (SuDS) features to be included within the proposed development.

Groundwater flooding

Groundwater flooding occurs when sub-surface water emerges from the ground at the surface or into Made Ground and structures. This may be as a result of persistent rainfall that recharges aquifers until they are full; or may be as a result of high river levels, or tides, driving water through near-surface deposits. Flooding may last a long time compared to surface water flooding, from weeks to months. Hence the amount of damage that is caused to property may be substantially higher.

Groundwater Flood Risk screening data (Figure 8) indicates there is a Negligible risk of groundwater flooding at surface in the vicinity from permeable bedrock and superficial deposits during a 1 in 100 year event. Mapped classes combine likelihood, possible severity and the uncertainty associated with predicting the subsurface system. The map is a national scale screening tool to prompt site-specific assessment where the impact of groundwater flooding would have significant adverse consequences. Mapping limitations and a number of local factors may reduce groundwater flood risk to land and property even where it lies within mapped groundwater flood risk zones, which do not mean that groundwater floods will occur across the whole of the risk area.

Figure 8. GeoSmart GW5 Groundwater Flood Risk Map (GeoSmart, 2020)



Guidance

Negligible Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Climate change predictions suggest an increase in the frequency and intensity of extremes in groundwater levels. Rainfall recharge patterns will vary regionally resulting in changes to average groundwater levels. A rise in peak river levels will lead to a response of increased groundwater levels in adjacent aquifers subject to the predicted climate change increases in peak river level for the local catchment. Sea level rises of between 0.4m and 1m are predicted by 2100, leading to a rise in average groundwater levels in the adjacent coastal aquifer systems, and potential increases in water levels in the associated drainage systems. The 'backing up' of groundwater levels from both coast and tidal estuary locations may extend a significant distance inland and affect infrastructure previously constructed above average groundwater levels.

The impact of climate change on groundwater levels beneath the Site is linked to the predicted risk in both peak river levels and sea levels and also the variation in rainfall recharge which is uncertain.

Flooding from Artificial Sources

Artificial sources of flood risk include waterbodies or watercourses that have been amended by means of human intervention rather than natural processes. Examples include reservoirs (and associated water supply infrastructure), docks, sewers and canals. The flooding mechanism associated with flood risk from artificial sources is primarily related to breach or failure of structures (reservoir, lake, sewer, canal, flood storage areas, etc.)

Sewer flooding

Information regarding site specific instances of flooding due to sewer flooding could not be obtained from the SFRA but it is stated that over 1000 properties are at risk from sewer flooding as a result of surcharge of the sewer systems due to high river levels within the area (SFRA Reference). Basement flooding is also considered a significant issue within the area (SFRA Reference).

Thames Water have confirmed that the flooding records that they hold indicate that there have been no incidences of flooding in the requested area as a result of surcharging public sewers. (Thames Water, 2020)

Guidance

Properties classified as "at risk" are those that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system either once or twice in the ten year reference period. Records held by the sewage utility company provide information relating to reported incidents, the absence of any records does not mean that the Site is not at risk of flooding.

Canal failure

According to Ordnance Survey (OS) mapping, there are no canals within 500 m of the Site.

Water supply infrastructure

Water supply infrastructure is comprised of a piped network to distribute water to private houses or industrial, commercial or institution establishments and other usage points. In urban areas, this represents a particular risk of flooding due to the large amount of water supply infrastructure, its condition and the density of buildings. The risks of flooding to properties from burst water mains cannot be readily assessed.

If more information regarding the condition and history of the water supply infrastructure within the vicinity of the Site is required, then it is advisable to contact the local water supplier Thames Water.

Culverts and bridges

The blockage of watercourses or structures by debris (that is, any material moved by a flowing stream including vegetation, sediment and man-made materials or refuse) reduces flow capacity and raises water levels, potentially increasing the risk of flooding. High water levels can cause saturation, seepage and percolation leading to failure of earth embankments or

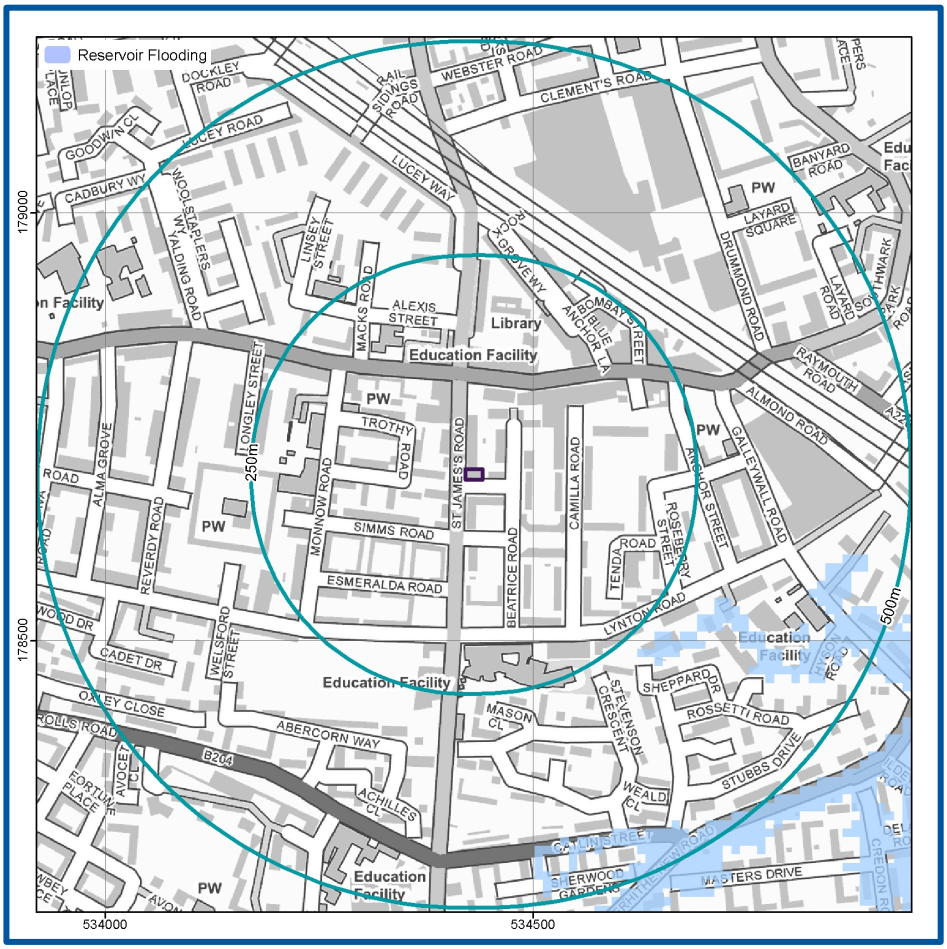
other structures. Debris accumulations can change flow patterns, leading to scour, sedimentation or structural failure.

Culverts and bridges have not been identified within 1 km of the Site.

Reservoir flooding

According to the Environment Agency's Risk of Flooding from Reservoir mapping the Site is not at risk of flooding from reservoirs (EA, 2020).

Figure 9. EA Risk of Reservoir Flooding (EA, 2020)



Guidance

The risk of reservoir flooding is related to the failure of a large reservoir (holding over 25,000 m^3 of water) and is based on the worst case scenario. Reservoir flooding is extremely unlikely to occur (Environment Agency, 2016c).

5. Flood risk from the development

Floodplain storage

The development is located within a tidal Flood Zone and involves an increase in the proposed building footprint. However, in undefended tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage is not considered to be necessary (CIRIA C624 (2004)).

It is however, considered to be best practice to provide an overall improvement in flood risk, so compensatory flood storage and / or Sustainable Drainage (SuDS) features should be provided wherever this is possible.

Drainage and run-off

The proposed development involves an increase of impermeable surfaces at the Site. An estimation of run-off is therefore required to permit effective site water management and prevent any increase in flood risk to off-site receptors from the Site.

Using FEH 2013 rainfall data from the online Flood Estimation Handbook (FEH), developed by NERC (2009) and CEH (2016), the potential surface water run-off generated from the Site during a 1 in 100 year return period should be calculated. The NPPF (2019) recommends the effects of climate change are incorporated into FRA's and the recently updated climate change guidance (published in 2016 and updated in 2019) confirms the requirements for inclusion within FRA's.

As the proposed development is being changed to residential, the lifespan of the development and requirements for climate change should allow up to the 2115 scenario.

Table 3. Climate change rainfall allowances

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

A method of investigating the run-off due to the proposed development can be calculated by multiplying the run-off per square metre by the impermeable area within the proposed development plan.

Sustainable Drainage System (SuDS)

It is recommended that attenuation of run-off is undertaken on site to compensate for proposed increases in impermeable surface areas. Attenuation may comprise the provision of storage within a Sustainable Drainage System (SuDS). SuDS can deliver benefits from improving the management of water quantity, water quality, biodiversity and amenity. Potential SuDS options are presented in the table below, subject to further investigation:

Table 4. SuDS features which may be feasible for the Site

Option	Description
Rainwater harvesting	Rainwater harvesting can collect run-off from the roofs for use in non-potable situations, using water butts for example.
Green roof	Having part/all of the roof as a green roof covered in vegetation can intercept and store a proportion of the rainfall to result in an overall reduction in the amount of surface water run-off generated from a building structure. They comprise a substrate (growth medium) layer which can be seeded with specially selected plants suitable for the local climatic conditions. Beneath the growth medium is a geotextile filter layer which filters out the substrate from entering the aggregate/geo-composite drainage layer below. At the very bottom of the green roofing, a waterproof membrane protects the roof structure below.
Permeable paving	Permeable pavements can be used for driveways, footpaths and parking areas to increase the amount of permeable land cover. Suitable aggregate materials (angular gravels with suitable grading as per CIRIA, 2007) will improve water quality due to their filtration capacity. Plastic geocellular systems beneath these surfaces can increase the void space and therefore storage but do not allow filtration unless they are combined with aggregate material and/or permeable geotextiles.
Swales	Shallow, wide and vegetated channels that can store excess run-off whilst removing any pollutants.
Soakaways	An excavation filled with gravel within the Site. Surface water run-off is piped to the soakaway.
Attenuation basins/pond	Dry basin or a permanent pond that is designed to hold excess water during a rainfall event.

It is assumed that any changes to the existing drainage system will be undertaken in accordance with best practice and that care will be taken to ensure the new development does not overload/block any existing drainage or flow pathways to/from the Site.

GeoSmart could provide a separate outline drainage strategy as required, through our SuDSmart Pro report range. A separate proposal could be provided upon request.

6. Suitability of the proposed development

The information below outlines the suitability of proposed development in relation to national and local planning policy.

National policy and guidance

The aims of the national planning policies are achieved through application of the Sequential Test and in some cases the Exception Test.

Guidance
Sequential test: The aim of this test is to steer new development towards areas with the lowest risk of flooding (NPPF, 2019). Reasonably available sites located in Flood Zone 1 should be considered before those in Flood Zone 2 and only when there are no reasonably available sites in Flood Zones 1 and 2 should development in Flood Zone 3 be considered.
Exception test: In some cases, this may need to be applied once the Sequential Test has been considered. For the exception test to be passed it must be demonstrated that the development would provide wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Suitability of the proposed development, and whether an Exception Test is required, is based on the flood zone the Site is located within and the flood risk vulnerability classification of the Site (Table 6.1).

This report has been produced to assess all development types, prior to any development. The vulnerability classification and Flood Zones are compared within Table 5 overleaf (Table 3 of the NPPG (2014)).

As the Site is located within Flood Zone 3a and the proposed development is defined as More Vulnerable; the proposals would be acceptable subject to the Exceptions Test and Sequential Test.

Where the Sequential Test is required it must be demonstrated that there are no alternative reasonably available Sites at lower risk of flooding within Carshalton. For a site to be considered to be reasonably available it must be 'deliverable' and 'developable' as defined by the NPPF (2019).

Table 5. Flood risk vulnerability and flood zone 'compatibility (taken from NPPG, 2014)

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	Zone 1 – low probability	✓	✓	✓	✓	✓
	Zone 2 – medium probability	✓	✓	Exception test required	✓	✓
	Zone 3a - high probability	Exception test required	✓	X	Exception test required	✓
	Zone 3b – functional flood plain	Exception test required	✓	X	X	X

EA Flood Risk Standing Advice for vulnerable developments located in Flood Zones 2 or 3

For all relevant vulnerable developments (i.e. more vulnerable, less vulnerable and water compatible), advice on the points should be followed:

- Surface water management;
- Access and evacuation; and
- Floor levels.

Surface water management

Plans for the management of surface water need to meet the requirements set out in either the local authority's:

- Surface water management plan where available; OR
- Strategic flood risk assessment.

They also need to meet the requirements of the approved building regulations Part H: drainage and water disposal. Read section H3 rainwater drainage.

Planning permission is required to use a material that can't absorb water (e.g. impermeable concrete) in a front garden larger than 5 square metres.

Access and evacuation

Details of emergency escape plans should be provided for any parts of a building that are below the estimated flood level:

Plans should show:

- Single storey buildings or ground floors that don't have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- Basement rooms have clear internal access to an upper level, e.g. a staircase; and
- Occupants can leave the building if there's a flood and there's enough time for them to leave after flood warnings.

Floor levels

The following should be provided:

- Average ground level of the building;
- Finished floor level of the lowest habitable room in the building.

Ground floor levels should be a minimum of whichever is higher of:

- 300 millimetres (mm) above the general ground level of the site; OR
- At least 600 mm above the estimated river or sea flood level[3].

If you cannot raise floor levels above the estimated flood level, you need to consider extra flood resistance and resilience measures.

Extra flood resistance and resilience measures

Follow the extra flood resistance and resilience requirements for developments in flood risk areas where ground floor levels are lower than the estimated flood level for the site.

Water depth up to 300 mm

The design of the building or development should keep water out as much as possible. You should use materials that have low permeability (materials that water cannot pass through, for example, impermeable concrete).

[3] This is 600 mm above the 1 in 100 year fluvial or 1 in 200 year tidal flood events. The 600 mm is split into a 300 mm freeboard allowance for climate change and 300mm allowance for the inaccuracies in the EA's flood modelling. Where the climate change flood level is known, a 300 mm allowance should be added to the climate change flood level to allow for the inaccuracies in the EA's flood modelling.

Water depth from 300 mm to 600 mm

The design of the building or development should keep water out (unless there are structural concerns) by:

- using materials with low permeability to at least 300mm;
- using flood resilient materials (for example lime plaster) and design (for example raised electrical sockets); and
- making sure there's access to all spaces to enable drying and cleaning

Water depth above 600 mm

The design of the building or development should allow water to pass through the property to avoid structural damage by:

- using materials with low permeability to at least 300 mm;
- making it easy for water to drain away after flooding; and
- making sure there's access to all spaces to enable drying and cleaning.

Local policy and guidance

For this report, the Carshalton Level 1 SFRA has been consulted. The SFRA was undertaken by (SFRA Reference). Relevant information contained in this report for the Site area is outlined below:

- Where new development is permitted in flood risk areas, this should include appropriate resilience and resistance features, and mitigation measures including evacuation plans to address residual risk.
- For development over 235m² impermeable area, a full FRA and Management and Maintenance plan will need to be submitted. The assessment will need to include calculations of the greenfield runoff rate, increased run-off rates and the associated volume of storm detention.
- A number of design strategies are detailed including the Water Exclusion Strategy and Water Entry Strategy. Resistance measures are aimed at preventing water ingress into a building (Water Exclusion Strategy); they are designed to minimise the impact of floodwaters directly affecting buildings and to give occupants more time to relocate ground floor contents. These measures will probably only be effective for short duration, low depth flooding, i.e. less than 0.3m.

Guidance

Strategic Flood Risk Assessments are carried out by local authorities, in consultation with the Environment Agency, to assess the flood risk to the area from all sources both now and in the future due to climate change. They are used to inform planning decisions to ensure inappropriate development is avoided (NPPF, 2019).

Environment Agency pre-application response:

The EA (2020) was contacted as part of this FloodSmart report in order to obtain site-specific feedback on the proposed development. Their response is shown below (full response letter is included in Appendix C):

"We have reviewed the submitted information and respond as follows:

Based on our initial constraint check, we have identified the following issues and opportunities at the site:

- *flood risk: Flood Zone 3a;*
- *the site benefits from flood defences.*

We strongly recommend that applicants and developers consult current evidence, policy and guidance, in order to inform the design of any development proposals. We note that the spatial planning and development control recommendations within the London Borough of Carshalton's SFRA (Section 6.4.4) which are themselves further embodied within the Sustainable Design and Construction Supplementary Planning Document (SPD) state that:

- *"it is preferable that 'less vulnerable' uses are located at ground floor level" within developments in areas at risk of flooding;*
- *"no residential development is permitted at ground floor level" for the 'less than six hours' rate of inundation zone";*
- *"sleeping areas should not be located below the predicted 1 in 200 year flood level";*
- *"no basements [are] permitted" within the 'less than six hours' rate of inundation zone;*
- *"basements should be avoided or used for storage, servicing or parking purposes only".*

7. Resilience and mitigation

Based on the flood risk identified at the Site, the national and local policies and guidance and proposed development, the mitigation measures outlined within this section of the report are likely to help protect the development from flooding.

Sea (coastal/tidal) flood mitigation measures

The Site is located within an area which is affected by flooding from the sea, the following table confirms the flood depths associated with the area proposed for development.

Table 6. Flood levels compared to ground levels in the area proposed for development

Ground levels in area proposed for development (mAOD)	Modelled Flood Levels (mAOD)	
	1 in 200 year (2060 scenario) (mAOD)	1 in 200 year (2100 scenario) (mAOD)
4 to 5	Nil Return	5.15
Flood depths (m)	N/A	0.15 – 1.15

Raising minimum floor levels

The vulnerability classification of the site and the Flood Zone means proposals for the Site fall under the EA's Flood Risk Standing Advice (FRSA) for more vulnerable developments.

In this instance, in line with the EA's FRSA the recommended minimum Finished Floor Level (FFL) should be set at least 0.3m above1 in 200 year flood level of 5.15 mAOD

Table 7. Recommended Minimum Finished Floor Level Required

Ground Level (mAOD)	Flood Level (mAOD)	Freeboard above Flood Level (m)	Recommended FFL (mAOD)
4 to 5	5.15	300mm	5.45

Surface water (pluvial) flood mitigation measures

Mitigation measures detailed above for fluvial/coastal flood risk are likely to be suitable for the flood depths which could be experienced in a pluvial flood event.

In addition, the regular maintenance of any drains and culverts surrounding/on the Site should be undertaken to reduce the flood risk. The proposed development avoids obstructing the modelled overland flow routes, and surface water flooding occurs in only a small none essential area of the site.

A SuDS design should be considered to mitigate any flood risk both to and from the Site.

Groundwater flood mitigation measures

It is likely that the mitigation measures put in place for fluvial/coastal risk will be sufficient for the groundwater flood risk at the Site. However specific groundwater measures that may also be considered include:

- Waterproof tanking of the ground floor and basement;
- Interceptor drains;
- Automatic sump and pump to extract flood water; and
- Non-return valve on the sewer lines.

Reservoir flood mitigation measures

According to Environment Agency information, the Site is not a risk of flooding from reservoirs; therefore, mitigation measures are not required.

Other flood risk mitigation measures

As the Site is not identified as at risk from other sources, mitigation measures are not required.

Residual flood risk mitigation measures

The risk to the Site has been assessed from all sources of flooding and appropriate mitigation and management measures proposed to keep the users of the development safe over its lifetime. There is however a residual risk of flooding associated with the potential for failure of mitigation measures if regular maintenance and upkeep isn't undertaken. If mitigation measures are not implemented or maintained, the risk to the development will remain as the baseline risk.

Further flood mitigation information

More information on flood resistance, resilience and water entry can be found here: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

Emergency evacuation - safe access / egress and safe refuge

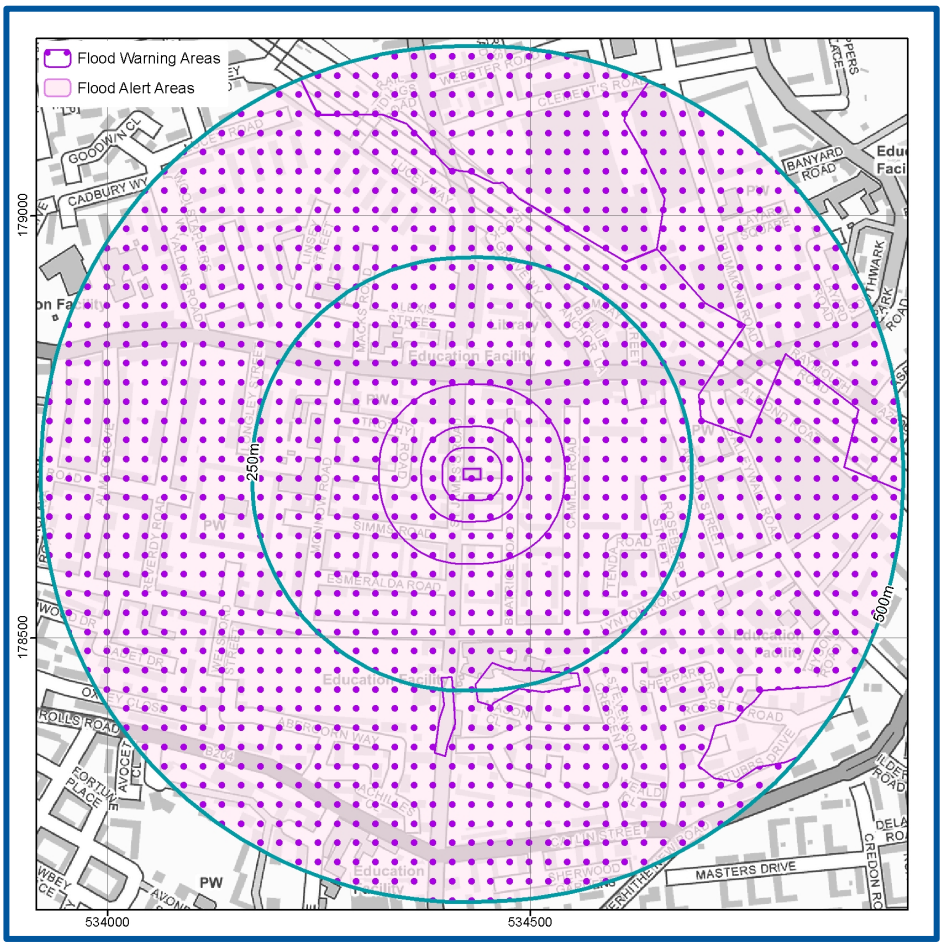
Emergency evacuation to land outside of the floodplain should be provided if feasible. Where this is not possible, 'more vulnerable' developments and, where possible, development in general (including basements), should have internal stair access to an area of safe refuge within the building to a level higher than the maximum likely water level. An area of safe refuge should be sufficient in size for all potential users and be reasonably accessible to the emergency services.

Emergency evacuation from the development and the Site should only be undertaken in strict accordance with any evacuation plans produced for the Site, with an understanding of the flood risks at the Site including available mitigation, the vulnerability of occupants and preferred evacuation routes.

Flood Warnings Direct (FWD)

The EA operates a flood warning service in all areas at risk of flooding; this is available on their website (www.environment-agency.gov.uk). Flood warnings are broadcast on TV and radio weather and travel bulletins and, in designated flood warning areas, direct to the local community by siren, loudhailer or flood wardens, and in high risk areas by phone or fax. The flood warning information on the EA website is updated every 15 minutes. All warnings are also available through the EA's 24 hour Floodline Service 0345 988 1188. Furthermore, people may sign up to Flood Warnings Direct (FWD) to receive a pre-recorded flood warning message sent to their home, work or mobile phone number.

Figure 10. EA Flood Warning Coverage for the local area



Emergency evacuation

The Site is located within an EA Flood Warning Coverage area so is able to receive warnings via the EA Flood Warnings Direct Service (Figure 10). The EA aims to issue flood warnings 2 hours in advance of a flood event (see Appendix F for EA warning classification scheme).

A safe egress route with a 'very low' hazard rating is possible if flood warnings are monitored and acted upon. In this case, residents are able to evacuate before flooding occurs and flood depths along the route reach their maximum level. The primary flood risk to the Site comes from the River Thames. The SFRA states that flood warnings issued for the area will have an advanced period of at least 3-6 hours warning before a flood event impacts the area.

Based on the modelled breach maps included in the SFRA and the EA Flood Risk Map the closest dry evacuation area is on Samson Street (c.1.5 km south east). Given the predicted rate of onset time outlined in the SFRA occupants should be able to reach this point with sufficient time. It is recommended that a flood plan is prepared for the site, highlighted the proposed actions and escape routes in the event of a flood.

On-site refuge

Evacuation should be the primary action in preference, however safe refuge could be sought at first floor level in a worst-case scenario as the residential areas of the development are situated on the first floor.

Other relevant information

A flood evacuation plan is recommended and occupants should be signed up to the Environment Agency's flood warning scheme.

Registration to the Environment Agency's flood warning scheme can be done by following this link: https://fwd.environment-agency.gov.uk/app/olr/register

Main communication lines required for contacting the emergency services, the electricity sockets/meters, water supply and first aid stations and supplies should not be compromised by flood waters.

8. Conclusions and recommendations

Table 8. Risk ratings following implementation and subsequent maintenance of mitigation measures

Source of Flood Risk	Baseline	After Mitigation
River (fluvial) and Sea (coastal/tidal)	Very Low	Very Low
Surface water (pluvial) flooding	Very Low	N/A
Groundwater flooding	Negligible	N/A
Other flood risk factors present	No	N/A

The table below provides a summary of where the responses to key questions are discussed in this report. Providing the recommended mitigation measures are put in place it is likely that flood risk to this Site will be reduced to an acceptable level.

Table 9. Summary of responses to key questions in the report

Key sources of flood risks identified	Fluvial (see Section 4).
Are standard mitigation measures likely to provide protection from flooding to/from the Site?	Yes (see Section 7).
Is any further work recommended?	Yes

Recommendations for mitigation are provided below, based upon the proposed development and the flood risk identified at the Site:

- As there is a risk of flooding from tidal sources, where flood depths could be up to 1.15 m in the area proposed for development, Finished Floor Levels (FFL) of the proposed development should be set to 5.45 mAOD[4] Standard flood resilient design measures should be incorporated;
- Occupants of the Site should be signed up to receive EA Flood Alerts and Flood Warnings;
- A Flood Warning and Evacuation Plan (FWEP) is recommended to ensure persons using the Site can evacuate safely on receipt of a Flood Warning; and
- A Sustainable Drainage Strategy (SuDS) should be developed for the Site, for effective management of surface water runoff over the lifetime of the proposed development.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

[4] 300mm above the 1 in 100 year plus climate change flood level of 5.15 mAOD.

9. Further information

The following table includes a list of additional products by GeoSmart:

Additional GeoSmart Products			
✓	Additional assessment: SuDSmart Report		The SuDSmart Report range assesses which drainage options are available for a Site. They build on technical detail starting from simple infiltration screening and work up to more complex SuDS Assessments detailing alternative options and designs. Please contact info@geosmartinfo.co.uk for further information.
	Additional assessment: FloodSmart Report		The FloodSmart Report range provides clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at a site. Our consultants assess available data to determine the level of risk based on professional judgement and years of experience. Please contact info@geosmartinfo.co.uk for further information.
	Additional assessment: EnviroSmart Report		Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective. Our EnviroSmart reports are designed to be the most cost effective solution for planning conditions. Each report is individually prepared by a highly experienced consultant conversant with Local Authority requirements. Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions. Please contact info@geosmartinfo.co.uk for further information.

10. References and glossary

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GeoSmart Information

Glossary

General terms

BGS	British Geological Survey
EA	Environment Agency
GeoSmart groundwater flood risk model	GeoSmart's national groundwater flood risk model takes advantage of all the available data and provides a preliminary indication of groundwater flood risk on a 50m grid covering England and Wales. The model indicates the risk of the water table coming within 1 m of the ground surface for an indicative 1 in 200 year return period scenario.
Dry-Island	An area considered at low risk of flooding (e.g. In a Flood Zone 1) that is entirely surrounded by areas at higher risk of flooding (e.g. Flood Zone 2 and 3)
Flood resilience	Flood resilience or wet-proofing accepts that water will enter the building, but through careful design will minimise damage and allow the re-occupancy of the building quickly. Mitigation measures that reduce the damage to a property caused by flooding can include water entry strategies, raising electrical sockets off the floor, hard flooring.
Flood resistance	Flood resistance, or dry-proofing, stops water entering a building. Mitigation measures that prevent or reduce the likelihood of water entering a property can include raising flood levels or installation of sandbags.
Flood Zone 1	This zone has less than a 0.1% annual probability of river flooding
Flood Zone 2	This zone has between 0.1 and 1% annual probability of river flooding and between 0.1% and 0.5 % annual probability sea flooding
Flood Zone 3	This zone has more than a 1% annual probability of river flooding and 0.5% annual probability of sea flooding
Functional Flood Plain	An area of land where water has to flow or be stored in times of flood.
Hydrologic model	A computer model that simulates surface run-off or fluvial flow. The typical accuracy of hydrologic models such as this is ±0.25m for estimating flood levels at particular locations.
OS	Ordnance Survey
Residual Flood Risk	The flood risk remaining after taking mitigating actions.
SFRA	Strategic Flood Risk Assessment. This is a brief flood risk assessment provided by the local council

SuDS	A Sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS also significantly improve the quality of water leaving the Site and can also improve the amenity and biodiversity that a site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. Sites over 1 Ha will usually require a sustainable drainage assessment if planning permission is required. The current proposal is that from April 2014 for more than a single dwelling the drainage system will require approval from the SuDS Approval Board (SABs).

Aquifer Types

Principal aquifer	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
Secondary A aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Secondary B aquifer	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
Secondary undifferentiated	Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

NPPF (2019) terms

Exception test	Applied once the sequential test has been passed. For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
Sequential test	Aims to steer new development to areas with the lowest probability of flooding.
Essential infrastructure	Essential infrastructure includes essential transport infrastructure, essential utility infrastructure and wind turbines.

Water compatible	Water compatible land uses include flood control infrastructure, water-based recreation and lifeguard/coastal stations.
Less vulnerable	Less vulnerable land uses include police/ambulance/fire stations which are not required to be operational during flooding and buildings used for shops/financial/professional/other services.
More vulnerable	More vulnerable land uses include hospitals, residential institutions, buildings used for dwelling houses/student halls/drinking establishments/hotels and sites used for holiday or short-let caravans and camping.
Highly vulnerable	Highly vulnerable land uses include police/ambulance/fire stations which are required to be operational during flooding, basement dwellings and caravans/mobile homes/park homes intended for permanent residential use.

Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2020 BlueSky copyright and database rights 2020
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2020 Ordnance Survey data © Crown copyright and database right 2020
Flood Risk (Flood Zone/RoFRS/Historic Flooding/Pluvial/Surface Water Features/Reservoir/ Flood Alert & Warning)	Environment Agency copyright and database rights 2020 Ordnance Survey data © Crown copyright and database right 2020
Flood Risk (Groundwater)	GeoSmart, BGS & OS GW5 (v2.3) Map (GeoSmart, 2020) Contains British Geological Survey materials © NERC 2020 Ordnance Survey data © Crown copyright and database right 2020
Location Plan	Contains Ordnance Survey data © Crown copyright and database right 2020
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2020 Environment Agency copyright and database rights 2020

11. Appendices

GeoSmart Information

Appendix A

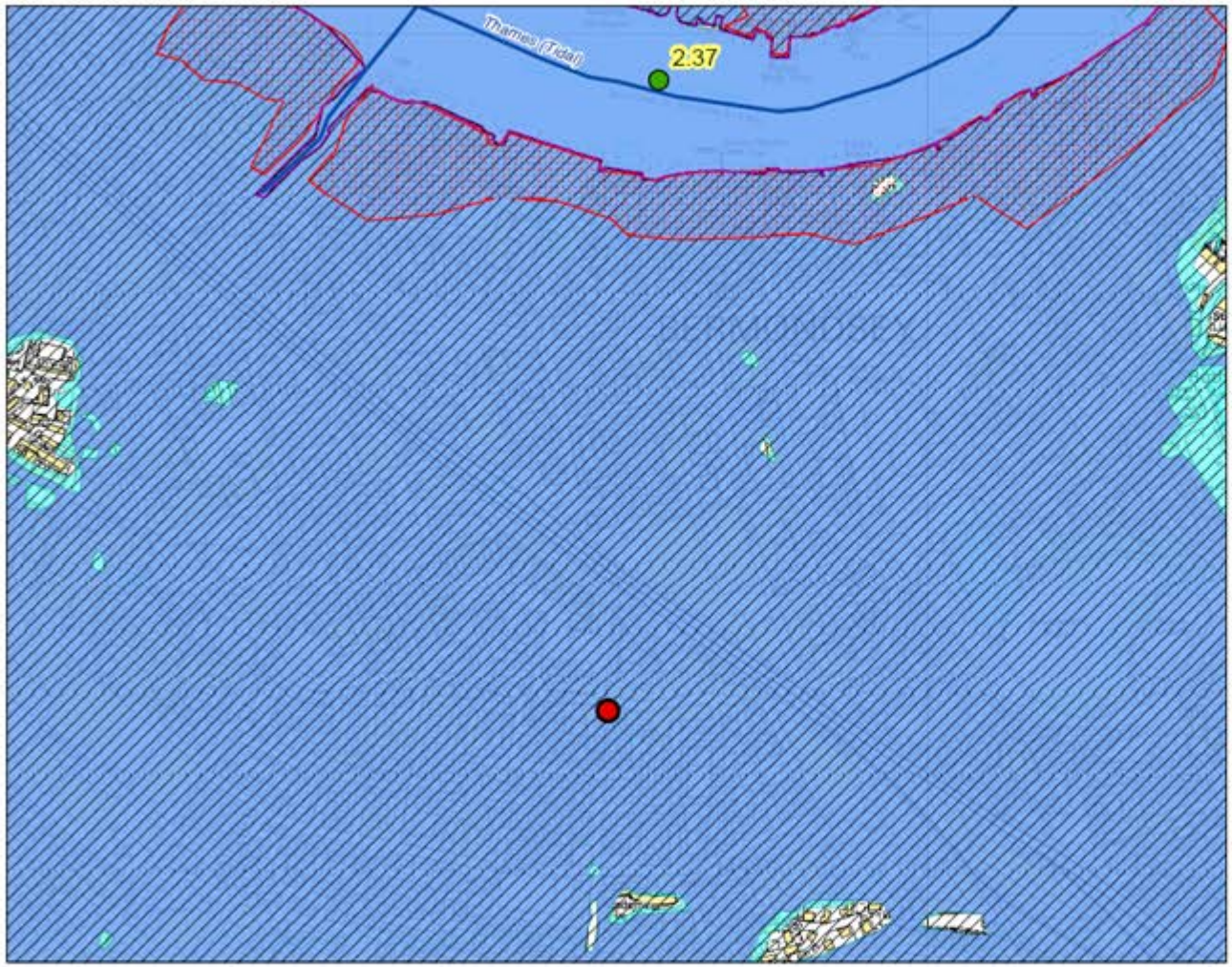
Site plans

GeoSmart Information

Appendix B

Environment Agency Data

Detailed Flood Map centred on Abbey Foregate, Carshalton EXAMPLE6AB created 07/12/2015



Environment Agency

Scale 1: 10,000

Legend

- Site Location
- TE2100 Model Nodes
- Main Rivers
- Flood Map - Defences
- Jan 1928 Flood Outline
- Areas Benefiting from Flood Defences
- Flood Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

Flood Map for Planning (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of occuring each year
- or from a river with a 1% or greater chance of occuring each year

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 0.1% chance of occuring each year.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

TE2100 2008 levels:

Levels downriver of the Thames Barrier are 0.1% AEP (1 in 1000) and levels upriver are the highest levels permitted by the Thames Barrier, described as the Maximum Likely Water Levels (MLWLs). The defence levels (left defence, right defence) are the minimum levels to which the defences should be built.

Location	Node	Easting	Northing	Extreme water level (m)	Left defence (m)	Right defence (m)	Allow for future defence raising to a level of...	
							Left Bank (m)	Right Bank (m)
Putney	2.24	525111	175430	4.92	5.41	5.41	6.35	6.35
	2.24au	525401	175383	4.92	5.41	5.41	6.35	6.35
	2.24ad	525605	175382	4.92	5.41	5.41	6.35	6.35
Battersea	2.25	526164	175611	4.90	5.41	5.41	6.35	6.35
	2.26	526642	176536	4.89	5.41	5.41	6.35	6.35
	2.27	526950	177323	4.88	5.41	5.41	6.35	6.35

TE2100 climate change levels:

				2065 to 2100		**2100**	
Location	Node	Easting	Northing	Design water level	Defence level (both banks)	Design water level	Defence level (both banks)
Putney	2.24	525111	175430	5.42	5.85	5.85	6.35
	2.24au	525401	175383	5.42	5.85	5.85	6.35
	2.24ad	525605	175382	5.42	5.85	5.85	6.35
Battersea	2.25	526164	175611	5.41	5.85	5.84	6.35
	2.26	526642	176536	5.40	5.85	5.83	6.35
	2.27	526950	177323	5.39	5.85	5.83	6.35

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Customer services line: 01732 223 202
Email: kslenquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Thames Tidal Breach Modelling

The table below displays site-specific modelled flood levels at your site. These have been taken from the Thames Tidal Breach Modelling Study 2015 completed by CH2M HILL in March 2015. The exact location of the given site-specific levels and the extent of the breach are shown on the enclosed map.

This modelling simulates tidal breaches along the Thames from Teddington to the Mar Dyke and River Darent. A series of 113 tidal models were developed for the Environment Agency at pre-determined breach locations. These were chosen using a risk-based approach by examining critical locations based on low floodplain topography. For hard and composite defences breaches are set at 20 m wide; for soft defences, breaches are 50 m wide. In both cases, the defence breach scour distance was assumed to extend into the floodplain by the same distance as the breach width.

Based on the 2008 TE2100 in-channel levels, the 0.5% (1 in 200 year) and 0.1% (1 in 1000 year) annual probability of exceedance tidal events were modelled for all breach locations downriver of the Thames Barrier. These were modelled for the 2014 year epoch, as well as a 2065 and 2100 epoch which include allowances for climate change.

For breaches upriver of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closures. The levels used are referred to as Maximum Likely Water Levels (MLWLs). Therefore 2014, 2065 and 2100 epochs were modelled on that basis.

The modelled levels shown assume that the Thames defences have been breached at location 'Berm24' (NGR TQ2670476490).

	Berm24				
	National Grid Reference		Modelled levels in mAODN for Max Likely Water Level		
Node	Easting	Northing	2014	2065	2100
1	526860	176294	3.60	4.05	4.21
2	526913	176278	3.50	4.04	4.21
3	526917	176298	Nil return	4.05	4.21
4	526913	176357	4.31	4.92	5.13
5	526834	176378	Nil return	Nil return	5.15
6	526784	176312	3.83	4.18	4.28
7	526804	176253	Nil return	4.05	4.21

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Thames Tidal Upstream Inundation Modelling

The enclosed map shows results for the Thames Tidal Upstream Inundation Modelling Study 2015 completed by CH2M HILL in March 2015.

Upriver of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closures. Therefore 2014, 2065 and 2100 epochs were modelled on that basis.

Using the domains updated as part of the Thames Tidal Breach Modelling Study 2015 completed by CH2M HILL in March 2015, the project generated outputs for water depths, velocity, levels and hazard. However the scenario modelled is that the Thames Barrier is operational but all linear defences have been removed. It uses the TE2100 in-channel levels calculated in 2008 and only provides data for embayments upriver of the Thames Barrier.

	National Grid Reference		Modelled levels in mAODN		
Point	**Easting**	**Northing**	**2014**	**2065**	**2100**
1	526860	176294	3.48	4.43	4.98
2	526913	176278	3.43	4.39	4.98
3	526917	176298	Nil return	4.39	4.98
4	526913	176357	Nil return	4.66	5.24
5	526834	176378	Nil return	Nil return	5.29
6	526784	176312	3.86	4.57	4.99
7	526804	176253	Nil return	4.46	4.98

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Defence Details

The design standard of protection of the flood defences in this area of the Thames is 0.1% AEP; they are designed to defend London up to a 1 in 1000 year **tidal** flood event. The defences are all raised, man-made and privately owned. It is the riparian owners' responsibility to ensure that they are maintained to a crest level of 5.41 m AODN (the Statutory Flood Defence Level in this reach of the Thames). We inspect them twice a year to ensure that they remain fit for purpose. The current condition grade for defences in the area is 2 (good), on a scale of 1 (very good) to 5 (very poor). For more information on your rights and responsibilities as a riparian owner, please see our document 'Living on the edge' found on our website at:

https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities

There are no planned improvements in this area. Please see the 'Thames Estuary 2100' document on our website for the short, medium and long term Flood Risk Management strategy for London:

https://www.gov.uk/government/publications/flooding-thames-estuary-2100-te2100-plan

Areas Benefiting from Flood Defences

This site is within an area benefiting from flood defences, as shown on the enclosed extract of our Flood Map. Areas benefiting from flood defences are defined as those areas which benefit from formal flood defences specifically in the event of flooding from rivers with a 1% (1 in 100) chance in any given year, or flooding from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would be flooded. An area of land may benefit from the presence of a flood defence even if the defence has overtopped, if the presence of the defence means that the flood water does not extend as far as it would if the defence were not there.

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Recorded Flood Events Data

We hold records of historic flood events from rivers and the sea. Information on the floods that may have affected the area local to your site is provided below and in the enclosed map (if relevant).

Flood Event Data

1928 – The site was within approximately 40 m of the tidal flooding on the night of the 6th and morning of the 7th January. There was overtopping in the area during a storm surge (which coincided with high fresh water flows). An approximate level in the Thames at the time was 5.17 m AODN.

Due to the fact that our records are not comprehensive, we would advise that you make further enquiries locally with specific reference to flooding at this location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage undertaker for the area.

We map flooding to land, not individual properties. Our historic flood event record outlines are an indication of the geographical extent of an observed flood event. Our historic flood event outlines do not give any indication of flood levels for individual properties. They also do not imply that any property within the outline has flooded internally.

Please be aware that flooding can come from different sources. Examples of these are:

- from rivers or the sea;
- surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system);
- overflowing or backing up of sewer or drainage systems which have been overwhelmed,
- groundwater rising up from underground aquifers

Currently the Environment Agency can only supply flood risk data relating to the chance of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding and drainage systems that have been overwhelmed.

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Additional Information

Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

Important

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

https://www.gov.uk/flood-risk-standing-advice-frsa-for-local-planning-authorities

https://www.gov.uk/government/publications/national-planning-policy-framework-technical-guidance

https://www.gov.uk/government/publications/development-and-flood-risk-practice-guide-planning-policy-statement-25

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

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Surface Water

We have provided two national Surface Water maps, under our Strategic Overview for flooding, to your Lead Local Flood Authority – London Borough of Wandsworth – who are responsible for local flood risk (i.e. surface runoff, ground water and ordinary watercourse), which alongside their existing local information will help them in determining what best represents surface water flood risk in your area.

The London Borough of Wandsworth have reviewed these and determined what it believes best represents surface water flood risk. You should therefore contact this authority so they can provide you with the most up to date information about surface water flood risk in your area.

You may also wish to consider contacting the appropriate relevant Local Planning Authority and/or water/sewerage undertaker for the area. They may be able to provide some knowledge on the risk of flooding from other sources. We are working with these organisations to improve knowledge and understanding of surface water flooding.

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GeoSmart Information

Appendix C

Thames Water sewer flooding report

Sewer Flooding
History Enquiry

GeoSmart Information Ltd

Search address supplied 160, Abbey Foregate
Carshalton,
SM5 3EH

Your reference 644447 PO: 88888

Our reference SFH/SFH Standard/2016_3227307

Received date **7 January 2016**

Search date **7 January 2016**

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Sewer Flooding

History Enquiry

Search address supplied: 160, Abbey Foregate, Carshalton, SM5 3EH

This search is recommended to check for any sewer flooding in a specific address or area

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(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

Thames Water Utilities Ltd

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PO Box 3189
Slough SL1 4WW

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Reading RG1 8DB

Sewer Flooding

History Enquiry

History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is “overloaded” when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- “Internal flooding” from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- “At Risk” properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company’s reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk

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Clearwater Court, Vastern Road
Reading RG1 8DB

GeoSmart Information

Appendix D

Environment Agency LiDAR ground elevation data

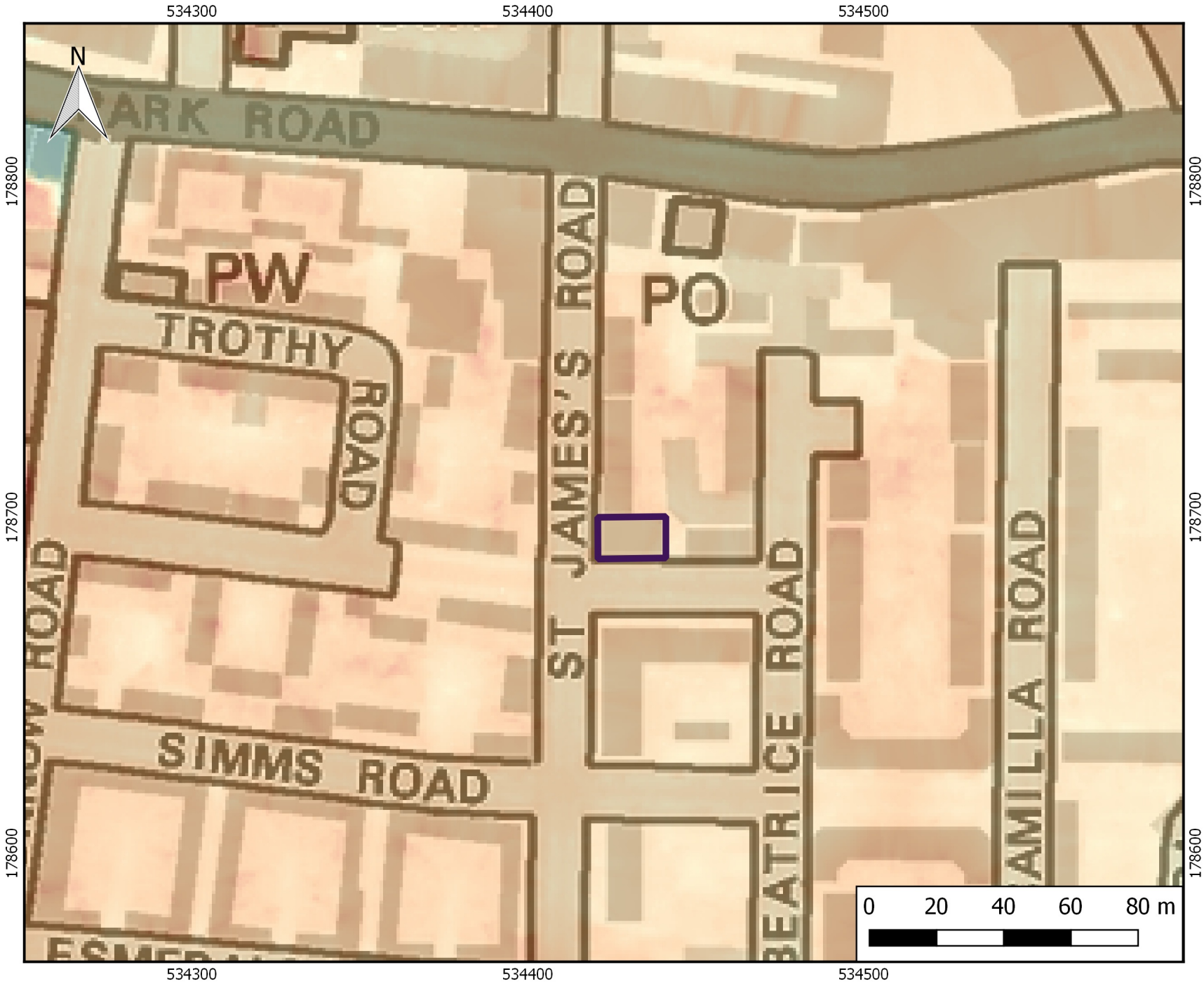

Figure D
Elevation on Site
(LIDAR Data)

Legend

- Site Boundary
- TQ37nw_DTM_1m
  - 0
  - 0.75
  - 1.5
  - 2.25
  - 3

GeoSmart Information

Date 15/09/2020	Drawn
Scale 1:1,583	Checked
Original	Revision
File Reference	

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Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

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- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.
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- handle complaints speedily and fairly
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TPOs contact details:

The Property Ombudsman scheme

Milford House

43-55 Milford Street

Salisbury

Wiltshire SP1 2BP

Tel: 01722 333306

Fax: 01722 332296

Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk.

Please ask your search provider if you would like a copy of the search code

Complaints procedure

GeoSmart Information Limited is registered with the Property Codes Compliance Board as a subscriber to the Search Code. A key commitment under the Code is that firms will handle any complaints both speedily and fairly. If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: admin@tpos.co.uk.

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision. Complaints should be sent to:

Martin Lucass

Commercial Director

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone, Shrewsbury, SY1 1HU

Tel: 01743 298 100

martinlucass@geosmartinfo.co.uk

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CDM regulations can be found on our website:

http://geosmartinfo.co.uk/knowledge-hub/cdm-2015/

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