	St Albans City and District Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Table
Site details	
Site Code	**OS1**
Address	Land to the North of 5 Acres, Bricket Wood and South of the M25
Area	6.52 ha
Current land use	Greenfield
Proposed land use	Community facilities
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the south of St Albans in the village of Bricket Wood, bounded by the M25 and A405 North Orbital to the North and East of the site. The A405 dual carriageway runs north to the A414 at Park Street Roundabout. The site is located within the Colne (from Confluence with Ver to Gade) catchment, which covers an area of 21.3km2, with the River Colne located approximately 1.8km to the south of the site. The site is within the upper catchment in the urban area of Bicket Wood. The River Colne is part of the Colne Management Catchment, which covers a much larger area of 1,040 km².
Topography	Environment Agency 1m resolution LiDAR across the site shows that topography varies. The LiDAR shows that the site has a horizontal band of low-lying land south of the site, helmed by areas of natural high ground present in the north and southern tip of the site. The highest elevation on the site is at 90mOD north of the site and the lowest elevation in the south is 74mOD.
Existing drainage features	There is an unnamed ordinary watercourse flowing in a south-west direction dividing the southern part of the site, mapping shows that this ordinary watercourse is part of a wider drainage network which flows under the M25. The nearest Main River is the River Ver, located approximately 2km east of the site.
Fluvial and tidal	**The proportion of site at risk FMFP:** FZ3b – 0% FZ3a – 0% FZ2 – 0%

	FZ1 – 100% The Flood Zone values quoted show the percentage of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone. This is because the values quoted are the area covered by each Flood Zone/extent within the site boundary. For example: Flood Zone 2 includes Flood Zone 3. Flood Zone 1 is the remaining area outside Flood Zone 2 (FZ2+ FZ1 = 100%). **Available data:** The Environment Agency's Flood Zone mapping has been used in this assessment. The ordinary watercourse that bisects the site is not included in national modelling or in any detailed hydraulic modelling. **Flood characteristics:** The site is located within Flood Zone 1 and is therefore at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 1.3% Max depth – 0.15-0.30m Max velocity – 0.00-0.25m/s **1% AEP** – 4.2% Max depth – 0.15-0.30m Max velocity – 0.50-1.00m/s **0.1% AEP** – 12.8% Max depth – 0.3-0.6m Max velocity – 1.00-2.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment. Surface water flooding has been recorded for the site; a Section 19 Flood Investigation was carried out in 2016 due to repeat flooding that occurred in the vicinity at Five Acres Avenue. **Description of surface water flow paths:** Risk of Flooding from Surface Water data for this site shows flow paths in the 3.3% AEP, 1% AEP and 0.1% AEP. Surface water risks are significant in the 1% AEP and 0.1% AEP extents, with minimal impact from 3.3% AEP extents which mostly consists of limited areas of ponding. The extents show a surface water flow path which originates northeast of the site and flows under the M25, towards the residential areas west of the site, the flow route follows the natural topography of the site. The 3.3% AEP extent show limited accumulation along the ordinary watercourse, from the flow path to the north-east. In the 1% AEP and 0.1% AEP extents, there are additional contributions to surface flows from the residential areas in the south-east which are topographically higher (Woodside Road, Garnett Drive and Meadow Close).

	The risk of surface water flooding and the ordinary watercourse will require careful consideration and the risk assessed to ensure that the risk can be safely managed as part of a site-specific flood risk assessment.
Reservoir	The Environment Agency's reservoir maps show the site is not at risk of reservoir flooding.
Groundwater	More than 50% of the area is at significant risk of groundwater flooding, the JBA Groundwater mapping predicts that 62% of the site has groundwater levels at between 0.025m and 0.5m from ground level. The mapping also shows that 7% of the site has groundwater levels at or less than 0.025m primarily affecting the northern section of the site. The remaining 38% of the site (southern part) is not at risk of groundwater flooding. The risk form groundwater will need to be investigated further as part of a site-specific flood risk assessment and is likely to require ground investigations to confirm the risk.
Sewers	The site is located within a postcode area with 48 historic incidences of sewer flooding, according to the Thames Water Hydraulic Sewer Flood Risk Register. Impermeable surfaces could add significant additional water volume especially during large rainfall events and enter the drainage system in a short time.
Flood history	There are no reported flood incidents reported by the Environment Agency, St Albans City and District Council or Hertfordshire County Council within the site. However, 10 historic incidents have been recorded within 250 m of the site. Three of these incidents are attributed to surface water and foul sewer flooding, the most recently recorded incident occurred in 2016 along Five Acres Avenue, where a Section 19 Flood Investigation was undertaken.
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	No residual risk of flooding to the site.
Emergency planning	
Flood warning	The site is not within the following EA Flood Warning and Flood Alert Areas
Access and egress	Access and egress to the site is directly via the North Orbital Road on the northern and eastern boundary. Access and egress are also possible via Oakwood Road. During the 1% and 0.1% AEP surface water events, shallow inundation (<0.30m) is predicted to occur on North Orbital Road; safe access and egress is unlikely to be affected. During the 0.1% AEP surface water event there is a flow route along the North Orbital Road, in north of the site.

	Flood depths are mainly 0.15 to 0.30m with moderate velocities reaching 0.50 to 1.00m/s. The flood hazard for is also predicted to be low. Along Oakwood Road, in the 1% and 0.1% AEP surface water event, inundation is predicted to be more severe, some parts of the road reach 0.6m to 0.9m in the 1% AEP event. Similarly flood hazard is significant, indicating it poses 'Danger for most'. Arrangements for safe access and egress will need to be demonstrated for the 1% AEP plus an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles at both access points, as the North Orbital Road and Oakwood Road are within the 0.1% AEP surface flood risk modelled data.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment: Colne Management Catchment** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. **Fluvial:** The latest climate change allowances have been applied to the Upper Colne (2010) model to indicate the impact of fluvial flood risk. Mapping shows that the site is within Flood Zone 1 and with the latest climate change allowances applied fluvial flood risk to the site remains negligible. The ordinary watercourse present on the site has not been modelled and thus the impacts of climate change are unknown. **Surface Water:** The latest climate change allowances have been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk. The 1% AEP plus 40% climate change corresponds to the 1% AEP upper end allowance for peak rainfall intensity for the 2070s epoch and is therefore the 'design event' scenario. Unlike the 1% AEP scenario, the 1% AEP plus 40% climate change event effects most of the site. The extent is similar to that of the 0.1% AEP, with a large flow route through the site, also affecting the access road to the west. The maximum depth, velocity, and hazard of this surface water is 0.6m, 2m/s, and 'Danger for most'. This change in extent and depth shows that this site is sensitive to climate change. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	• Geology at the site consist of:
	  ○ Sedimentary bedrock – Bedrock geology of the site is Lewes Nodular Chalk Formation and Seaford Chalk Formation – chalk. This is a sedimentary bedrock.
	  ○ Superficial deposits – The superficial deposits of the site is the Kesgrave Catchment Subgroup– which is comprised of glacial sand and gravels.
	• Soils at the site consist of:
	  ○ Freely draining slightly acid loamy soils.
	
	Sustainable Drainage Systems (SuDS)
	• Groundwater levels are indicated to be at or very near (within 0.025m) ground level and there is a risk of groundwater flooding at the surface during a 1% AEP event, which may flow to and pool within topographic low spots. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate at this site
	• BGS data indicates that the underlying geology is chalk which is likely to be free draining. Although, groundwater mapping indicates that the site is at moderate risk of groundwater flooding, therefore infiltration techniques may not be suitable. This should be confirmed through infiltration testing, and groundwater monitoring throughout a winter period.
	• The site is located within Groundwater Source Protection Zone 1 (inner zone). Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zone 1 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (St Albans City and District Council, Hertfordshire County Council (LLFA) and the Environment Agency at an early stage to understand possible opportunities and constraints. The Groundwater Source Protection Zone guidance is currently undergoing review; therefore developers should ensure they are using the latest guidance regarding this.
	• The site is not designated by the Environment Agency as previously being a landfill site.
	• Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.

	• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 1% AEP and 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
Opportunities for wider sustainability benefits and integrated flood risk management	• Proposals to use SuDS techniques should be discussed with relevant stakeholders (St Albans City and District Council, Hertfordshire County Council (LLFA) and the Environment Agency an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
NPPF and planning implications	
Exception Test requirements	The site is within Flood Zone 1 but at risk from surface water and groundwater flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 Assessment. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required as the site is:
	  ○ Greater than 1 hectare (ha) in flood zone 1
	  ○ At risk from surface water and groundwater flooding
	• All sources of flooding should be considered as part of a site-specific FRA. Ground investigations are likely to be necessary to confirm the risk form groundwater flooding to the site.
	• An unmodelled ordinary watercourse has been identified within mapping of the site. This is in the southern section of the site, and it appears to be connected to the surface water sewer for the adjacent residential area. It is advised that this watercourse is modelled to understand any additional risk posed to the site.

	• Consultation with St Albans City and District Council, Hertfordshire County Council, Thames Water and the Environment Agency should be undertaken at an early stage. • Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG), St Albans District Council's Local Plan policies and Hertfordshire County Council's Guidance for Developers • The development should be designed with mitigation measures in place where required. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates. • Safe access and egress will need to be demonstrated in the 1 in 100-year plus climate change surface water events, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk. Consideration is needed where the site is bisected by the ordinary watercourse to ensure access to both parts of the site. • Betterment on the existing site runoff rate should be sought to ensure that there is no increase in surface water flood risk elsewhere. Ideally, surface water runoff should be fully attenuated to the greenfield rate. • All development should adopt source control SuDS techniques. Conveyance features should be designed above ground and following natural flow paths where possible. Assessment for post development runoff should include allowance for climate change effects. • The design of SuDS schemes must take into account the seasonally high groundwater table. Infiltration techniques may be ineffective and may pose a pollution risk. SuDS may need to be shallow and take up larger areas. Above ground conveyance and attenuation can be used but care must be taken that groundwater does not enter the SuDS feature and reduce the storage capacity and structural integrity of the design.

	• Example features may include swales, attenuation features, green roofs, rainwater capture and reuse and permeable paving.
	• The design must ensure that flows resulting from rainfall in excess of a 1% AEP event are managed via exceedance routes that minimise the risks to people and property. Storage for runoff from the development in extreme events should be located out of flood risk areas.
	• SuDS design must follow Hertfordshire County Council guidance, meet the Defra National Non-Statutory Technical Standards, and follow current best design practice (CIRIA Manual 2015).
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

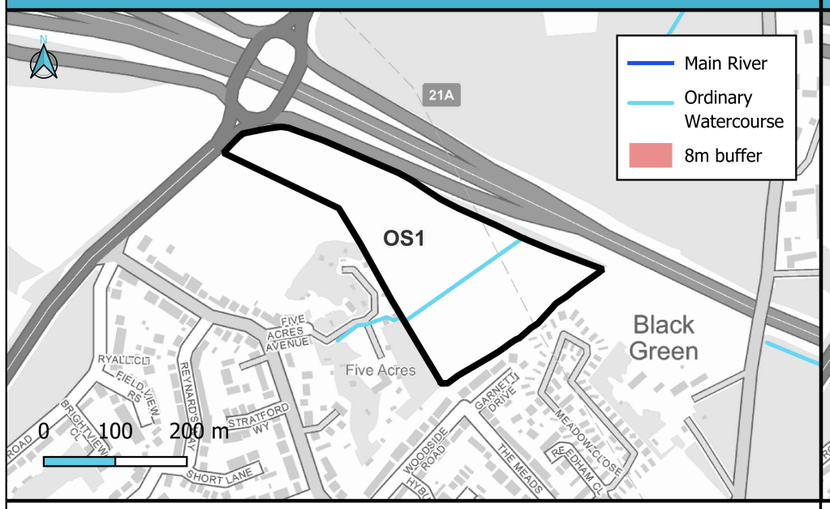
Key messages	
The site is in Flood Zone 1; however, has significant risk of surface water and groundwater flooding. Development is likely to be able to proceed if: • A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water or groundwater flooding on the site and to neighbouring areas. • Development incorporates the existing drainage to the ordinary watercourse that traverses the site and other existing small flow paths/areas of surface water ponding into the development design. • A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site. • Safe access and egress can be demonstrated for the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory storage will be required in another).	
Mapping Information	
Flood Zones	Flood Zones 2 and 3a have been taken from the Environment Agency's Flood Map for Planning mapping. There is no detailed hydraulic modelling available at this location.

Climate change	The latest climate change allowances have been applied to the Environment Agency's RoFSW map to indicate the impact on surface water flood risk. In the absence of detailed hydraulic modelling, Flood Zone 2 has been used as an indicative assessment of future fluvial risk at 1% AEP.
Fluvial depth, velocity and hazard mapping	There is no detailed hydraulic modelling available at this location.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from Environment Agency's RoFSW.

Site Reference	OS1
Site Name	Land to the North of Bricket Wood, bounded by the M25 and A405 North Orbital

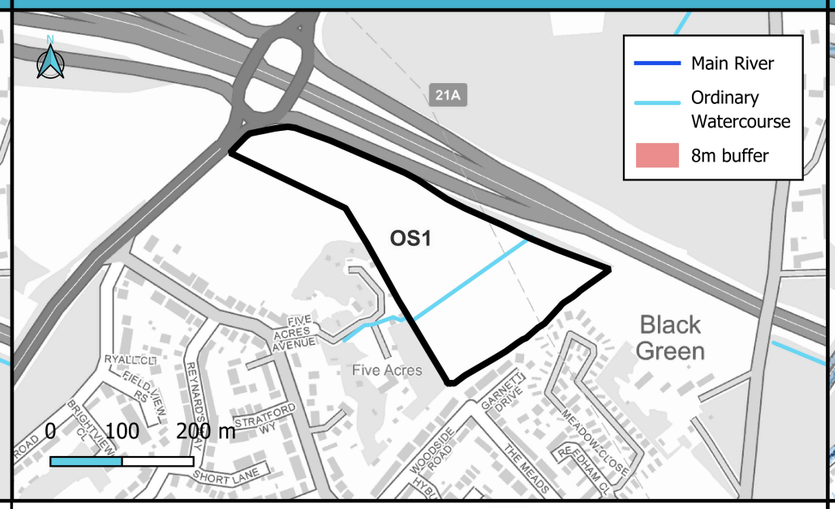
St Albans District Council
Strategic Flood Risk Assessment
Level 2 Detailed Site Summary

Flood Zone Map (present day)



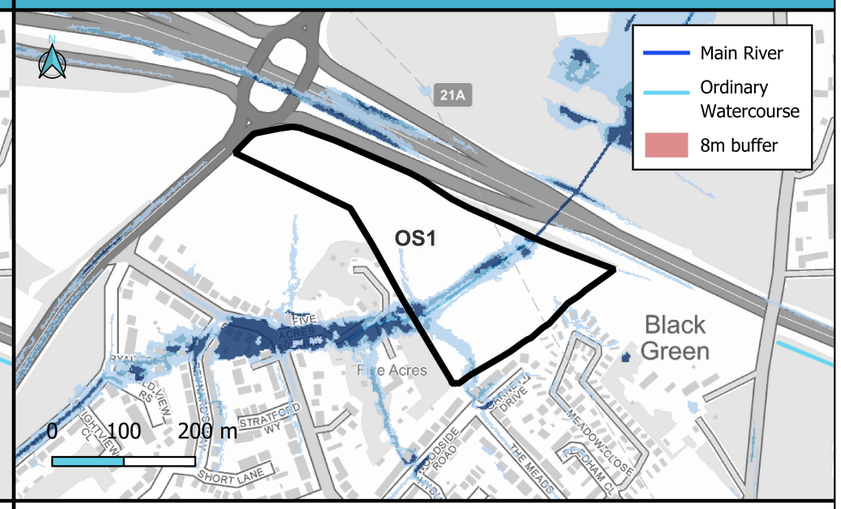
- Flood Zone 2 (Between 1% and 0.1% AEP)
- Flood Zone 3a (Between 3.33% and 1% AEP)
- Flood Zone 3b (Less than 3.33% AEP)
- Site boundary
- Other site

Flood Zone 3b + Climate Change



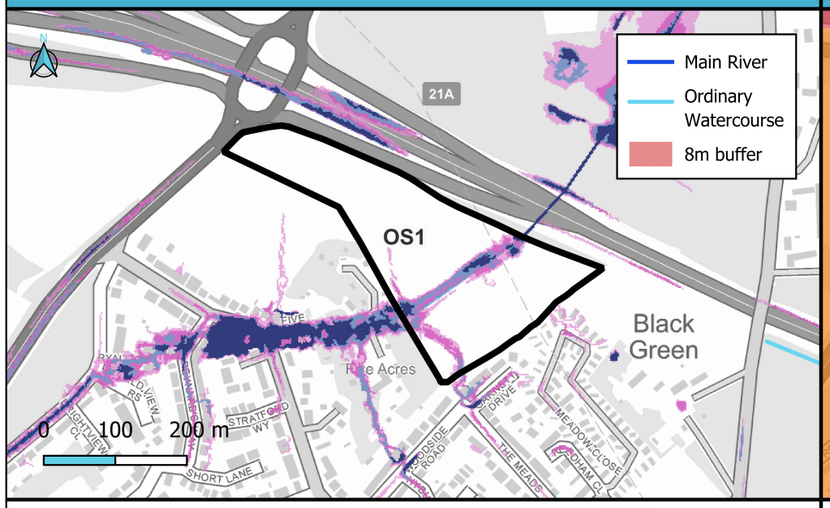
- Flood Zone 3b + 21% (Central allowance)
- Flood Zone 3b + 35% (Higher allowance)
- Flood Zone 3b
- Site boundary
- Other site

Surface Water Map (RoFSW)



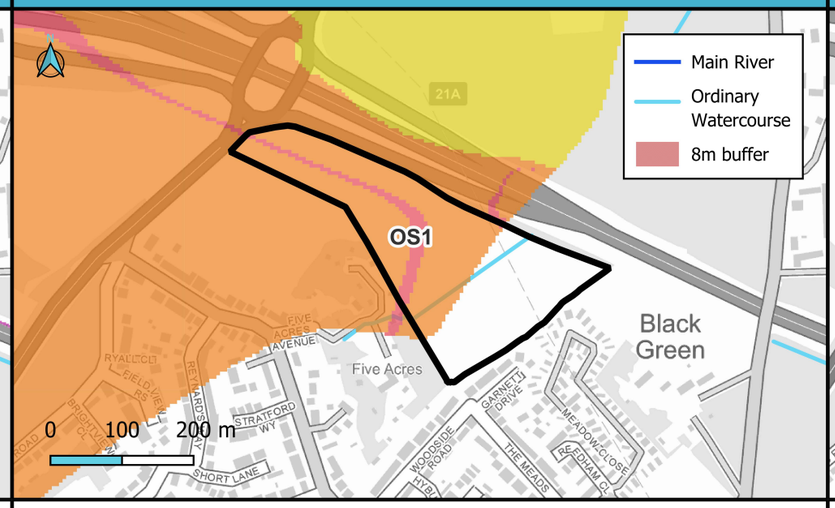
- RoFSW 1 in 30-year (3.33% AEP)
- RoFSW 1 in 100-year (1% AEP)
- RoFSW 1 in 1000-year (0.1% AEP)
- Site boundary
- Other site

Surface Water Map + Climate Change



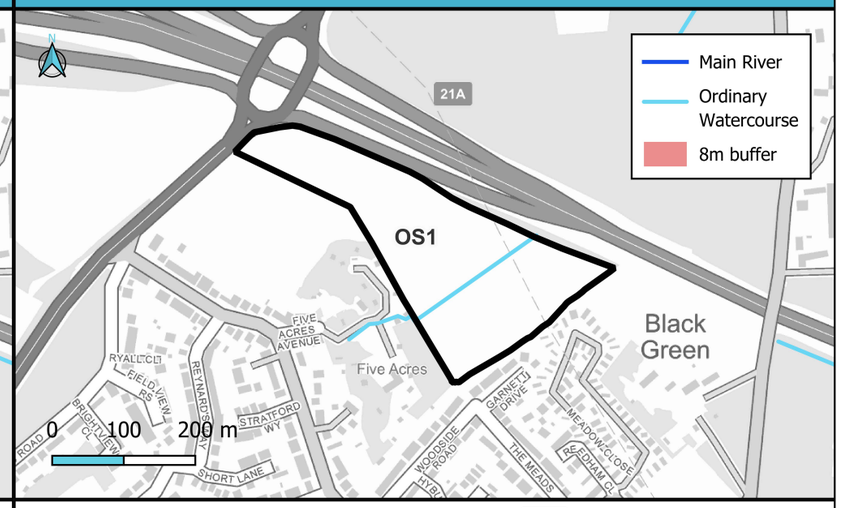
- RoFSW 1 in 30-year (3.33% AEP)
- RoFSW 1 in 30-year (3.33% AEP) plus 40%
- RoFSW 1 in 100-year (1% AEP)
- RoFSW 1 in 100-year 1% AEP plus 40%
- Site boundary
- Other site

Groundwater (Gw) Flood Risk 1% AEP



- GW levels <0.025m below ground
- GW levels 0.025m to 0.5m below ground
- GW levels 0.5 to 5m below ground
- GW levels atleast 5m below ground
- Site boundary
- Other site

Reservoir Flood Risk

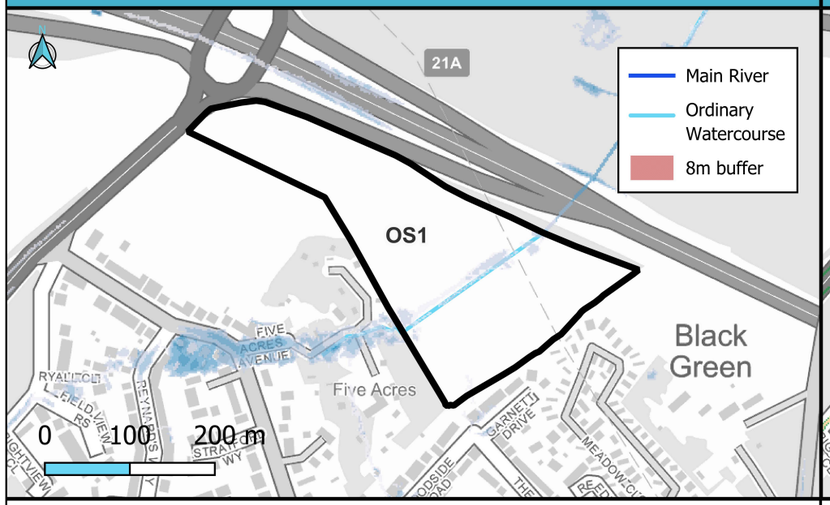


- Reservoir 'Dry Day' flood extent
- Reservoir 'Wet Day' flood extent
- Reservoir - Fluvial contribution to flood extent
- Site boundary
- Other site

Site Reference	OS1
Site Name	Land to the North of Bricket Wood, bounded by the M25 and A405 North Orbital

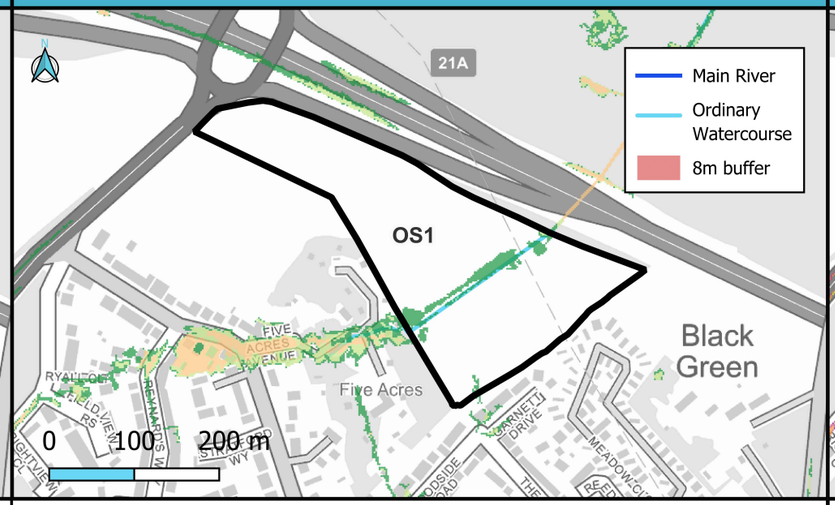
St Albans District Council
Strategic Flood Risk Assessment
Level 2 Detailed Site Summary

RoFSW Max Depth - 1% AEP



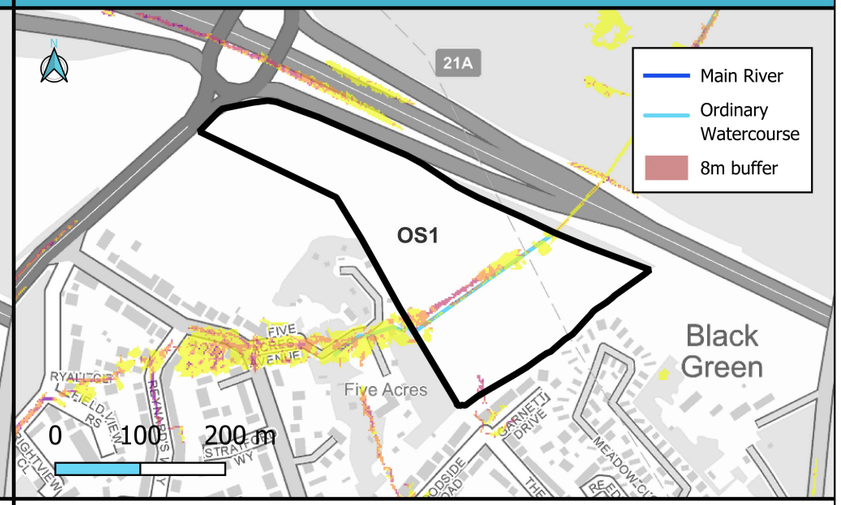
Depth (m)
0.00 - 0.15
0.15 - 0.30
0.30 - 0.60
0.60 - 0.90
0.90 - 1.20
> 1.20
Site boundary
Other site

RoFSW Max Hazard - 1% AEP



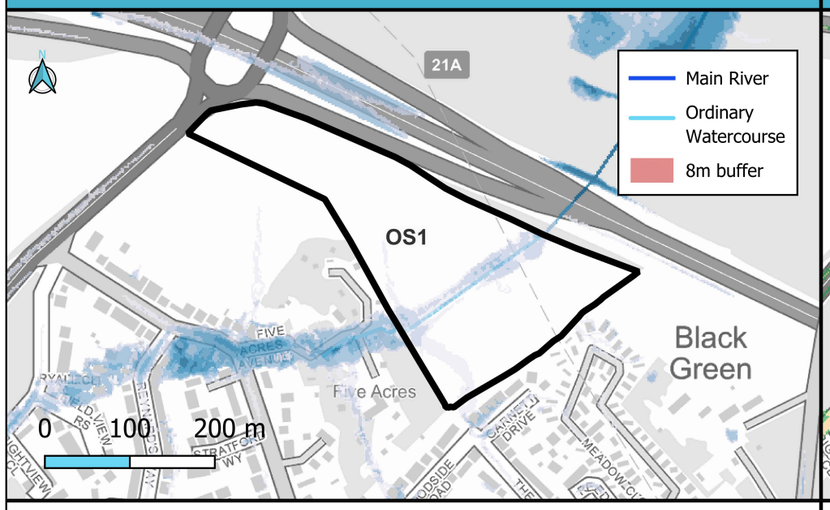
Hazard
< 0.75: Low
0.75 - 1.25: Moderate
1.25 - 2.00: Significant
> 2.00: Extreme
Site boundary
Other site

RoFSW Max Velocity - 1% AEP



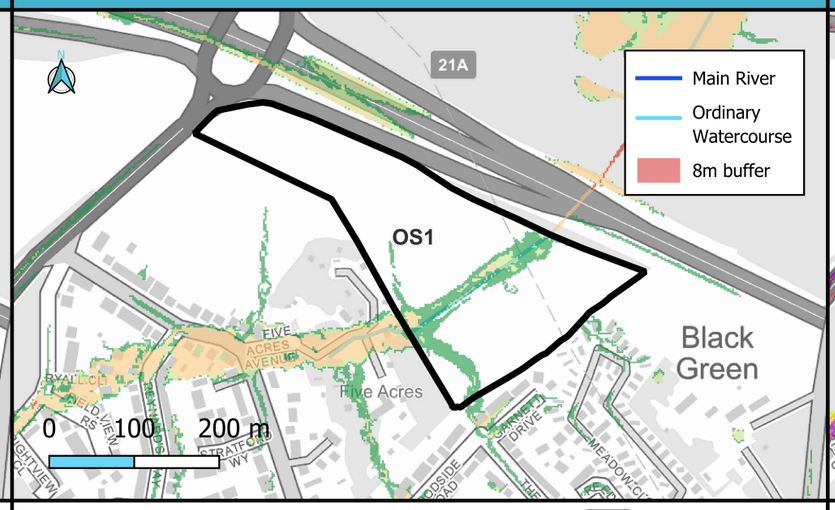
Velocity (m/s)
0.00 - 0.25
0.25 - 0.50
0.50 - 1.00
1.00 - 2.00
> 2.00
Site boundary
Other site

RoFSW Max Depth - 1% AEP + 40% CC



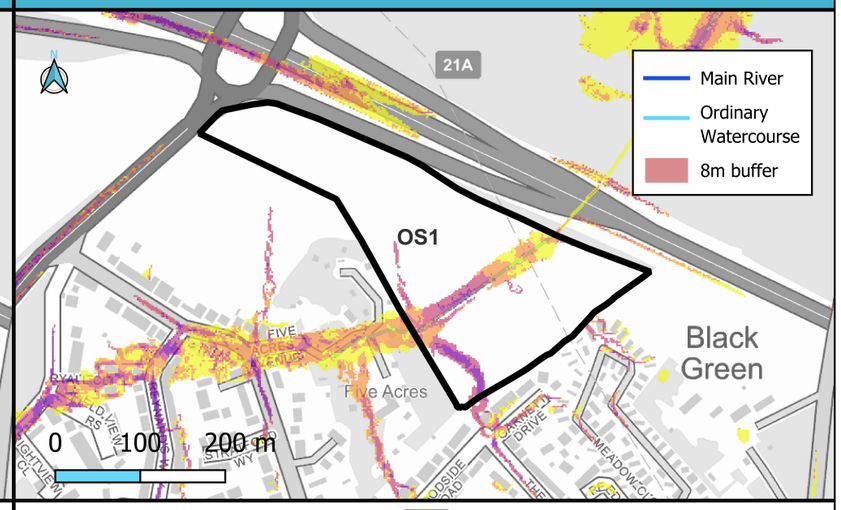
Depth (m)
<= 0.15
0.15 - 0.30
0.30 - 0.60
0.60 - 0.90
0.90 - 1.20
> 1.20
Site boundary
Other site

RoFSW Max Hazard - 1% AEP + 40% CC



Hazard
< 0.75: Low
0.75 - 1.25: Moderate
1.25 - 2.00: Significant
> 2.00: Extreme
Site boundary
Other site

RoFSW Max Velocity - 1% AEP + 40% CC



Velocity (m/s)
0.00 - 0.25
0.25 - 0.50
0.50 - 1.00
1.00 - 2.00
> 2.00
Site boundary
Other site