	St Albans City and District Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Table
Site details	
Site Code	**B3**
Address	West Redbourn, Redbourn, AL3 7HZ
Area	27.02ha
Current land use	Greenfield
Proposed land use	Mixed – Residential and education establishment
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is in a rural location, situated to the west of the village of Redbourn and to the northwest of St Albans. The M1 motorway is adjacent to the western boundary of the site. The site is within the River Ver catchment, which covers an area of 146.4 km², with the River Ver located approximately 0.96 km to the east of the site. The site is in the upper catchment, which is predominantly rural. The River Ver is part of the Colne Management Catchment, which covers a much larger area of 1,040 km². The Redbourn Ditch is approximately 0.37 km to the east of the site, and a drainage ditch for the M1 runs alongside the western boundary of the site.
Topography	Environment Agency 1m resolution LiDAR across the site shows that topography varies, as the site is on a slope. The highest elevations are in the northeast of the site reaching a maximum elevation of 129.5mAOD. From there, the terrain gradually descends towards the south and northeast. The site fall to an elevation of 119.1 mAOD near Lybury Lane in the northeast. To the south the elevations fall to 96.8m by Gaddesden Lane along the site's southern boundary.
Existing drainage features	There are no existing drainage features within the site that are visible on topographic mapping or aerial imagery.
Fluvial	**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, alongside the River Ver (2019) 1D-2D hydraulic model received for this Level 2 SFRA. **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% Max depth – 0.30 – 0.60m Max velocity – 0.50 – 1.00m/s **1% AEP** – 2% Max depth – 0.30 – 0.60m Max velocity – 1.00 – 2.00m/s **0.1% AEP** – 6% Max depth – 0.60 – 0.90m 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. **Description of surface water flow paths:** During the 3.3% AEP event, there is a flow route across the site in the northern region, flowing west to east and exiting the site onto Lybury Lane. Flood depths are <0.15m with velocities reaching between 0.25 to 0.50m/s. As a result, the flood hazard is 'Very low'. There is an area of ponding in the centre of the site, to the north of Flamsteadbury Lane, where flood depths reach between 0.30 – 0.60m, with flood hazard of 'Danger for some'. An additional flow path crosses the southwest corner, where the flood depth and velocity are <0.15m and 0.50 to 1.00m/s, respectively. During the 1% AEP event, the flow path towards the northern boundary has a wider flood extent; however, depths remain <0.15m, and velocities reach between 0.50 to 1.00m/s. The hazard remains 'Very Low'. The ponding in the centre of the site by Flamsteadbury Lane is now part of a flow route across the site. Once the water reaches the area of ponding, the flow path continues south along part of the eastern boundary. The maximum flood depth is within the area of ponding is between 0.30 – 0.60m. Velocities across this flow rout reach between 0.50 to 1.00m/s, as a result the hazard is categorized as 'Very Low' to 'Danger for some'. The

	flow route across the southeastern corner has velocities between 0.15 to 0.30m/s, with the maximum velocity and hazard reaching 1.00 to 2.00m/s and 'Danger for some. During the 0.1% AEP event, the three flow routes have increased in size and severity. The northern flow path reaches maximum depths of 0.15 to 0.30 meters, velocities of 1.00 to 2.00m/s, and a hazard level of 'Danger for most'.. The flow path across the centre of the site has a much wider area of ponding by Flamsteadbury Lane, in addition to covering a larger area of the eastern boundary. The flood depth reaches 0.30 to 0.60m, with velocities between 1.00 to 2.00m/s. The resulting flood hazard is 'Danger for most'. The flow path in the south of the site covers the entire southern boundary of the site. The maximum depth, velocity, and hazard for this flow path are, 0.60 to 0.90m, 1.00 to 2.00m/s and 'Danger for all'.
Reservoir	A small area covering 1% of the site along the southern boundary is shown to be at risk of Wet Day reservoir flooding and Dry Day reservoir flooding according to the Environment Agency's reservoir flood mapping. During the Wet Day and Dry Day scenarios, flood risk is posed from the Redbourn Reservoir managed and operated by Thames Water.
Groundwater	The JBA Groundwater mapping, shows the majority of the site is at low risk of groundwater flooding, with 95% of the site having groundwater levels between 0.5 and 5 meters below ground level. A small area, comprising 1% of the site located in the southeastern corner, is at moderate risk with groundwater levels between 0.25 and 0.5 meters below ground level. The remaining 4% along a section of the eastern boundary is not at risk. The risk from 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 where there were 20 reported historic incidences of sewer flooding, according to the Thames Water Hydraulic Sewer Flood Risk Register.
Flood history	The site is not shown to be within the reaches of the Environment Agency's Historic Flood Map. St Albans District Council flood record and Hertfordshire County Council show no records of flooding within the site. However, several flood incidents have been reported along Lybury Lane downstream of the northern part of the site. Once incident occurred in October 2020 where there was surface water flooding along Lybury Road. An additional incident was reported in February 2014 where there were 15 internal and 5 external incidents of flooding caused by surface water flooding along Lybury Road.
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any flood defences.

Residual risk	The site is not at residual flood risk.
Emergency planning	
Flood warning	The site is not located in an Environment Agency Flood Warning or Flood Alert Area.
Access and egress	There are currently several access and egress routes to the site. This includes via Lybury Lane, Flamsteadbury Lane and Gaddesden Lane which is accessed to the east via Hemel Hempstead Road. During the 3.3% AEP surface water event, there is safe access and egress via Flamsteadbury Lane. Along Gaddesden Lane and Hemel Hempstead Road there is a flow route with maximum depths, velocity and hazard of 0.30 to 0.60m, 0.50 to 1.00m/s and 'Danger for most'. The areas identified as 'Danger for most' were small areas of ponding along Hemel Hempstead Road with the remaining hazard identified as 'Danger for some'. Therefore, vehicular access and egress along this route will be limited. Lybury Lane has a small surface route from the site south onto Redbourn. The associated maximum flood depths, velocities and hazard are, 0.30 to 0.60m, 1.00 to 2.00m/s and 'Danger for some', safe vehicular access and egress is still possible via this route. During the 1% AEP surface water event, there is safe access and egress to the site via Flamsteadbury Lane. The surface flow route along Gaddesden Lane/Hemel Hempstead Road has increased in extent from the 3.3% event, with maximum flood depths of 0.60 to 0.90 meters, velocities of 1.00 to 2.0m/s, and a hazard of 'Danger for most'. Therefore, access and egress to the sit via this route is not possible. Gaddesden Lane to the west of the site, where the flow route originates, is classified as 'Danger for all', due to flood depths reaching between 0.90 to 1.20m and velocity >2.00m/s. As a result, access and egress from the west of the site along Gaddesden Lane is also not possible. The flow route along Lybury Lane has flood depths primarily between 0.15 to 0.30m but reaches a maximum of 0.30 to 0.60m in places along the road, both to the north and south of the site. The velocities mainly vary between 1.00 to 2.00m/s, with some small areas reaching >2.00m/s. The flood hazard is 'Very low' to 'Danger to most', so access and egress may not be possible. During the 0.1% AEP surface water event, safe access and egress via Lybury Farm and Gaddesden Lane/Hemel Hempstead Road is not possible, as both routes have a flood hazard of 'Danger for all'. Flamsteadbury Lane has a flow route where it runs through the centre of the site, in addition to a small flow route flowing down where it merges with West Common. The flood depths are all <0.15m, with velocities reaching a maximum between 0.50 to 1.00m/s. The resulting hazard is therefore categorised as 'Very low', so safe access and egress to the site via Flamsteadbury Lane is possible. However, vehicular access to Flamsteadbury Lane may be limited due to the flow routes entering the

	village via Lybury Lane and Hemel Hempstead Lane, affecting a large number of roads with Redbourn, including Lamb Street and Chequer Lane. Developers will need to demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change.
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 River Ver (2019) 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. **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. In the 1% AEP plus 40% climate change event the flood extent is similar to that in the 0.1% AEP event. The maximum flood depth, velocity and hazard within the site are 0.95m, 1.68m/s and 'Danger for All', specifically along the site's southern boundary. This shows the site is somewhat sensitive to increases in pluvial flooding due 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:
	  ○ The bedrock geology is Lewes Nodular Chalk formation and Seaford Chalk Formation
	  ○ Two different superficial deposits Head – Caly, silt, sands and gravels and Clay-with-flints Formation – Clay, silt, sand and gravel. Both deposits are types of sedimentary superficial deposits.
	• Soils at the site consist of:
	  ○ To the north slightly acid loamy and clayey soils with impeded drainage

	○ To the south freely draining slightly acid but base-rich soils **Sustainable Drainage Systems (SuDS)** • Groundwater levels are indicated to be between 0.5 and 5m below ground level and there is a risk of flooding to subsurface assets and below ground development such as basements. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. • BGS data indicates that the underlying geology is chalk which is likely to be free draining. This should be confirmed through infiltration testing, and groundwater monitoring throughout a winter period. • The whole site is located within Groundwater Source Protection Zone 3. 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 site is not located within a historic landfill site. The Groundwater Source Protection Zone guidance is currently undergoing a review. Therefore, developers should ensure they are using the latest guidance. • Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed 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 3.33%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • 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.
Opportunities for wider sustainability benefits and integrated flood risk management	• Implementation of SuDS at the site should provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. 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) at 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. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is within Flood Zone 1 but at risk from surface water, groundwater and reservoir 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 one hectare
	  ○ At risk of other sources of flooding (surface water, groundwater, and reservoir)
	• 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 from groundwater flooding 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 City and 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.
- Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
- Arrangements for safe access and egress will need to be demonstrated for the 3.3%, 1% and 0.1% surface water events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs.
- Should built development be proposed within the 1% AEP surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
- 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 and at moderate risk from surface water flooding, and low risk from reservoir and groundwater flooding. Development is likely to be able to proceed if:

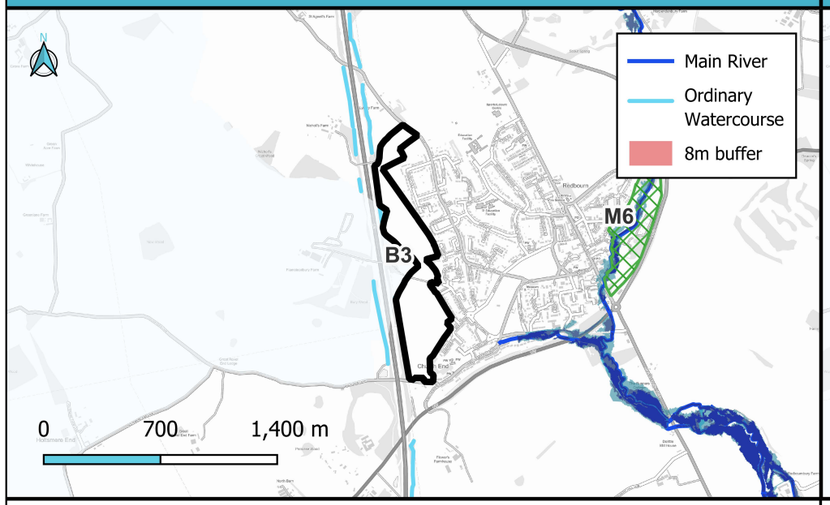
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Arrangements for safe access and egress will need to be demonstrated for the 3.3% and 1% surface water events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.

- The flow paths and areas of surface water ponding are incorporated and considered within the development design.
- The surface water flow paths which cross the site are incorporated into SuDS/blue-green infrastructure.
- 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 flood storage will be required in another).
- A site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan is submitted along with the FRA.

Mapping Information	
Flood Zones	Flood Zones 2 and 3a have been taken from the Environment Agency's Flood Map for Planning mapping. Flood Zone 3b has been created from the River Ver (2019) model.
Climate change	The most recent uplifts have been applied to the River Ver (2019) model to indicate the impacts on fluvial flood risk. The latest climate change allowances have been applied to the Environment Agency's RoFSW map to indicate the impact on pluvial flood risk.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the River Ver (2019) model.
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.

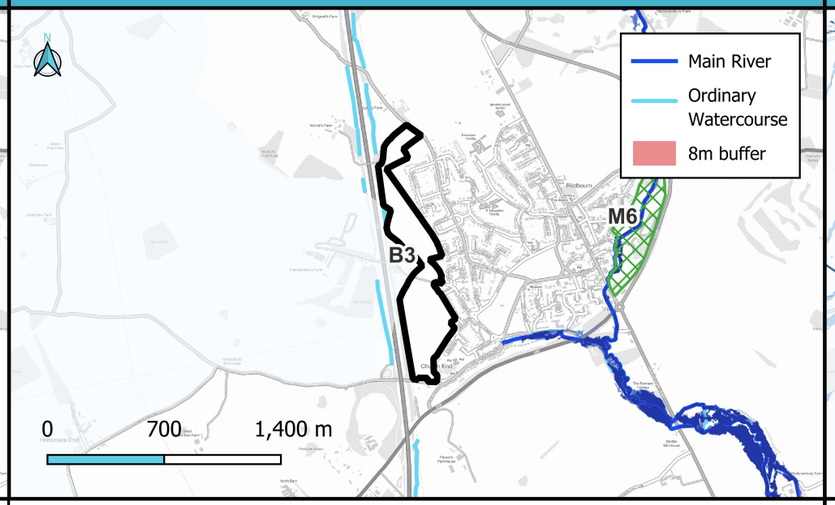
Site Reference	B3	St Albans District Council Strategic Flood Risk Assessment Level 2 Detailed Site Summary	St Albans City & District Council JBA consulting
Site Name	West Redbourn		

Flood Zone Map (present day)



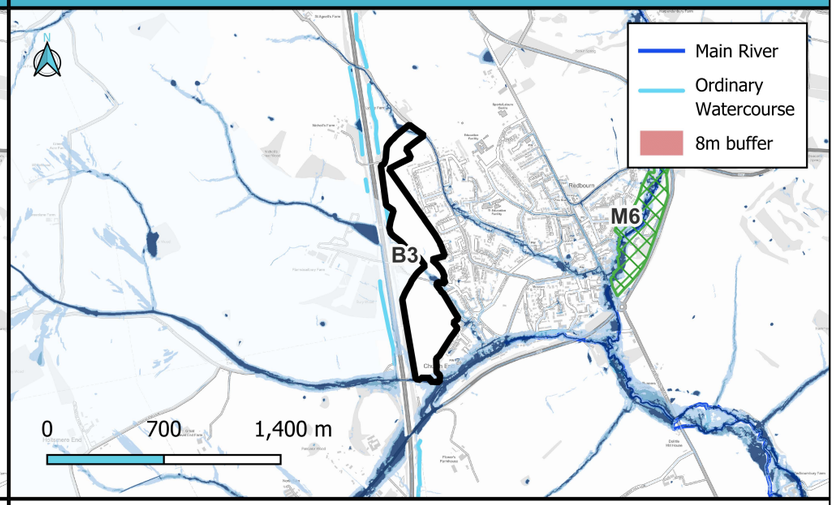
Flood Zone 2 (Between 1% and 0.1% AEP)
Flood Zone 3a (Between 3.33% and 1% AEP)
Flood Zone 3b (Less than 3.33% AEP)
Site boundary
Other site

Flood Zone 3b + Climate Change



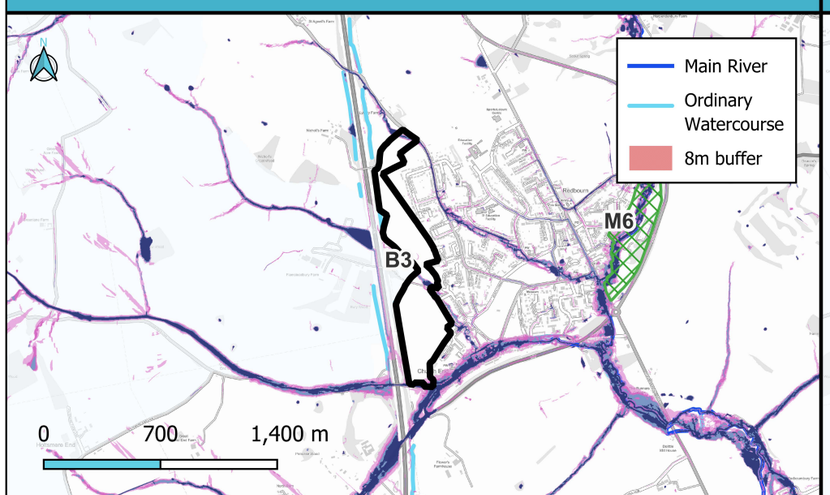
Flood Zone 3b + 21% (Central allowance)
Flood Zone 3b + 35% (Higher allowance)
Flood Zone 3b
Site boundary
Other site

Surface Water Map (RoFSW)



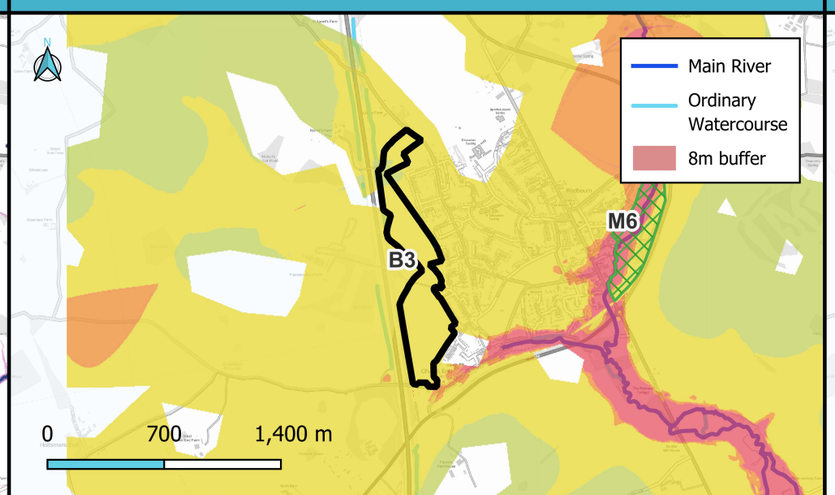
RoFSW 1 in 30-year (3.33% AEP)
RoFSW 1 in 100-year (1% AEP)
RoFSW 1 in 1000-year (0.1% AEP)
Site boundary
Other site

Surface Water Map + Climate Change



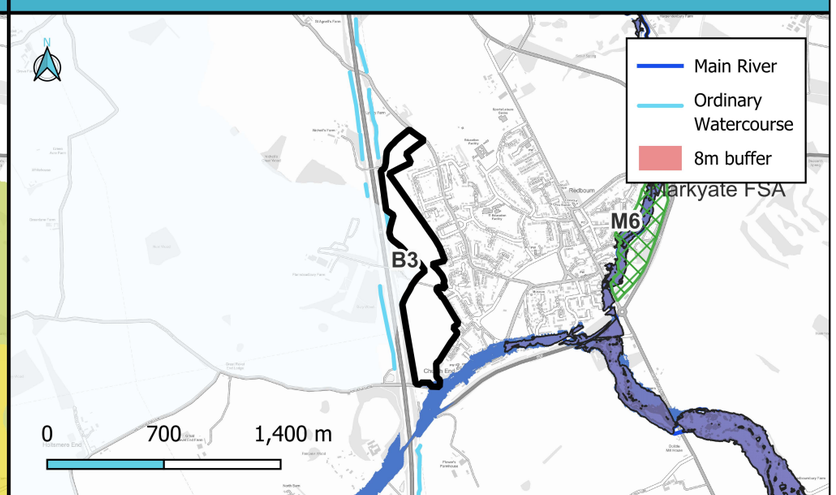
RoFSW 1 in 30-year (3.33% AEP)
RoFSW 1 in 30-year (3.33% AEP) plus 40%
RoFSW 1 in 100-year (1% AEP)
RoFSW 1 in 100-year 1% AEP plus 40%
Site boundary
Other site

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

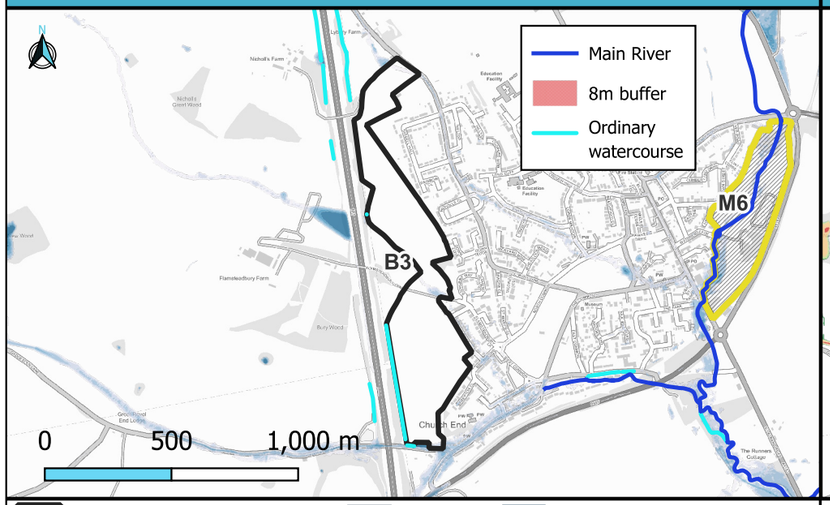


Reservoir 'Dry Day' flood extent
Reservoir 'Wet Day' flood extent
Reservoir - Fluvial contribution to flood extent
Site boundary
Other site

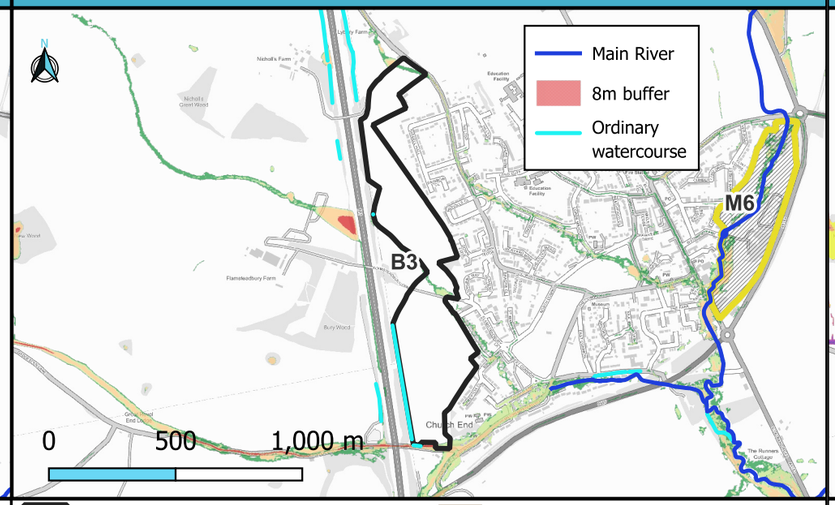
Site Reference	B3
Site Name	West Redbourn, Redbourn, AL3 7HZ

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

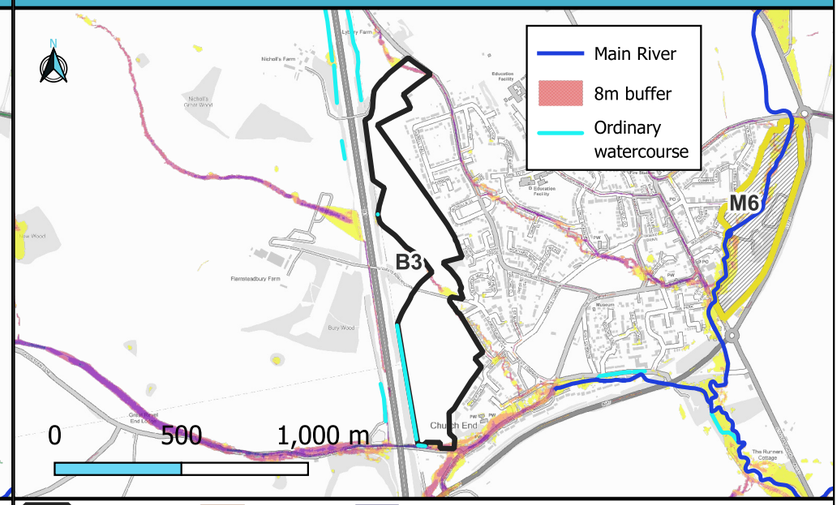
RoFSW Max Depth - 1% AEP



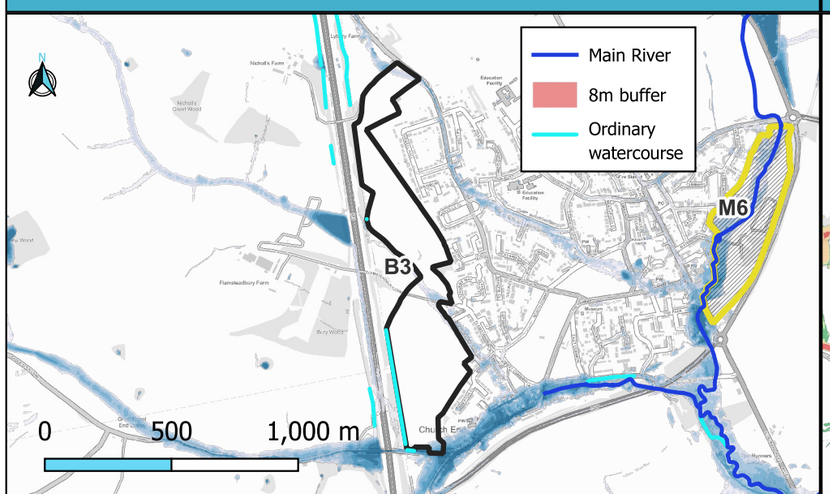
RoFSW Max Hazard - 1% AEP



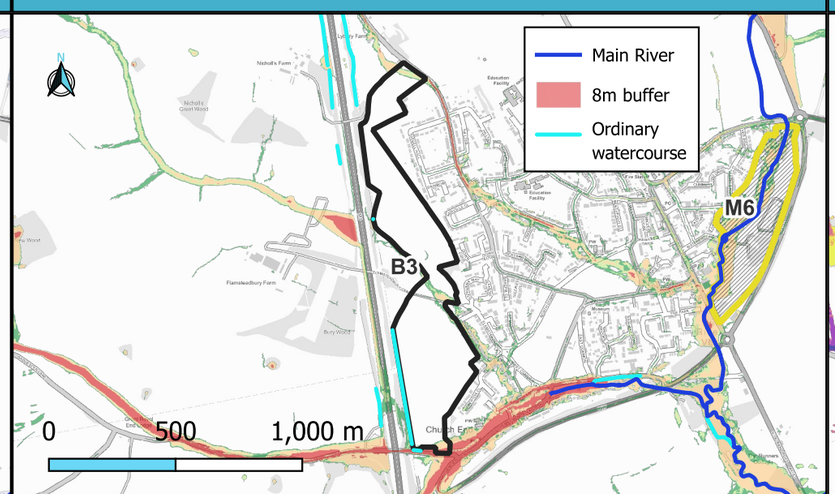
RoFSW Max Velocity - 1% AEP



RoFSW Max Depth - 1% AEP + 40% CC



RoFSW Max Hazard - 1% AEP + 40% CC



RoFSW Max Velocity - 1% AEP + 40% CC