



**Chelmsford City Council Level 2
Strategic Flood Risk Assessment
Detailed Site Summary Tables**

Site details

Site Code	GS1u
Address	Rivermead, Chelmsford
Area	1.61ha
Current land use	Industrial Estate
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable

Sources of flood risk

Location of the site within the catchment	<p>The site is located within the Chelmer Operational Catchment, which is 657.4km², and located on the River Chelmer. This catchment is not designated as artificial or heavily modified. The site is located on two islands in the middle of the River, connected by a bridge, and is therefore bounded by the River Chelmer to the north, south, east and west of the site (flowing south). The river also runs through the centre of the site. These islands are connected to the mainland by a bridge in the southwest of the site.</p> <p>The catchment is predominantly rural, but at the site the River Chelmer has flown through the urban area of Chelmsford City.</p>
Topography	EA LiDAR 1DRM indicates that the site is relatively flat with a maximum elevation of 26.6mAOD in the north of the site and a minimum elevation of 24.4mAOD along the eastern site boundary.
Existing drainage features	<p>The Environment Agency's Statutory Main River Map indicates that the River Chelmer, a main river, runs within the site boundary. This runs along the middle of the site from east to west, part of which is covered by a bridge. There are no Ordinary Watercourses or ditches within the site boundary. The River Chelmer is constrained with development built up almost to the river edge.</p> <p>The site is already developed and so is likely drained by the surface water drainage network.</p>
Critical Drainage Area	The site is not in a critical drainage area.
Fluvial and tidal	<p>The proportion of site at risk FMFP: FZ3 – 60.3% FZ2 – 24.0% FZ1 – 76.0%</p> <p><i>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%).</i></p>

	<p>Defended outputs: 3.3% AEP fluvial event – 20.4% 1% AEP fluvial event – 21.5% 0.1% AEP fluvial event - 55.9%</p> <p><i>Modelled results show the percentage of site at risk from a given AEP flood event.</i></p> <p>Available data: Flood Zones are determined from the Environment Agency’s Flood Map for Planning (FMFP). This represents the undefended scenario.</p> <p>The Environment Agency’s 1D-2D ISIS-TUFLOW detailed hydraulic model for the River Chelmer (2018) has been used within this assessment of fluvial flooding.</p> <p>Flood characteristics:</p> <p>The 3.3% AEP fluvial event shows a small extent of fluvial flooding along the site boundaries, but flooding appears to be constrained to the main river channel. In the 1% flooding encroaches slightly further into the site around the boundaries, but remains confined to the channel.</p> <p>In 0.1% AEP fluvial event fluvial flooding inundates the entire south of the site, with the exception of the bridge which has a higher elevation. Flooding also encroaches slightly further into the site around the boundaries of the northern island, however is mostly confined to the channel. The maximum depth on the flooded southern island is approximately 0.4m and the maximum velocity is approximately 0.5m/s. The maximum hazard on the southern island is ‘Danger for most’.</p> <p>The site is not considered to be at risk from tidal flooding.</p>
<p>Surface Water</p>	<p>Proportion of site at risk (RoFfSW): 3.3% AEP – 0.2% Max depth – N/A Max velocity – N/A 1% AEP – 2.6% Max depth – 0.60-0.90m Max velocity – 1.00-2.00m/s 0.1% AEP – 8.5% Max depth – >1.20m Max velocity – 1.00-2.00m/s</p> <p><i>The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %).</i></p> <p>The Environment Agency’s Risk of Flooding from Surface Water mapping was used in this assessment.</p> <p>Description of surface water flow paths:</p> <p>There is limited surface water risk to the site in all modelled scenarios. The site is not at risk from surface water flooding in the 3.3% AEP event.</p>

	In the 1% an 0.1% AEP events, surface water flooding is limited to the immediate vicinity of the channel of the River Chelmer, and the majority of the site is unaffected.
Reservoir	<p>According to the Environment Agency's (EA) risk of flooding due to reservoirs dataset, there is no risk of flooding in the 'Dry Day' scenario.</p> <p>The bridge and eastern boundary are at risk of reservoir flooding in the 'Wet Day' scenario, from the Chignal Hall Farm, Handley Barns Farm (Private Individual), and Mashbury Hall Fram (CJH Framing Ltd) Reservoirs cover part of the centre and boundary of the site.</p> <p>The risk designation of Chignal Reservoir has not yet been determined while the others have been determined to be high risk, therefore, in the very unlikely event that the reservoirs fail, there is a risk to life.</p>
Groundwater	<p>The JBA Groundwater Emergence Risk Map, is provided as 5m resolution grid squares.</p> <p>The whole site is shown to have negligible risk of groundwater emergence in this area, and any groundwater flooding incidence has a chance of less than 1% annual probability of occurrence. 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.</p>
Sewers	<p>Sewer flooding records were not available for this assessment. The entirety of Chelmsford is identified as a Flood priority catchment in Anglian Water's Drainage and Wastewater Management Plan (DWMP). Developers should consult Anglian Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits in line with the long term strategic aims set out in the DWMP.</p>
Flood history	<p>The Environment Agency's Historic Flood Map shows records of flooding on the site, associated with the River Chelmer.</p> <p>Essex County Council as LLFA has one record of flooding within 500m of the site. This lies approximately 325m to the southeast of the site although the date and source of this flooding has not been recorded.</p>
Flood risk management infrastructure	
Defences	<p>The Environment Agency AIMS dataset shows that there are no formal defences within the site boundary. There are no formal defences upstream of the site.</p> <p>The site does not lie within the Environment Agency's reduction in risk of flooding from rivers and sea dataset.</p> <p>The Margaretting Flood Alleviation Scheme to safeguard the city centre was cancelled in March 2022. The risk from flooding remains. The City Council continues to work with the Environment Agency to supplement existing flood defences and deliver a new series of catchment-based measures under the Chelmsford Flood Resilience Partnership. Developers should consult the Environment Agency to find out whether this site will be affected by this flood alleviation scheme. Sites affected by flood risk should devise an FRA on the basis that existing city centre flood defences are in place and, if sufficiently advanced, the catchment-based measures identified by the Chelmsford</p>

	<p>Flood Resilience Partnership project. In either scenario a financial contribution to the Chelmsford Flood Resilience Partnership project would be required.</p> <p>Developers should consult with Chelmsford City Council and the Environment Agency to identify whether land within the site boundary may need to be safeguarded for flood defences in future. If defences are proposed as part of the development, maintenance arrangements (including funding mechanisms) for the defences will need to be demonstrated for the lifetime of development.</p>
<p>Residual risk</p>	<p>The natural high ground upstream along the Chelmer Channel is recorded to protect to a 1% AEP flood event, although modelling suggests the standard of protection is lower. The most recent Visual Asset Inspection (16 April 2023) found that the natural high ground protecting the site was in good condition.</p> <p>The residual risk to the site posed by failure of flood defences, including overtopping and breach must be considered in a site-specific Flood Risk Assessment if defences are proposed to protect the site. Maintenance arrangements (including funding mechanisms) for the defences will need to be demonstrated for the lifetime of development, this will need to include how the existing defences can be improved and fixed.</p>
<p>Emergency planning</p>	
<p>Flood warning</p>	<p>The entire site is located in both an Environment Agency Alert Warning Area, and an Environment Agency Flood Warning Area.</p> <p>Flood Alert Area: 051WAFEF6A (The River Chelmer from Great Dunmow to Rivermead campus and the Industrial Estate in Chelmsford).</p> <p>Flood Warning Area: 051WAFEF6A (The River Chelmer from Great Dunmow to Rivermead campus and the Industrial Estate in Chelmsford).</p>
<p>Access and egress</p>	<p>Access and egress to the site is currently via an access road off Ransomes Way on the eastern site border, across bridges.</p> <p>Access and egress are impacted by surface water flooding in the 3.3% AEP plus climate change event and more extreme events. The maximum depth of flooding in the 3.3% AEP plus climate change event is approximately 0.3m and the maximum velocity is approximately 1.7m/s. The maximum depth is approximately 0.4m and the maximum velocity is approximately 2.7m/s for the 1% AEP plus climate change. The maximum depth of this flooding is approximately 0.8m and the maximum velocity is approximately 3.5m/s for the 0.1% AEP plus climate change. These depths and velocities are occurring on the access road leading to the bridge on the southeast of the site boundary. All AEP events have a hazard score of 'Risk to Most', and are likely to significantly limit access to the site.</p> <p>Access and egress are impacted by the 3.3% fluvial AEP events and more extreme events. Access to the site is currently via two bridges and if these become unpassable due to flooding, access and egress will not be possible. Furthermore, during the 0.1% AEP event the entire southern island is flooded, and the northern island will be cut off.</p> <p>Arrangements for safe access and egress will need to be demonstrated for 1% AEP plus an appropriate allowance for climate change surface water and fluvial events, using the depth, velocity, and hazard outputs. Given the considerable risk to the</p>

	<p>site during the surface water and fluvial scenarios, consultation with RMAs early on should be implemented to ensure an appropriate flood evacuation plan is put in place for the site.</p>
<p>Dry Islands</p>	<p>The site is located on two islands in the centre of the river Chelmer and has the potential to become a dry island if access bridges become unpassable during a flood event.</p>
<p>Climate change</p>	
<p>Implications for the site</p>	<p>Management Catchment: Combined Essex Management Catchment</p> <p>Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding.</p> <p>Fluvial</p> <p>The River Chelmer (2018) model has available climate change outputs for the Lower, Central and Upper End allowances for the 2080s.</p> <p>The 1% fluvial AEP event plus upper climate change is very similar in extent and velocity to the 0.1% fluvial AEP event. However, the maximum depth increases by 0.9m. This indicates that the site is less sensitive to climate change.</p> <p>Surface Water:</p> <p>The latest climate change allowances have also 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.</p> <p>The 1% AEP plus climate change event impacts the site to a slightly larger extent however surface water flooding remains limited to the very edges of the site, associated with the River Chelmer.</p> <p>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.</p>
<p>Requirements for drainage control and impact mitigation</p>	
<p>Broad-scale assessment of possible SuDS</p>	<p>Geology & Soils</p> <ul style="list-style-type: none"> • Geology at the site consists of: <ul style="list-style-type: none"> ○ Bedrock Geology- London Clay Formation consisting of clay, silt and sand. ○ Superficial Geology- Alluvium consisting of clay, silt, sand and gravel. • Soils at the site consist of: <ul style="list-style-type: none"> ○ loamy and clayey floodplain soil with naturally high groundwater. ○ freely draining and slightly acidic loamy soil to the north of the site. <p>SuDS</p>

- The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
- BGS data indicates that the underlying geology is a mixture of clay, silt, sand, and gravel which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
- The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
- The site is not located within a historic landfill site.
- It is advisable that attenuation features such as basins, ponds and tanks, are located outside of Flood Zone 2. This is to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into the River Chelmer may be susceptible to surcharging due to water levels in the River Chelmer.
- Proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 3 to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into the River Chelmer may be susceptible to surcharging due to water levels in the River Chelmer. The impacts of flood flows will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls.
- 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 that there are no surface water flow paths, during any AEP event. However, there is ponding in the 1% and 0.1% AEP events. Existing ponding 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.
- Implementation of SuDS at the site could 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 (LPA, LLFA and EA) 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

	<p>quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.</p> <ul style="list-style-type: none"> • 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.
<p>Opportunities for wider sustainability benefits and integrated flood risk management</p>	<ul style="list-style-type: none"> • Implementation of SuDS at the site could 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 (LPA, LLFA and EA) 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. • SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and should be supported by an appropriately detailed maintenance and operation manual.
<p>NPPF and planning implications</p>	
<p>Exception Test requirements</p>	<p>The site is classified as more vulnerable and is within Flood Zone 2, therefore the Exception Test is required for this site. Particular attention will need to be given to ensuring safe access and egress can be provided given the sites location in the middle of the River Chelmer.</p>
<p>Requirements and guidance for site-specific Flood Risk Assessment</p>	<p>Flood Risk Assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific FRA will be required as the proposed development site is: <ul style="list-style-type: none"> ○ Within fluvial Flood Zones 2 and 3 ○ Greater than one hectare ○ At risk of other sources of flooding (surface water and reservoir) • All sources of flooding should be considered as part of a site-specific FRA, including consideration of the residual risk from a failure or overtopping of any proposed defences. • Consultation with Chelmsford City Council, Essex County Council, Anglian 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); and the Council's Local Plan Policy's and SuDS Strategy. • The development should be designed with mitigation measures in place where required. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • 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

	<p>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).</p> <ul style="list-style-type: none"> • 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 pre-development greenfield rates. • Arrangements for safe access and egress will need to be provided for the 1% AEP fluvial and rainfall events with an appropriate allowance for climate change, considering depth, velocity, and hazard. Design and access arrangements will need to incorporate measures, so development and occupants are safe. Given the significant risk to the site and proximity to the watercourse, a flood warning and evacuation plan should be prepared for the site. See Section 8.6 of the Level 1 SFRA for details of the requirements for plans. • Provisions for safe access and egress should not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk. • Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels and use of boundary walls. These measures should be assessed to make sure that flooding is not increased elsewhere.
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Key messages

The site is located on two islands in the centre of the watercourse, is partly within Flood Zones 2 and 3, and is at significant risk form fluvial flooding. Therefore, the Exception Test will need to be passed before the site can be bought forwards. With regards to the flood risk portion of the Exception Test, development may be able to proceed if:

- Development is steered away from the south of the site, at risk of deep flooding in the 1% and 0.1% fluvial AEP events.
- 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 in the fluvial and surface water 1% AEP plus climate change events. This will need to carefully consider how access can be ensured during extreme events, given the sites location across two islands. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. Given the significant risk to the site at the 0.1% AEP events, a suitable flood warning and evacuation plan will be required.
- A site-specific FRA demonstrates that site users will be safe throughout the lifetime of the development and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- 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).

Mapping Information

The key datasets used to make planning recommendations for this site were the Environment Agency's Flood Map for Planning, the Environment Agency's Risk of Flooding from Surface Water map and the Environment Agency's River Chelmer model. More details regarding data used for this assessment can be found below.

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	<p>The central and upper end allowances were available for the River Chelmer (2018) hydraulic model to indicate the impacts on fluvial flood risk.</p> <p>The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.</p>
Fluvial and tidal extents, depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the River Chelmer (2018) hydraulic model.
Surface Water	The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding.
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.