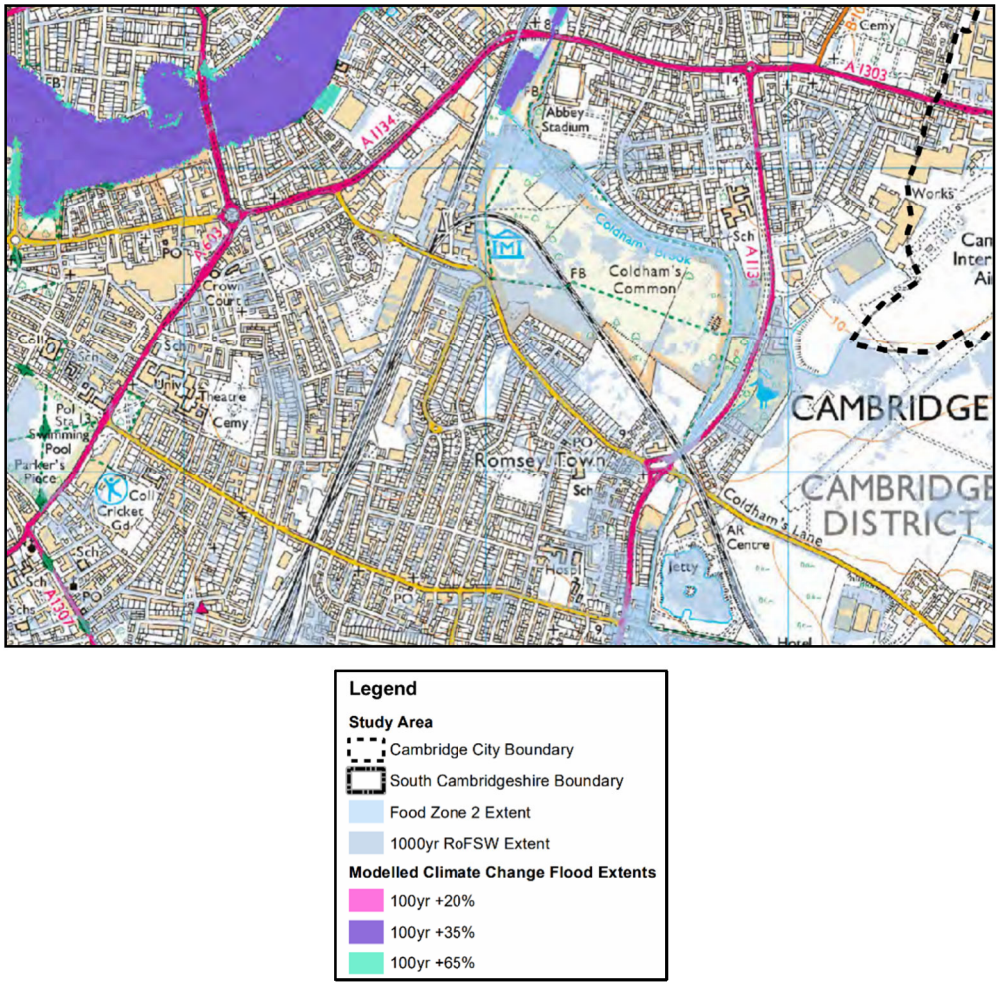
Climate Change Effects

4.4. Appendix D4 of the Level 1 SFRA confirms that the risk of fluvial flooding remains very low at the Site even taking into account the 1 in 100 annual probability event with an overly onerous 65% uplift in peak flood flows to represent future climate change effects. Refer to mapping extract in Figure 5.

Figure 5: SFRA Modelled Climate Change Extents Map Extract



Surface Water Flooding & Overland Flow

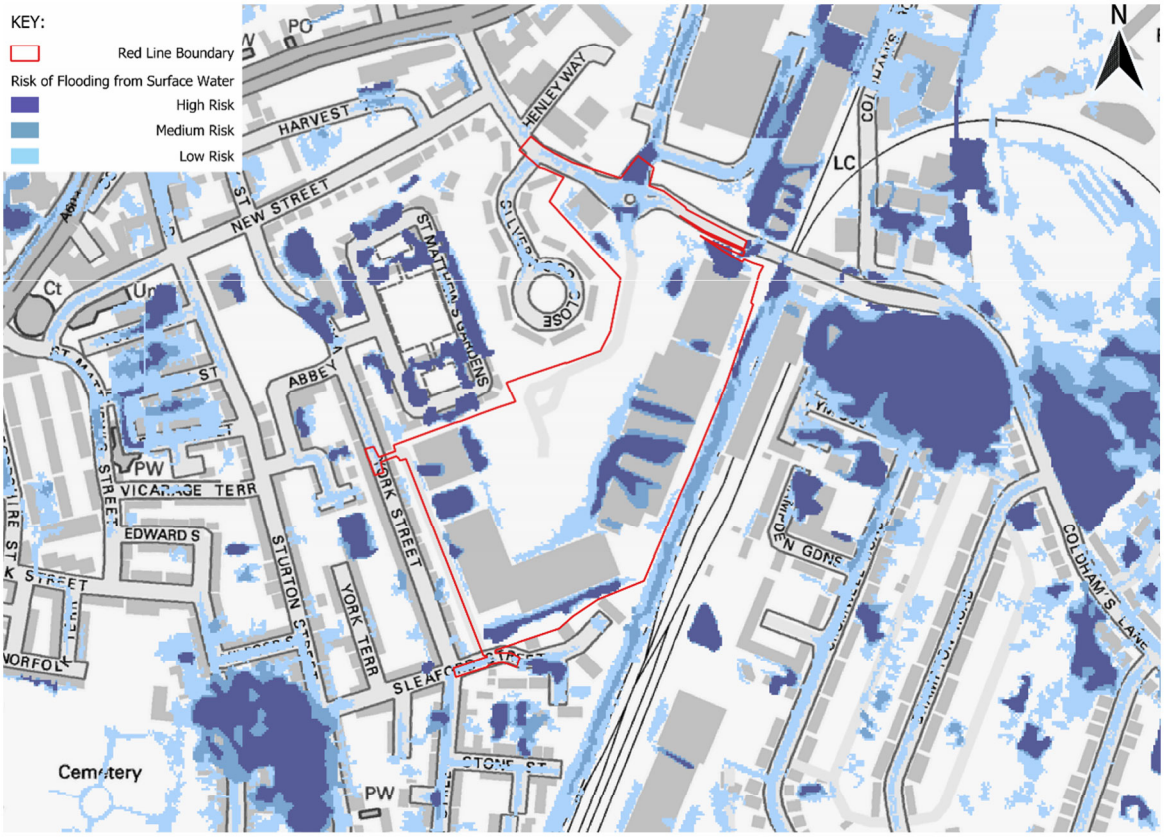
4.5. SFRA mapping records various incidents of Surface Water Flooding (Pluvial) in Cambridge. However, no incidents of Surface Water Flooding are reported at, or in close proximity to, the Site.

4.6. Mapping presented within the Cambridge and Milton Surface Water Management Plan – Detailed Assessment and Options Appraisal Report (SWMP) indicates that the Site lies outside (to the south west of) the designated boundary of the 'Cherry Hinton Wetspot', an area shown to be at elated risk of surface water flooding. SWMP mapping largely mimics the EA and SFRA mapping.

4.7. Surface water modelling has been undertaken by the EA in order to seek to establish areas at risk of surface water flooding based upon latest hydrological techniques and surface terrain data.

Extracts from the Long Term Flood Risk Information (LTFRI) Surface Water Flood Maps are presented in Figure 6 - 10 which confirms that the majority of the Site is designated as being at a 'very low' risk of surface water flooding.

Figure 6: Surface Water Flood Extents



High Risk – Chance of flooding greater than 1 in 30
Medium Risk – Chance of flooding between 1 in 30 and 1 in 100
Low Risk – Chance of flooding between 1 in 100 and 1 in 1000
Very Low Risk – Chance of flooding less than 1 in 1000

4.8. For surface water events with a chance of occurrence of between 1 in 30 and 1 in 100, flood depths across localised lowest lying car park areas and along lowered walkways between retail units are predicted to remain below 300mm and can be classed as shallow surface 'ponding'. Refer to Figure 7 and Figure 8.

4.9. Even for the most significant surface water events with a chance of occurrence of between 1 in 100 and 1 in 1000, flood depths across a narrow strip of the lowest lying car park areas and along lowered walkways between retail units are predicted to remain below 300mm. Only very localised external areas at the very north eastern corner of the Site and within the south eastern extent of the car park are predicted to flood depths just exceeding 300mm. Refer to Figure 9 and Figure 10.

4.10. No significant overland flood flow pathways across the Site are evident from published mapping or consideration of local topography. Movement and velocity of flood flows in a north easterly direction across the Site surface are predicted to be minor as they are interrupted and managed by the presence of topographical valleys comprising channel drainage. Any residual overland flood flows are naturally conveyed northwards away from the Site following the natural topography. Refer to Figures 7 - 10.

4.11. Track levels along the railway are generally at a slightly lower elevation than the Site and therefore naturally provide a preferential flow pathway for runoff generated from off-site areas to the east.

4.12. Highway levels bounding the southern and north-eastern extents of the Site are all at a higher elevation than the Site itself, however, road surfaces are generally cambered away from the Site and intermediate footpath levels are elevated thus providing resistance to off-site overland flood flows entering the Site.

4.13. Based upon the above, it is considered that the risk of surface water flooding is low at the present day and remaining low over the anticipated lifetime of the Proposed Development incorporating allowances for climate change. This is validated by Appendix D4 of the Level 1 SFRA mapping (refer to Figure 5) which only identifies localised south eastern and north eastern portions of the Site as being at risk of surface water flooding for the 1 in 1,000 year event used as conservative way of representing future climate change effects upon the 1 in 100 year storm event.

Figure 7: Surface Water Flood Depth (Medium Risk Scenario)

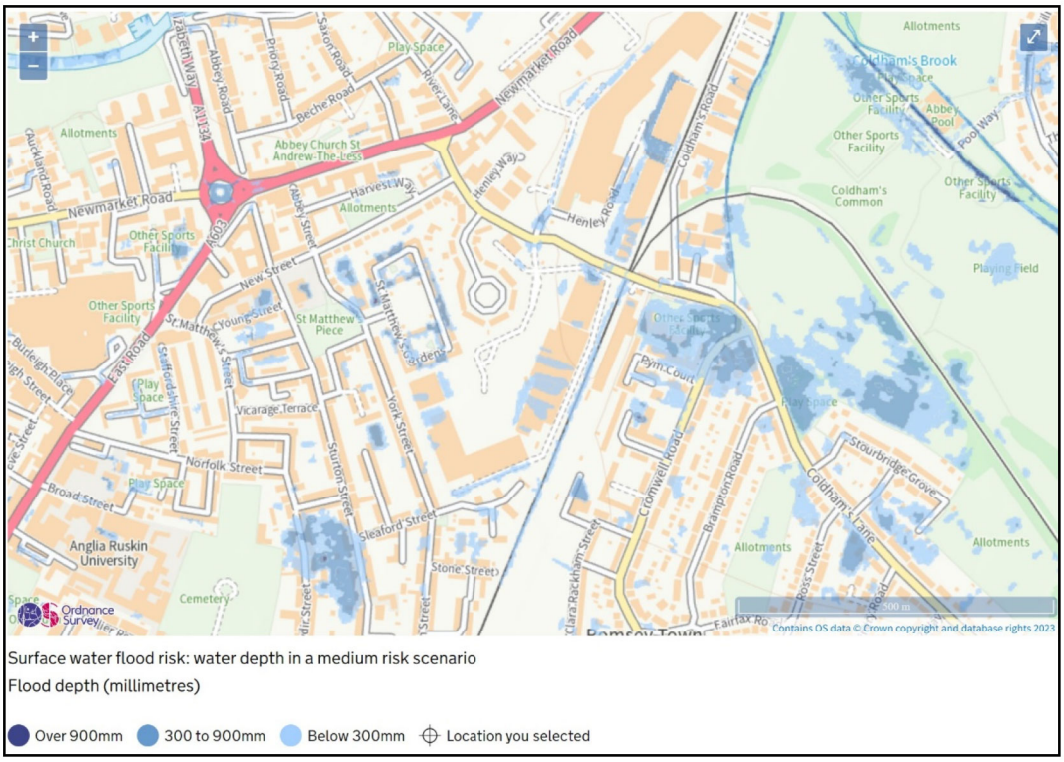


Figure 8: Surface Water Flood Velocity (Medium Risk Scenario)

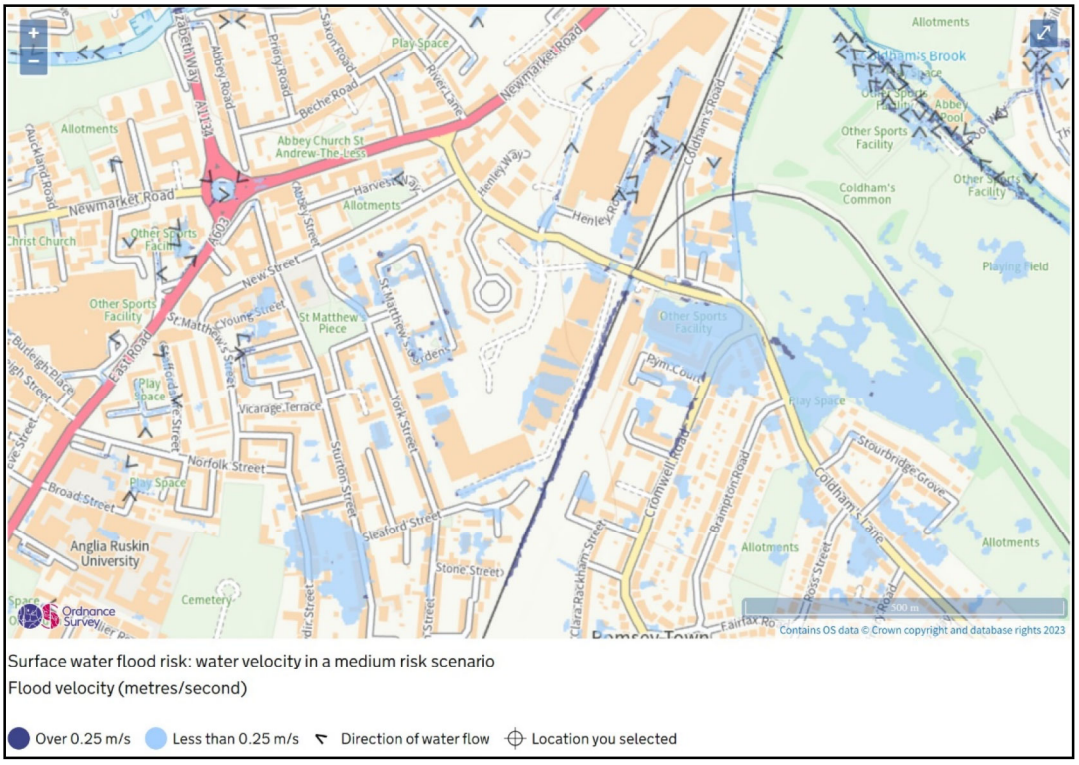


Figure 9: Surface Water Flood Depth (Low Risk Scenario)

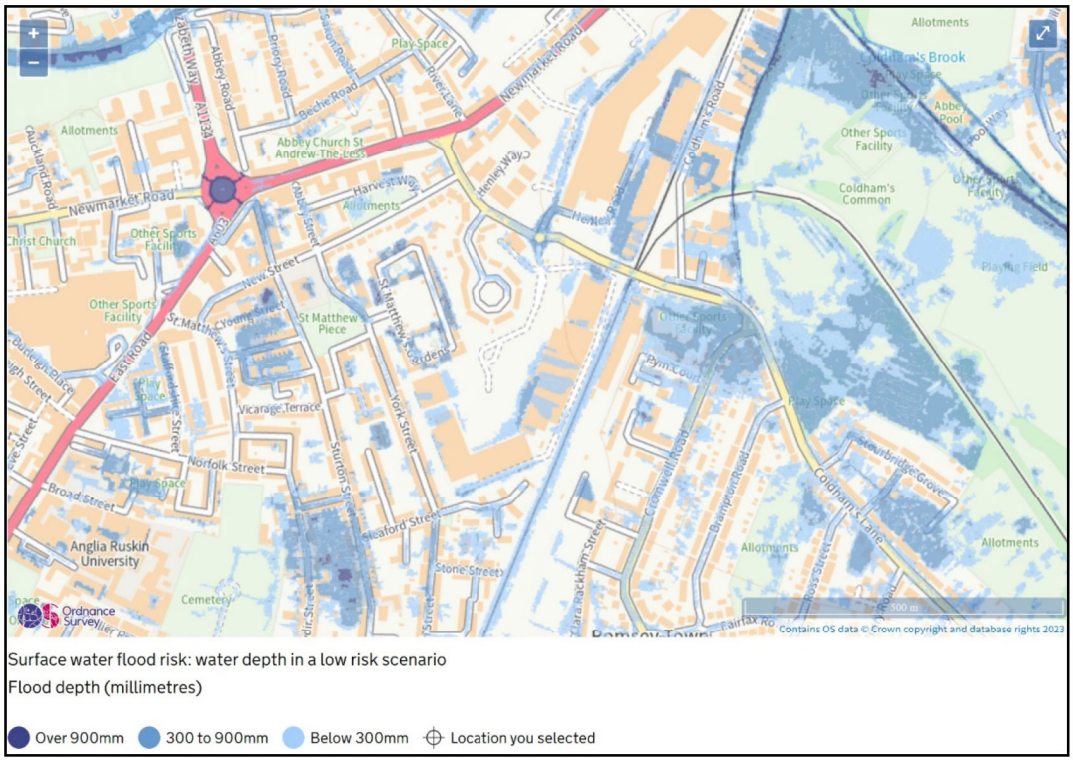
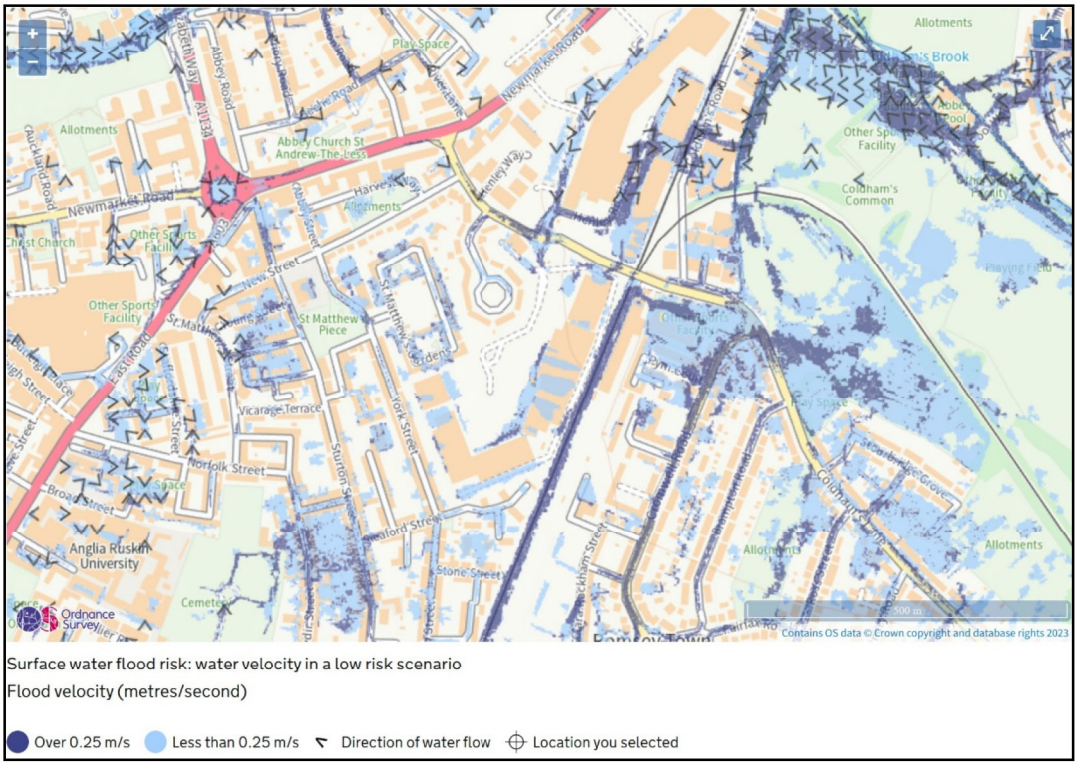


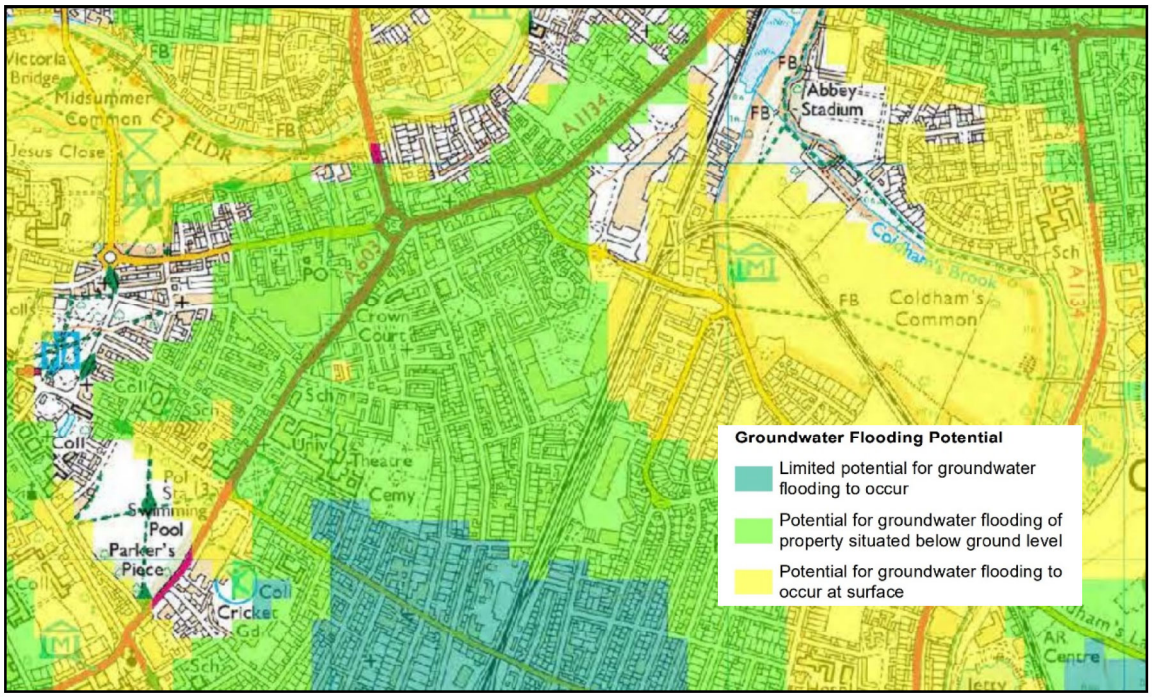
Figure 10: Surface Water Flood Velocity (Low Risk Scenario)



Groundwater Flooding

4.14. Based upon Appendix D10 of the Level 1 SFRA the majority of the Site is shown to be at low potential for groundwater flooding. The majority of the Site is designated as having *'Potential for groundwater flooding of property situated below ground level'* which is typical of an area with a relatively shallow groundwater table. Refer to extract in Figure 11.

Figure 11: Groundwater Flooding Potential



4.15. It is evident from local topography that the Site does not lie in a topographic depression in which groundwater could emerge and inundate the Site after progressing overland.

4.16. Based upon limited evidence of flooding incidents in the locale, the presence of Made Ground beneath the Site almost entirely covered by impermeable surfacing, the risk of groundwater emergence resulting in inundation of buildings is considered to be very low at the present day and remaining low over the anticipated lifetime of the Proposed Development incorporating allowances for climate change.

4.17. Despite the overall low risk, it is prudent to consider some basic mitigation measures to ensure the lower ground floors remain dry and functional. Ensuring that the lower ground floors are adequately waterproofed using appropriate membranes and sealants.

4.18. Additionally, designing the structure to withstand hydrostatic pressure from potential groundwater and using materials resistant to water damage for lower ground floor constructions will enhance resilience. Incorporating allowances for climate change in the design to account for potential future changes in groundwater levels and developing an emergency response plan to address potential groundwater flooding scenarios, even if they are deemed unlikely, will provide added security and peace of mind for the lower ground floors of the proposed development.

Sewer & Water Main Flooding

4.19. Based upon Appendix D11 of the Level 1 SFRA, the Site lies within an area of *'2-5 recorded incidents of sewer flooding'* which represents one of the lowest risk bands. As a result, the Site can be deemed to be at low risk of flooding from public sewers.

4.20. Asset records indicate the presence of a short section of 375mm diameter public surface water sewer that traverses an existing area of soft landscaping at the very northern tip of the Site just to the east of the Coldham's Lane access. Refer to Figure 12.

4.21. The 375mm diameter public surface water sewer conveys flows in an easterly direction beneath Coldham's Lane just to the north of the Site. Immediately adjacent to the north eastern boundary of the Site, the sewer increases to 525mm diameter. A 525mm diameter public foul sewer conveys flows in a westerly direction beneath Coldham's Lane. Refer to Figure 12.

4.22. A 525mm diameter public surface water sewer and 300mm diameter public foul sewer convey flows in a north westerly direction beneath York Street adjacent to the south western boundary of the Site. Refer to Figure 13.

4.23. Coldham's Lane highway surfaces are generally cambered away from the Site and intermediate footpath levels are elevated thus providing resistance to overland flood flows from surcharged sewers entering the Site. Whilst the York Street highway is elevated above the Site, overland flood flows from surcharged sewers would tend to progress northwards following the local topography rather than enter the Site. Based upon the above, it is considered that the risk of sewer flooding is very low at the present day and remaining low over the anticipated lifetime of the Proposed Development incorporating allowances for climate change.

4.24. Public water main records indicate the presence of potable water mains routed beneath the Coldham's Lane and York Street carriageways. Other water mains in the locale are nominal bore.

4.25. Burst water mains and failure of public sewerage infrastructure could inherently pose a residual risk to any site, and are not specifically covered within a FRA. However, risk to the Site is considered to be low due to the natural sloping topography providing pathways for excess flows from burst mains to progress overland away from the Site towards lower lying land.

4.26. Existing private drainage arrangements are covered further within Chapter 6 of this report. Excess surface water ponding would be readily accommodated at shallow depth across the extensive areas of car parking. Flood risk to the Site from the existing private foul drainage arrangements, which incorporate a small package foul pumping station in the south east of the Site, is considered to be low. Even in the event of failure or blockage of the pumping station, or power outage, excess flows from the network would tend to be accommodated within the service yard located a few metres downgradient.

Figure 12: Public Sewer Records Extract (North)

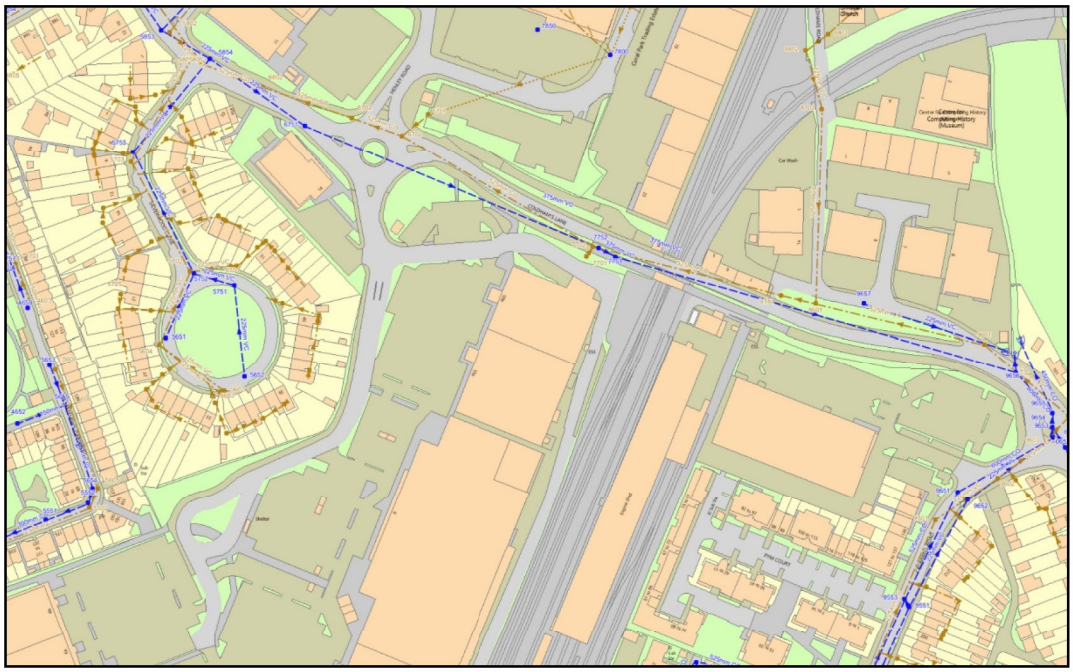
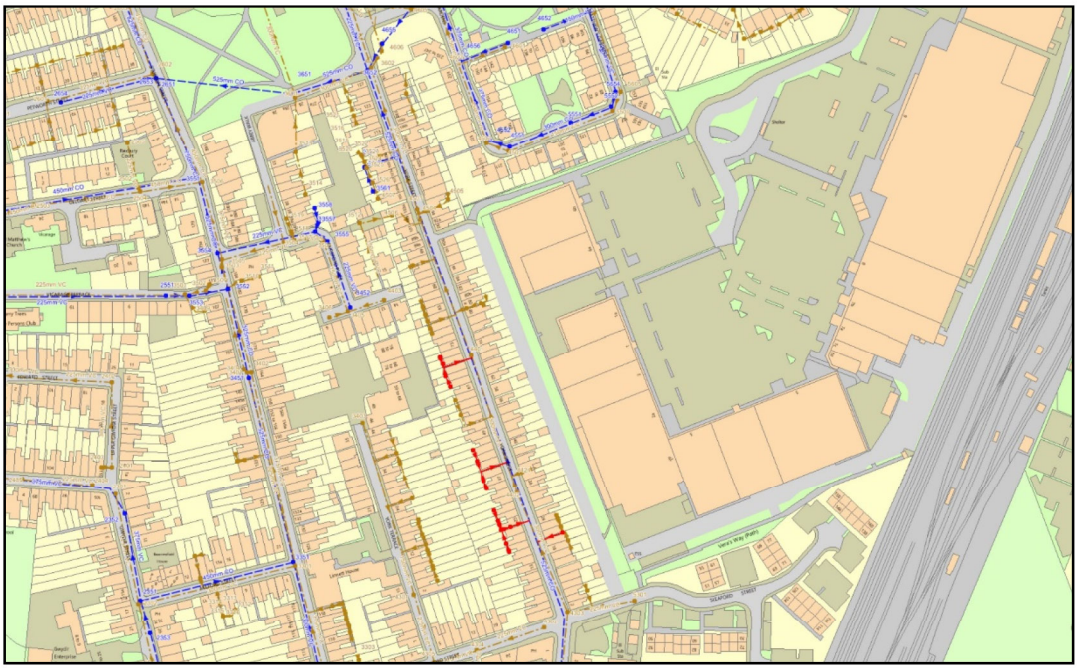


Figure 13: Public Sewer Records Extract (South)



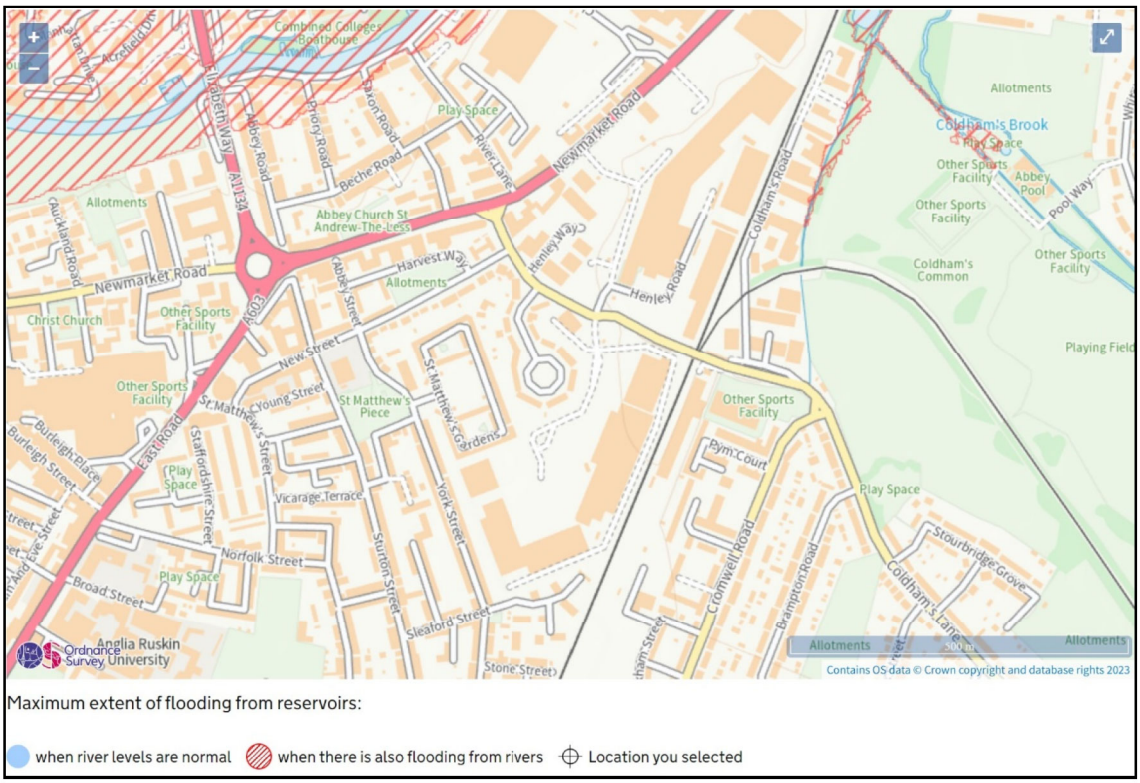
Flooding from Canals and Artificial Sources

4.27. There are no Canals or Artificial Waterbodies within close proximity to the Site, therefore, the risk of flooding from breach of Canal embankments or walls is considered to be very low.

Flooding from Reservoirs

4.28. Based upon LTFRI mapping and Appendix D9 of the Level 1 SFRA, the Site is not deemed to be at risk of flooding from reservoir embankment breach (failure). Refer to Figure 14.

Figure 14: Reservoir Flood Risk (Floodwater Depth)



Flood Risk to Off-Site Areas

Floodplain Storage Displacement

4.29. No functional floodplain or active flood storage is displaced as a result of the proposed scheme (as the proposed building footprint lies outside of predicted floodplain extents); therefore, no specific mitigation measures in the form of compensatory flood storage need to be specified.

Regrading of Existing Levels

4.30. Minor reprofiling of land is anticipated; thereby overland flow routes will not be materially affected by the proposed scheme. Risk to off-site areas would not be detrimentally affected.

Surface Water Runoff

4.31. Hardstanding areas draining to off-site sewers and watercourses will remain at, or below, the coverage of existing arrangements, and existing drainage connections will also remain in-situ,

therefore no detrimental impacts upon drainage or downstream hydrology would be anticipated 'without mitigation'.

4.32. In accordance with the requirements of the NPPF, Local Plan policies, and SFRA guidance, 'post development' runoff rates will be restricted to those rates generated by the 'pre-developed' site, or less, for up to and including the critical 1% annual probability storm event taking into account the impacts of climate change (applied as a 40% uplift in peak rainfall intensity) for the lifetime of the Proposed Development.

4.33. Furthermore, with the implementation of rainwater harvesting and reuse, and a suite of sustainable drainage (SuDS) measures, together with an uplift in soft landscaping post-development, the overall volume of surface water discharged into the public drainage network will be reduced post-development.

4.34. Potential measures for offsetting the impacts of climate change on surface water runoff over the lifetime of the Proposed Development are described in Section 6.

Foul Flows

4.35. Foul flows generated by the Proposed Development will be discharged to the local public foul sewer system via the existing Cambridge Retail Park sewer network.

4.36. Foul flows generated by the Proposed Development will represent a material increase on pre-development rates owing to the nature of the land uses.

4.37. A Pre-Development Enquiry has been submitted to Anglian Water owing to the uplift in average foul flow anticipated from the Proposed Development. Sufficient capacity is expected to be available within the existing 525mm diameter public sewer beneath Coldham's Lane to accommodate the increase in flows. This will be verified with Anglian Water at the appropriate time.

4.38. Treatment capacity at the Milton Water Recycling Centre (WRC) is understood to be limited at the present time, although schemes and strategies are programmed to enable Anglian Water to facilitate anticipated levels of population growth over the anticipated lifetime of the Proposed Development.

4.39. By accepting the anticipated uplift in flows attributed to the proposed development, Anglian Water would inherently take on the responsibility for reinforcing their sewerage network so as not to result in an increased risk of offsite flooding post-development.

5. Proposed Flood Management Measures

Finished Floor Levels & Level Differentials

5.1. Finished floor level for the ground floor of buildings across the Proposed Development will be set between 12.20m AOD adjacent to the southern boundary, gradually reducing in a northerly direction to 9.80m AOD adjacent to the north eastern boundary.

5.2. 'Flush access' is required at key points around building perimeters to allow unhindered access to the main entrance doorway and service yard door.

5.3. Aside from the points of doorway access, a minimum level differential of 150mm will be maintained along the building perimeter to provide a degree of 'freeboard' to prevent the ingress of any overland flow from surface water into the proposed buildings over the lifetime of the Proposed Development by providing a level differential above shallow overland flood flow routes.

5.4. Where the level differential cannot be achieved along the building perimeter it will be provided at the interface between the outer edge of the development platform, or pathway, and external landscape or car parking areas.

Lower Ground Floor Threshold Levels

5.5. Lower ground floors are proposed beneath selected buildings to provide car parking, cycle storage plant rooms, servicing, and general storage. Despite the low risk of flooding anticipated at the Site threshold levels for entrances to lower ground floor areas, including ramped access for vehicles, will be raised a minimum of 150mm above adjacent external ground levels to provide a degree of 'freeboard' to prevent the ingress of any overland flow from surface water into the proposed lower ground floor areas over the lifetime of the Proposed Development by providing a level differential above shallow overland flood flow routes.

Flood Resilience

5.6. Due to the low risk of flooding anticipated at the Site no formal flood resilience measures are deemed to be required at ground floor level within the buildings.

5.7. In the event that adequate level differentials are unable to be achieved careful consideration will be given to the introduction of flood resilient materials within the flooring, construction materials, and surface finishes at ground floor.

5.8. Careful consideration will be given to flood resilient construction materials, and surface finishes at lower ground floor for areas that could potentially be vulnerable in the event of ingress of floodwater during extreme events.

5.9. Lower ground floors will be formed using 'tanked' construction techniques, incorporating waterproofing measures as appropriate, to mitigate against ingress of groundwater.

Overland Flow Mitigation

5.10. The elevation of the buildings in relation to external ground levels will allow any existing overland flow paths to remain unhindered. This allows floodwater to be routed around and away from the buildings as per the baseline scenario.

5.11. No further mitigation is required to address potential overland flows.