City of Wolverhampton Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details	
Site Code	**E25**
Address	South Citadel Junction, Murdoch Road, Bilston
Area	3.25ha
Current land use	Brownfield with green areas
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the east of Murdoch Road, which borders the western site boundary, with the A444 (Black Country New Road) bordering the eastern boundary. The site is in a predominantly urban area, with commercial buildings to the north and west of the site and residential areas to the south and east. The site is located in the Darlaston Brook catchment, which is a tributary of the River Tame. The Darlaston Brook is approximately 70m north of the site, where the brook rises. The Darlaston Brook then flows approximately 1.3km north-east towards its confluence with the River Tame. The Darlaston Brook drains approximately 1.9km^2 at the site. Additionally, the Walsall canal is approximately 50m west of the site.
Topography	Environment Agency 1m resolution LiDAR across the site shows that there are two distinct areas of high ground within the site but is on otherwise flat ground. The highest point of elevation within the site is 134.9m AOD on the western area of high ground, and the lowest elevation is 122.7m AOD where there is a slope at the southern boundary. The site is situated within a densely populated, developed urban area and LiDAR data is unlikely to be representative of the actual site topography, this may have an impact on some of the flood risk datasets used in this assessment. It is recommended that developers undertake a new topographic survey at the site.
Existing drainage features	The site is near the Darlaston Brook and Walsall Canal, and as a brownfield site it is likely to drain into the surface water sewer network, which is in turn is likely to then drain into the River Tame. There are no other drainage features in the vicinity of the site.
Critical Drainage Area	The site is not located within a Critical Drainage Area (CDA).
Fluvial	**The proportion of site at risk FMFP:** **FZ3 – 17.53%** **FZ2 – 24.61%** **FZ1 – 75.39%** *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:** Flood Zones are determined from the Environment Agency's Flood Map for Planning (FMfP). **Flood characteristics:** Flood Zone 2 encroaches the site at the north-western corner and then covers the south-western area of the site with further encroachment along the southern/south-eastern boundary. Flood Zone 3 extents are predominantly in the south-western area of the site with minor encroachment along the western boundary and south-eastern boundary. It is likely that the Flood Zones do not accurately represent the flood risk at the site due to the modelling based on LiDAR/topography which appears to be inaccurate for the site and the surrounding areas. It is recommended that developers undertake an Integrated Catchment Model (ICM) at the site to accurately assess flood risk to the site as part of a site-specific FRA.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0.38% Max depth – 0.15 – 0.3m Max velocity – <0.25m/s **1% AEP** – 1.76% Max depth – 0.3 – 0.6m Max velocity – <0.25m/s **0.1% AEP** – 5.13% Max depth – 0.3 – 0.6m Max velocity – <0.25m/s *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. 1% AEP event includes the 3.3% AEP event).* **Available data:** The Environment Agency's Risk of Flooding from Surface Water mapping was used in this assessment. **Description of surface water flow paths:** The site is predominantly affected by the 0.1% AEP event, although risk to the site remains relatively low. In the 3.3% AEP event there is one instance of ponding close to the western boundary where depths are between 0.15 to 0.3m and a velocity less than 0.25m/s. The 1% AEP event has the ponding at the western boundary with a flow path at the central northern boundary and encroachment at the southern boundary. Across these extents, maximum depths are between 0.3 to 0.6m and velocities do not exceed 0.25m/s. In the 0.1% AEP event, a flow path is present between the two areas of high ground and ponding at the western boundary. These instances have a velocity that does not exceed 0.25m/s with maximum depths between 0.3 to 0.6m with an overall hazard rating of 'Danger to Some'.
Reservoir	The site is shown to not be at risk of Dry Day and Wet Day reservoir flooding according to the Environment Agency's reservoir flood mapping.
Groundwater	The JBA Groundwater Flood Emergence Mapping (5m resolution) shows the site is at no risk from ground water emergence. The site is deemed to have negligible risk from groundwater flooding due to the nature of the geological deposits. This should be confirmed through additional site investigation work.

Sewers	The site is not located within a postcode area where there are recorded incidents of sewer flooding, according to the Severn Trent Water Hydraulic Sewer Flood Risk Register.
Flood history	The site is not located in or near historic flood outlines in accordance with flood records provided by City of Wolverhampton Council and the Environment Agency's Historic Flood Map and Recorded Flood Outline Map datasets.
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that there are no formal defences at the site or in its vicinity.
Residual risk	The site encounters residual risk from the culverted Darlaston Brook underneath the A444 approximately 120m north of the site. The culvert could pose a residual risk to the site in the event of a blockage, which could cause water to back up and encroach on the site. Developers should seek modelling of blockage scenarios for the culverts at the site.
Emergency planning	
Flood warning	The south-western area of the site is within the Upper Tame (033WAF303) Flood Alert Area, but the site is not within a Flood Warning Area.
Access and egress	At present there are no access points into the site from the two roads that border the site, the Black Country New Road (A444) and Murdoch Road. However, there are potential areas of access with anticipated access along the A444 or Murdoch Road. Access to the wider area is through Dale Street onto Vulcan Road, then the Black Country Route. Developments at the site should consider appropriate access points to the site. For Flood Zones 2 and 3, access to the site is impeded due to extents that cover potential access points to the site; access to and from Dale Street and Vulcan Road. However, LiDAR and topography at the site is likely to be inaccurate. Since the Flood Zone extents are reliant on the LiDAR and topographic data, it is recommended that developers undertake topographic surveying and ICM modelling to accurately assess undefended fluvial flood risk to the site, and to reassess safe access and egress to the site with the newest results. For surface water events, in the 3.3% AEP and 1% AEP, access and egress to the site is maintained at Murdoch Road, although impeded within the site and further surrounds. The maximum depths along the roads to the Black Country Route are between 0.3 to 0.6m, with a maximum velocity between 0.5 to 1.0m/s however the predominant velocity is less than 0.25m/s. These have a hazard rating of 'Danger for Some'. In the 0.1% AEP surface water event, access and egress within the site is maintained at Murdoch Road, however access to the wider area through is impeded where maximum depths are between 0.6 to 0.9m along both Vulcan Road and Dale Street, with maximum velocities that are between 1.0 to 2.0 m/s with a maximum hazard rating of 'Danger to Most'. In the design surface water event (the 1% AEP + 40% climate change allowance), extents are similar to the 0.1% AEP event and are likely to face similar access and egress issues within the vicinity of the site. The maximum depth in these extents is 0.93m with a maximum velocity of 1.8m/s along Vulcan Road. Extents have a maximum hazard rating of 'Danger for Most'. Arrangements for safe access and egress will need to be demonstrated for the 1% AEP plus an allowance for climate change rainfall events, using the depth, velocity, and hazard outputs. Any raising of access routes should not impede surface water flows or contribute to increasing flood risk off-site. If detailed modelling (including consideration of breach scenarios) suggests that

	the site is at significant risk of flooding which affects access routes, a Flood Warning and Evacuation Plan will be required.
Dry Islands	The site becomes a dry island with the Flood Zone 2 extent; however, this would need to be confirmed through a site-specific Flood Risk Assessment.
Climate change	
Implications for the site	**Management Catchment: Tame, Anker and Mease** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding **Surface Water:** The design event for rainfall intensities is the upper climate allowance for the 2070s epoch. As such the design event is the 1% AEP + 40% CC. The extent of the design event is similar to that of the present day 0.1% AEP event, with maximum depths of 0.54m in the area of ponding along the western boundary. With an increase in extent, the site is shown to be slightly sensitive to increased surface water flood risk 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 drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• The geology consists of:
	  ○ Bedrock formed of mudstone, siltstone, sandstone, coal, ironstone and ferricrete, which forms the Pennine Middle Coal and the South Wales Middle Coal Measures Formations.
	  ○ Superficial deposits consisting of diamicton till in the eastern area of the site and glacial deposits of sand and gravel in the western area.
	• The soil is comprised of loamy soils with naturally high ground water.
	SuDS
	• The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed with site investigations.
	• BGS data suggests that the underlying geology is likely to have variable permeability and should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff.
	• The site is not in a Groundwater Source Protection Zone.
	• The site has areas within its boundary designated by the Environment Agency as being a historic landfill site. A thorough ground investigation will be required as part of a detailed site-specific FRA, to determine potential mitigation for contamination and the impact this may have on SuDS. As such, proposed SuDS should be discussed with the relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.
	• The site is within the River Trent (source to confluence with Derwent) Nitrate Vulnerability Zone (NVZ), and partially in an undifferentiated Secondary Superficial Aquifer Designation Zone. As such, infiltration techniques may not be appropriate at the site in order to preserve water quality.

	• In accordance with information provided by Severn Trent Water, surface water should be managed through SuDS and any excess flow discharged to 750mm diameter storm system within the development site, eventually discharging into the Walsall Canal. Although there are constraints on SuDS at the site (due to the presence of historic landfill, the NVZ, and the Secondary Superficial Aquifer Designation Zone), any designs from developers should be investigated and tested to ensure they are appropriate to the site.
Opportunities for wider sustainability benefits and integrated flood risk management	• 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 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.
NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. As the site is within Flood Zone 3 and Flood Zone 2, classified as 'Less Vulnerable' with some surface water flood risk, the Exception Test is not required for this site.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** Section 2 of the Level 2 SFRA and Sections 2 and 3 of the Level 1 SFRA have more guidance on this section and any relevant policies and information applicable to development within Wolverhampton. • Consultation with City of Wolverhampton Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Development plans should use their Level 1 and 2 SFRA for Wolverhampton, as well as the Local Flood Risk Management Strategies to identify cumulative flood risk issues. It should also promote an integrated approach to water management. Drainage should be designed and implemented in ways that promote multiple benefits. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; Birmingham City Council's Local Plan Policies and Sustainable Drainage Design and Evaluation Guide for developers. • Development within the site should be designed in line with requirements set out in the Bilston Corridor Area Action Plan, with policy BC8 requiring that "all development proposals and public realm improvements should consider the use of Urban Wetlands and Street

Rain Gardens as part of Sustainable Urban Drainage Schemes (SuDS) and the incorporation of street trees and areas of woodland in new development, particularly where there are known surface water flooding issues or where wildlife habitat connectivity could be enhanced."

- **From the Black Country Core Strategy – Policy ENV5 (2011)**

  The Wolverhampton Local Plan succeeds the Black Country Core Strategy building upon policies from the Strategy. Until the Local Plan is adopted the Strategy still applies. Developers should ensure the correct policy is applied. The following development principles will apply to assist in both reducing the extent and impact of flooding:
  - incorporate Sustainable Drainage Systems (SuDS), unless it would be impractical to do so, in order to significantly reduce surface water run-off and improve water quality. The type of SuDS used will be dependent on ground conditions;
  - on sites requiring a Flood Risk Assessment, reduce surface water flows back to equivalent greenfield rates;
  - create new green space, increase tree cover and/or provide green roofs.

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).
- Developers should seek new topographic survey to confirm topography at the site in addition to detailed ICM modelling at and close to the site to confirm actual flood risk to the site.
- Developers should wherever possible open up underground culverts, and in a manner which improved biodiversity, amenity and natural drainage in accordance with the current River Basin Management Plans for the area
- Development must not take place over culverted watercourses and a suitable easement must be provided from the outside edge of the culvert.
- Where there is known or suspected culverted watercourse(s) either on or immediately downstream of a site, and where the Level 1 SFRA highlights that there may be a risk of flooding, developers should:
  - Confirm the location and presence of the watercourse (or otherwise) through ground-truthing strategic datasets and undertaking an assessment of the culvert extent and location
  - Confirm by survey, modelling and mapping the flood extents of the watercourse(s), as many of the flood outlines associated with such watercourses have been carried out at a broad scale and may not account specific local features, such as culverts, bridges and detailed topographical survey.
  - Design the development to accommodate the floodplain of the watercourse and mitigate against flooding to properties to the site. This should include a consideration of residual flood risk e.g. if a culvert were to block downstream.
- 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.
- 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.

- Arrangements for safe access and egress will need to be demonstrated for the 1% AEP pluvial events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs.
- Consultation with RMAs early on should be implemented to ensure an appropriate flood evacuation plan is put in place for the site.
- In accordance with information supplied by Severn Trent Water, the site is likely to be served by the Minworth Works wastewater treatment works, which has been assed to have 'marginal concern… (to estimated spare capacity) subject to development size" and "limited scope to provide additional capacity" for surface water discharge into watercourses. As such surface water disposal measures (detailed in the broad-scale assessments of SuDS section) should be undertaken by the developer.
- Developers should adhere to CWC's guidance on SuDS as laid out in Policy ENV 13 – Sustainable Drainage Systems (SuDS) and Surface Water Management:
    - All developments must incorporate Sustainable Drainage Systems (SuDS) and provide for their adequate adoption, ongoing maintenance, and management over the lifetime of the development, in accordance with any surface water drainage strategy required for the development under Policy ENV12.
    - SuDS must be designed in accordance with Local Lead Flood Authority standards, as follows:
        - demonstrate application of the surface water discharge hierarchy: Re-Use (Water Harvesting); Infiltration; Discharge to a watercourse; Discharge to a surface water sewer; Discharge to a combined sewer;
        - manage surface run-off as close to the source as possible to reduce flood risk and improve water quality;
        - include mitigation within storage calculations for future climate change, designed to 100yr + Climate Change (currently 40%);
        - designed to accord with the Environment Agency's Guidance on Flood Risk and Coastal Change, Construction Industry Research and Information Association (CIRIA) guidance, and Department for Environment Food & Rural Affairs (DEFRA) non-statutory technical standards;
        - designed to be daylight (open), natural and contribute to the conservation and enhancement of biodiversity and green infrastructure in the wider area, as far as is practical and viable.
    - For all major developments, surface water flows must be reduced back to equivalent greenfield rates. If greenfield runoff rates are not considered to be feasible for viability or other reasons, then the developer must submit evidence demonstrating what the constraints to achieving this are and how their development will accommodate runoff rates that are as close as reasonably possible to greenfield rates.
    - For all minor developments, a minimum reduction of 30% over pre-development run-off rates will be required. Under no circumstances will post-development runoff rates that are greater than pre-development run-off rates be permitted.
    - A hydrogeological risk assessment must be provided where infiltration SuDS is proposed for anything other than clean roof drainage in a Source Protection Zone 1.
- 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. If the floor levels cannot be raised to meet the minimum requirements, developers will need to:
    - raise them as much as possible.
    - consider moving vulnerable uses to upper floors.
    - 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 shown to be at fluvial risk where Flood Zones 2 and 3 are present within the site. There is also access and egress issues with the fluvial events, the 0.1% AEP surface water event and the design surface water event (1% AEP plus 40% climate change allowance). There is then residual risk from the culvert for the Darlaston Brook.

- To locate new development in areas of lowest risk, in line with the Sequential Test, by steering sites to river Flood Zone 1 and avoiding where possible areas with a high risk of surface water flooding. If a Sequential Test is undertaken and a site at flood risk is identified as the only appropriate site for the development, the Exception Test shall be undertaken. If development can't be avoided in a high-risk surface water Zone, then part "b" of the Exception Test should be satisfied.
- A site-specific Flood Risk Assessment demonstrates that site users will be safe in the 1% AEP fluvial and surface water events, including an allowance for climate change. This will need to use detailed fluvial/surface water modelling and any interaction with the Darlaston Brook to show 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 off site. Additionally, it is recommended that developers seek a detailed integrated ICM model of the culverted Bilston Brook, with a new topographic survey of the site and its vicinity. Developers should consult the Environment Agency to ensure latest model for the Darlaston is used. Depending on the age of the model, additional updates including consideration of breach scenarios may be required.
- Safe access and egress can be demonstrated in the 1% AEP plus upper climate change fluvial and surface water events. If this is not possible, an appropriate Flood Warning and Evacuation Plan is needed.
- At the site, surface water should be managed through SuDS with excess flow discharged into a 750mm diameter storm system within the site that eventually discharges into the Walsall Canal in accordance with information provided by Severn Trent Water.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed modelling (as above), with development to be steered away from the areas identified to be at highest risk of surface water flooding within the site. This is in line with the sequential approach to site layout.
- Raise commercial finished floor levels 600mm above the 1 in 100-year plus climate change flood level. Protect and promote areas for future flood alleviation schemes.
- If flood mitigation measures are implemented then they are tested to ensure 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 and the Environment Agency's Risk of Flooding from Surface Water map. 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	The latest climate change allowances (updated May 2022) have been applied to the EA's RoFSW dataset.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) map has been used to define areas at risk from surface water flooding.

Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) has been used to define areas at risk from surface water flooding.