South Staffordshire Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables	
Site details	
Site Code	**SA-0139**
Address	Pool View, Churchbridge, Great Wyrley / 399383, 307846
Area	1.92ha
Current land use	Greenfield
Proposed land use	Residential
Sources of flood risk	
Location of the site within the catchment	The site is located in the east of Churchbridge, 35m south of Wash Brook and 70m east of the greater Wash Brook Lake, in the catchment of the River Penk. The town of Cannock lies to the northwest of the site, with the M6 Toll passing westwards, 0.23km from the north boundary of the site.
Existing drainage features	Topographical analysis of the site shows the site draining north into the Wash Brook which flows east to west before joining the Ridings Brook further downstream to form the Saredon Brook. Topography of the site shows a central undulation in the hillside which is likely to direct surface water through the centre of the site, south to north.
Fluvial	**The proportion of site at risk (EA Flood Zones):** **FZ3a –** 0% **FZ2 –** 0% **FZ1 –** 100% **The proportion of site at risk (modelled outlines):** **3.3% -** 7.97% **1% -** 17.86% **0.1% -** 33.02% *The % Flood Zones quoted show the % 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, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%). As there are no Flood Risk Management features or defences the flood risk defined by the zones is also the actual flood risk.* **Available data:** The Environment Agency's (EA) Flood Maps for Planning have been used within this assessment, which are believed to be based on broadscale modelling at this location. Generalised 2D modelling has also been undertaken for the Wash Brook to the north of the site. Percentages quoted above relate to Environment Agency Flood Zones. **Flood characteristics:** Generalised modelling undertaken as part of this assessment indicates that the north-eastern portion of the site is predicted to be at risk in the 3.3%, 1% and, 0.1% AEP events. In all modelled events, flooding occurs in the area of lower topography in the north of the site. In the 3.3% AEP event, flooding is constrained to the north-eastern corner, with maximum depths of ~0.8m. In the 1% AEP event, the area of flooding increases slightly, with depths reaching up to 1.0m away from the drainage ditches and up to 1.4 m in the ditches, with a maximum hazard of 'Danger for Most'. There is a significant increase in flood extent during the 0.1% AEP event, which reaches across the majority of the north-eastern portion of the site, with depths and velocities also increasing to a maximum hazard classification of 'Danger for All'.

Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 1.6% Max depth: 0.3-0.6m Max velocity: 0.25-0.5m/s **1% AEP** – 7.0% Max depth: 0.3-0.6m Max velocity: 1-2m/s **0.1% AEP** – 11.8% Max depth: 0.6-0.9m Max velocity: 1-2m/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. 100-year includes the 30-year %)* **Description of surface water flow paths:** Parts of this site are predicted to be at high risk from surface water flooding, with areas of risk present in all events, though the 3.3% AEP extent is minor, with only a small ponding in the centre-north of the site in a topographic depression (0.3-0.6m). The 1% AEP predicts extension of this ponding to bisect the site and joining with a central flow path coming into the south of the site downhill. This has a maximum velocity of 1.2m/s though 0.5-1m/s is shown as the most common. Maximum hazard through this central channel categorised as 'Caution'. In the 0.1% AEP event, flood extents increase further an connect all 1% flow paths and ponding accumulations within the site. The central channel is predicted to connect with the centre-north ponding, which links to that in the north-eastern corner. This in turn flows into the Wash Brook. Maximum depths and velocities through this flow path are 0.6-0.9m and >2m/s, with a maximum hazard designation of 'Danger to Most' in the areas of ponding.
Reservoir	The Environment Agency reservoir flood risk extent online dataset provides insight into the extent of water inundation originating from reservoirs. The site is shown to be at risk of reservoir flooding from the online maps, with the north-eastern portion of the site impacted by the dry extent of reservoir flooding, and the sites area found at lower topography (approximately half), covered by the wet extent.
Canals	The site is not impacted by risks from Canals.
Groundwater	The Environment Agency's "Areas Susceptible to Groundwater Flooding 2010 dataset, displayed as a 1km grid resolution, provides insight into the susceptibly of a flood event at the site, as well as the surrounding region. The site has been shown to be within an area of moderately high likelihood of flooding, with a value of 50%-75%.
Sewers	There are no records of areas of critical drainage problems.
Flood history	The Environment Agency's Historic Flood Map shows there are no records of historic flooding events on or in the vicinity of the site.
Flood risk management infrastructure	
Defences	The site is not protected by any formal flood defences. The banks of the river are classified as 'natural high ground' in the Environment Agency's AIMS dataset.
Residual risk	Risks are associated with the culverted channel of the Wash Brook where is passes beneath the A5 highway near the northern corner of the site, posing a risk of blockage causing an impoundment upstream bursting into the site. The lake downstream also poses an overtopping risk to the east of the site.
Emergency planning	
Flood warning	The Wash Brook is situated within the River Sow and River Penk Flood Alert Area. No Environment Agency Flood Warning Areas are present along the brook.
Access and egress	Access and egress are possible at the south-west corner where a 24' field gate leads directly only Pool View, part of a residential estate connecting to the A34. Fluvial flooding is unlikely to impede access/egress to the site via Pool View during any modelled flood events. Similarly, access and egress via Pool View is unlikely to be affected in the 1% AEP surface water event, although flooding could impede incoming routes along the A34 in the 0.1% AEP surface water event,

Climate change

Implications for the site	• Central and Higher climate change allowances for the 3.3%, 1%, and 0.1% AEP fluvial events have been modelled as part of this assessment. The site is shown to be at significant risk in the 0.1% AEP fluvial event in the Central and Higher climate change scenarios, which further extend the 0.1 AEP modelled reach across the north-eastern and central portions of the site. • Surface water climate change uplifts have been modelled for the 3.3% AEP and 1% AEP surface water events in the Central and Higher climate change scenarios. Surface water risk is not significantly greater to the site in any modelled scenario. No new surface water flows occur and maximum depths on site reach up to 1m in the 1% AEP Higher Climate change scenario. • The preservation of existing and predicted future surface water flow routes and storage volumes should be considered when preparing the layout and site scheme. Similarly consideration should be given to the preservation of fluvial flood storage volumes. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA. • A site-specific FRA, with the most up-do-date climate change allowances, should be undertaken to investigate the implications of climate change on the site.

Requirements for drainage control and impact mitigation

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Pennine Middle Coal formation – mudstone, siltsone and sandstone.
	  ○ Superficial- Glaciofluvial deposits with sand and gravel, and till and diamicton.
	• Soils at the site consist of:
	  ○ Slowly permeable seasonally wet, slightly acid but base-rich loamy and clayey soils.
	SuDS
	• The site is considered to have a moderate susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate at this site.
	• BGS data indicates that the underlying geology is mudstone to sandstone 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 historic landfill 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.
	• 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 0.1% AEP event. 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 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 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. • 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.
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. The entire site lies outside of Flood Zone 2 and 3 but is affected by surface water flood risk so part "b" of the Exception Test should be satisfied. In addition as the generalised modelling identifies that part of the site could be affected by fluvial flood risk the FRA should include the preparation of detailed site scale river and flood plain modelling so the extent and level of hazard from fluvial flood risk can be appropriately addressed.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Whilst the site lies entirely outside of Flood Zones 2 and 3, a site-specific Flood Risk Assessment will be required as the site is greater than 1ha. • The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; the South Staffordshire Local Development Scheme; and the Staffordshire County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document. • Consultation with the Local Authority and the Lead Local Flood Authority should be undertaken at an early stage. **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). • As a large new development any proposal should be accompanied by an overall Surface Water Management Masterplan and Strategy. This should cover: ○ How the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. This should be used to develop and implement appropriate drainage sub catchments and specific runoff rate and volume requirements for each phase of the development. ○ The risk of flooding from all sources, including for rainfall events greater than the design standard of the surface water drainage system should be taken into account to ensure there is no flood risk to new properties and that exceedance flows in extreme events are safely routed around those properties. ○ The consideration of how SuDS, natural flood management techniques, green infrastructure and green-blue corridors can be designed into the development master plan to facilitate drainage flood risk management and ensure wider benefits such as biodiversity, amenity, water quality and recreation are realised. ○ Based on the above, a Drainage Phasing Plan should be developed, based on the SuDS train method (considering firstly how water can be infiltrated/stored at a plot level, then conveyed through the site and any regional storage needs at a settlement level). ○ The provision of drainage during the building phase shall be based on the Drainage Phasing Plan to ensure adequate drainage is provided and implemented throughout the development life.

	○ The LLFA, Environment Agency and LPA should be consulted during the development of the Surface Water Management Masterplan and Strategy. • The development should be designed using a sequential approach. Development should be steered away from areas of flood risk in the north and central portions of the site, preserving these spaces as green infrastructure. This is likely to significantly limit the area available for development which should be restricted to land of higher elevation. In particular, low-lying land near the Wash Brook to the north of the site should be left undeveloped and surface water flow routes should be preserved and integrated into blue-green infrastructure. • Safe access and egress will need to be demonstrated in the 1% AEP event plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must 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. • On site attenuation schemes would need to be tested to ensure flows are not exacerbated downstream within the catchment. • Surface water should be discharged at the pre-development (greenfield) runoff rate which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. An integrated flood risk management and sustainable drainage scheme for the site is advised. • Developers should refer to Staffordshire County Council's SUDS Handbook and the Level 1 SFRA for information on SuDS for guidance on the information required by the LLFA from applicants to enable it to provide responses to planning applications.

Key messages

With close proximity to areas of flood risk the site potentially at risk of flooding and the principle of development can be supported by implementing practical schemes based on an appropriate understanding of the flood hazards. This will involve:

- The areas predicted to be at greatest risk (namely the north-eastern and central areas of the site adjacent the Wash Brook and known areas of surface water risk) are left undeveloped (this should be defined by more detailed modelling).
- Any proposal is accompanied by an overall Surface Water Management Masterplan and Strategy
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development to be steered away from the north, east and centre of the site.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future as a result of climate change, and that the development of the site does not increase the risk of flooding both on the site and downstream.

Mapping Information

The key datasets used to make planning recommendations regarding this site were the generalised 2D modelling outputs from the Environment Agency's Flood Map for Planning and the 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	Climate change uplifts have been applied to the Environment Agency's Risk of Flooding from Surface Water dataset for the 3.3% and 1% AEP scenarios. Climate change allowances have also been applied to the site-specific modelling undertaken as part of this assessment.
Fluvial depth, velocity and hazard mapping	Generalised 2D TUFLOW hydraulic models were built by JBA in May 2022 to inform the risk to sites as part of the Level 2 SFRA. Each model is comprised of a 2m DTM, material layers created from OS Vector mapping, upstream and downstream boundary conditions and a 2d_zsh line and elevation points representing the Wash Brook near the study area.
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, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water mapping.