

# Level 2 Strategic Flood Risk Assessment - Site TC40

**A1-C01**

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**Prepared for:  
Newcastle-under-Lyme Borough Council**

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# 1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for TC40. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'Newcastle-under-Lyme Level 1 SFRA' and read the 'Newcastle-under-Lyme Level 2 SFRA Main Report' and is therefore familiar with the terminology used in this report.

## 1.1 Site details

- **Location:** Blackfriars Road Car Park. Urban area, situated centrally in Newcastle-under-Lyme by the intersection of the A519 Blackfriars Road and the A53 Priory Road.
- **Site area:** 0.20ha.
- **Existing site use:** Brownfield, currently used as a car park.
- **Proposed site use:** Residential.

## 1.2 Topography

The Environment Agency (EA) 1m resolution LiDAR shows that the site gently slopes downhill from higher ground in the west of the site to lower ground in the southeast. The site has a maximum elevation of 117.94mAOD in the southwest and has a minimum elevation of 115.00mAOD in the southeast corner of the site, along the path of Lyme Brook.

## 1.3 Geology and soils

Geology at the site consists of:

- Bedrock made up of sandstone that forms the Springpool Sandstone Bed.
- Superficial deposits comprising of alluvium, clay, silt, sand, and gravel.

Soils at the site consist of:

- Loamy and clayey floodplain soils with naturally high groundwater.

## 2 Sources of flood risk

### 2.1 Location of site within the catchment

The site is in the 'Lyme Brook Catchment (trib of Trent)', which drains an area of 29.59km<sup>2</sup>. Lyme Brook flows south, converging with the River Trent near Hanford. The site is adjacent to the Lyme Brook which flows along the northern and eastern site boundaries.

The majority of catchment is urban, encompassing a number of built-up areas and settlements, the largest being Newcastle-under-Lyme. There are more rural areas in the northwest of the catchment, located north of Silverdale. There are also green spaces along the watercourse, particularly to the south of Newcastle-under-Lyme.

### 2.2 Existing drainage features

The site is likely to drain to the Lyme Brook, which flows southwards approximately 15m from the northern and eastern boundaries the site. There are no other existing drainage features within the site.

### 2.3 Fluvial

#### 2.3.1 Available data

The EA's Flood Map for Planning (FMfP) and the EA's 2015 Estry-TuFLOW detailed hydraulic model of Lyme Brook were available for use within this assessment.

It should be noted that due to the delineation of the FMfP, it shows that Flood Zone 3a is not in the site. However, the hydraulic model shows that it intersects the boundary in the south east corner of the site.

#### 2.3.2 Description of risk to the site

There is minimal fluvial flood risk shown in the site, as it is almost entirely within Flood Zone 1. The fluvial flood risk is confined to the southeast corner of the site, along the path of Lyme Brook.

Flood Zone 2 encroaches marginally in the southeast corner of the site, and in the 0.1% AEP event the maximum depth is 3.03m and the maximum velocity is 1.91m/s. In all of the events the maximum hazard classification is 'Danger for All'. In Flood Zones 3a and 3b, the percentage of site at risk is less than 1% in the southeast corner of the site. However, the maximum depths are 2.07m in the 1% AEP event and 1.94m in the 3.3% AEP event. In the 1% AEP event, the maximum velocity of 1.72m/s, and in the 3.3% AEP event the velocity is 1.94m/s.

Table 2-1: Existing fluvial flood risk based on the EA FMfP and 2015 Estry-TuFLOW.

Risk	Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
Percentage of site at risk* (%)	99	1	Less than 1	Less than 1
Maximum depth (m)	N/A	3.03	2.07	1.94
Maximum velocity (m/s)	N/A	1.91	1.72	1.65
Maximum hazard classification	N/A	Danger For All	Danger For All	Danger For All

\* The percentage flood zones quoted show the percentage of the site at flood risk from that particular flood zone or event, including the percentage of the site at flood risk at a higher risk zone, e.g. Flood Zone 2 includes the Flood Zone 3 percentage. Flood Zone 1 is the remaining area outside Flood Zone 2 (Flood Zone 2 + Flood Zone 1 = 100%).

## 2.4 Surface water

### 2.4.1 Available data

The EA's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment.

### 2.4.2 Description of risk to the site

Most of the site is not at risk of surface water flooding. There is no risk to the site in the 3.3% AEP event, and in the 1% and 0.1% AEP events the percentage of the site at risk is less than 1%.

In the 1% AEP event, a flow path forming along Lyme Brook encroaches onto the boundary in the southeast corner of the site. The maximum depth reaches up to 0.15m, the velocity is between 1.00m/s and 2.00m/s, and the maximum hazard classification is 'Very Low Hazard'.

In the 0.1% AEP event, much of the area outside the site to the north is at risk of surface water flooding, with prominent flow paths along the roads to the south of the site. The extent in the southeast of the site at risk increases marginally, with the depth increasing from the 1% AEP event to greater than 1.20m. The velocity remains the same as in the 1% AEP event, however the risk classification escalates to 'Danger For Most'.

Table 2-2: Existing surface water flood risk based on the RoFSW map.

Event	3.3% AEP	1% AEP	0.1% AEP
Percentage of site at risk* (%)	0	Less than 1.00	Less than 1.00
Maximum depth (m)	N/A	0.00 to 0.15	Greater than 1.20
Maximum velocity (m/s)	N/A	1.00 to 2.00	1.00 to 2.00
Maximum hazard classification	N/A	Very Low Hazard	Danger For Most

\* The percentage surface water extents quoted show the percentage 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 includes the 3.3% AEP percentage).

## 2.5 Reservoir

The site is not shown to be at risk of reservoir flooding during the 'dry day' or 'wet day' scenario from the EA reservoir flood maps.

## 2.6 Groundwater

The EA Areas Susceptible to Groundwater Flooding (AStGWF) dataset (1km resolution) suggests that the entire site has between 25% and 50% susceptibility to groundwater flooding. However, the JBA Groundwater Emergence Map (5m resolution) differs from this, showing that the entire site has predicted groundwater levels that are either at or very near (within 0.025m) of the ground surface indicating a high likelihood of groundwater emergence.

Based on the RoFSW and topography of the site it is likely that any groundwater that emerges will flow in an easterly direction towards Lyme Brook and to the lower-lying areas in the southeast of the site.

This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific Flood Risk Assessment (FRA) stage.

## 2.7 Sewers

The site is located in a postcode area (ST5 2), where there were 8 recorded historic sewer flooding incidents within Newcastle-under-Lyme borough, according to information provided by Severn Trent Water. Severn Trent Water provided historical flooding data for reports of external and internal sewer flooding between 1 January 2004 and 19 March 2024, including locations with repeat incidents..

There are no incidents of sewer flooding within the site or within its immediate vicinity.

## 2.8 Flood history

The EA's historic flooding and recorded flood outline datasets do not have a record of any flooding on or surrounding the site.



## 3 Climate change

Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. Please see Section 3.5 of the main Level 2 SFRA report for information on fluvial models and climate change allowances.

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 escape routes must also address the potential increase in severity and frequency of flooding.

### 3.1 Fluvial

#### 3.1.1 Available data

As part of the 2024 Level 1 SFRA for Newcastle-under-Lyme borough, the existing EA's 2015 Estry-TuFLOW detailed hydraulic model of Lyme Brook was uplifted with the latest central, higher central, and upper end climate change allowances for the 3.3%, 1%, and 0.1% AEP events.

#### 3.1.2 Description of risk to the site

The fluvial flood risk to the site is not shown to be sensitive to the impacts of climate change.

The area of the site at risk is below 1% for the 3.3% and 1% AEP events and remains below 1% for the central and higher central climate change events, with the risk confined to the southeast corner of the site. The maximum hazard classification is also consistent at 'Danger For All' across the events measured.

In the 3.3% AEP event, the maximum depth increases marginally from 1.94m to 2.04m in the central event, and to 2.06m in the higher central event. Velocity decreases from 1.65m/s in the 3.3% AEP event to 0.88m/s in the central event, and to 0.89m/s in the higher central event.

In the 1% AEP event, the maximum depth increases from 2.07 to 2.35 in the central event, and to 2.50m in the higher central event. Just as in the 3.3% event, velocity decreases. In the 1% AEP event it was 1.72m/s, reducing to 0.96m/s in the central event and to 0.99m/s in the higher central climate change event.

Table 3-1: Fluvial flood risk to the site in the 3.3% and 1% AEP events considering central and higher central climate change.

Event	3.3% AEP	3.3% AEP plus 29% CC	3.3% AEP plus 39% CC	1% AEP	1% AEP plus 29% CC	1% AEP plus 39% CC
Percentage of site at risk* (%)	Less than 1	Less than 1	Less than 1	Less than 1	Less than 1	Less than 1
Maximum depth (m)	1.94	2.04	2.06	2.07	2.35	2.50
Maximum velocity (m/s)	1.65	0.88	0.89	1.72	0.96	0.99
Maximum hazard classification	Danger For All	Danger For All	Danger For All	Danger For All	Danger For All	Danger For All

## 3.2 Surface water

### 3.2.1 Available data

The latest climate change allowances have been applied to the RoFSW map to indicate the impact on pluvial flood risk.

The design event for rainfall intensities is the 1% AEP event with the upper end climate allowance for the 2070s epoch, which is the 1% AEP plus 40% climate change for the Trent Valley Staffordshire Management Catchment which this site falls within.

### 3.2.2 Description of risk to the site

The surface water flood risk to the site is not shown to be very sensitive to the impacts of climate change.

The extent of the 1% AEP plus 40% climate change event is marginally greater than the present day 1% AEP event, increasing to 1%, from less than 1%, in the southeast corner of the site, as seen in Table 3-2.

The depths are also shown to increase with climate change, with a higher maximum depth of 0.30m compared with 0.15m in the present day event. The climate change event has a velocity of 1.87m/s, which falls within the 1.00m/s to 2.00m/s category in the 1% AEP event. The maximum hazard classification also increases from 'Very Low Hazard' to 'Danger For Most'.

Table 3-2: Comparison of surface water flood risk to the site between the 1% AEP and 1% AEP 2070s Upper End climate change extents.

Event	1% AEP	1% AEP plus 40% climate change
Percentage of site at risk (%)	Less than 1	1
Maximum depth (m)	0.00 to 0.15	0.30
Maximum velocity (m/s)	1.00 to 2.00	1.87
Maximum hazard classification	Very Low Hazard	Danger For Most

## 4 Flood risk management infrastructure

### 4.1 Defences

The EA AIMS dataset shows that the site may be offered some protection by engineered high ground to the north and south of the site, along parts of the River Lyme.

### 4.2 Residual risk

Lyme Brook enters a culvert under Pool Dam (A525) approximately 60m west of the site. This could pose a residual risk to the site in the event of a blockage, which could cause water to back up upstream of Pool Dam (A525) and overtop on the site and surrounding roads.

Lyme Brook also enters a culvert under Blackfriars Road (A53) adjacent to the site. This could pose a residual risk to the site in the event of a blockage which could result in water backing up and impacting the site. It should be noted that the site is currently situated at a higher level than the land on the east bank of Lyme Brook, and therefore, if water were to back up it would affect the lower-lying land on the east bank of the watercourse. However, any modifications to ground levels proposed as part of the development could affect the risk to the site. Therefore, the residual risk should be considered as part of a site-specific FRA.

Failure of the engineered high ground to the north and south of the site could pose a residual risk of flooding to the site. However, there is no change in extent at the site between the defended and undefended River Lyme outputs, and minimal change in the flood depths suggesting a low residual risk.

## 5 Emergency planning

### 5.1 Flood warnings and alerts

The site is covered to a small extent in the southeast by the 'Lyme Brook at Newcastle-under-Lyme and Trent Vale' EA Flood Warning Area and the 'Stoke Trent' EA Flood Alert Area.

### 5.2 Access and escape routes

Safe access and escape routes will need to be demonstrated in the 1% AEP plus climate change fluvial and surface water events. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk elsewhere on the site and in the wider catchment.

#### 5.2.1 Existing access

The site has one existing entrance, accessed from Blackfriars Road (A519) in the southwest corner of the site. 60m west of the entrance to the site Blackfriars Road (A519) intersects the A525, which runs north as Pool Dam and continues west as Higherland. Approximately 60m east of the entrance there is an intersect with Priory Road/Blackfriars Road (A53), with the A519 continuing southeast.

On foot there is a walkway outside of the southern site boundary along Blackfriars Road (A519 and A53). On this walkway a cycle and pedestrian path can be accessed from the southeast corner of the site, which runs across the north of the site to Pool Dam (A525).

#### 5.2.2 Fluvial

Safe access and escape routes are shown to be maintained at this location in all available modelled fluvial events.

Access to the site from the north along Pool Dam (A525) and Blackfriars Road (A53) is affected by fluvial risk. Pool Dam (A525) is inundated immediately north of where the Lyme Brook enters a culvert under the road in the 1% and 0.1% AEP events, as well as in all available climate change events. Blackfriars Road (A53) becomes is affected by fluvial risk immediately northeast of the site in the 0.1% AEP event and in the 1% AEP higher central climate change event.

However, the entrance to the site via Blackfriars Road (A519) in the southwest corner of the site remains clear. The area south of the site is not shown to be affected by fluvial flooding, and the site is still accessible via all the southern roads.

### 5.2.3 Surface water

The entrance to the site via Blackfriars Road (A519) remains clear in all surface water flooding events.

In the 3.3% AEP event, safe access and escape routes are maintained. There is a small area of isolated surface water ponding between 0.15m and 0.30m on Blackfriars Road (A53) northeast of the site. There is also surface water pooling on Friarswood Road (A519) around 130m southeast of the site, with a maximum depth of between 0.30m and 0.60m. All other routes in the vicinity of the site remain clear.

Access and escape routes are also likely to be maintained in the 1% AEP event. There is a flow path that forms along Priory Road (A53) heading south from the site, however it has a maximum depth that reaches up to 0.15m. The extent of surface water flood risk seen on Friarswood Road in the 3.3% AEP event increases, but the maximum depth remains between 0.30m and 0.60m. It is also possible to access the site via Higherland (A519) and then Seabridge Road (B5352). While there is pooling on these roads it remains below 0.15m in depth.

In the 1% AEP event plus 40% uplift for climate change, access may still be maintained via Pool Dam (A525), Priory Road (A53), and Seabridge Road from Higherland (A525). There are surface water flow paths on all of these roads, however the depths are typically around 0.15m or below. There are greater depths along Pool Dam (A525) however these are a function of how the Lyme Brook culvert is represented in the surface water modelling, and the fluvial flood risk section should be used to assess the flood risk in this area. However, access is impeded via Blackfriars Road (A53) in the northeast, and via Friarswood Road (A519) in the southeast.

Just as in the 1% AEP climate change event, in the 0.1% AEP event, access is maintained but not via the northeastern and southeastern roads. Blackfriars Road (A53) and Friarswood Road (A519) are almost entirely covered by flow paths that have a maximum depth of between 0.60m and 0.90m. However, from the west the site can be accessed via Seabridge Road and Higherland (A525), which have flow paths with a maximum depth between 0.15m and 0.30m. Priory Road (A519) is covered by a flow path and there is some pooling on Pool Dam (A525), both have depths mainly of 0.15m or below. As above, there are more significant depths indicated along Pool Dam (A525) where Lyme Brook is culverted beneath the road however these are a function of how the Lyme Brook culvert is represented in the surface water modelling, and the fluvial flood risk section should be used to assess the flood risk in this area.

## 5.3 Dry islands

The site is not located on a dry island.

## 6 Requirements for drainage control and impact mitigation

### 6.1 Broadscale assessment of possible SuDS

- The JBA Groundwater Emergence Map shows that groundwater levels are indicated to be at or very near (within 0.025m) ground level and there is a risk of groundwater flooding at the surface during a 1% AEP event, which may flow to and pool within topographic low spots. 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 sandstone, which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy. The local soils are identified to be loamy and clayey floodplain soils with naturally high groundwater, which may limit infiltration potential within the winter months. Infiltration potential at the site 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 located within a Nitrate Vulnerable Zone. Therefore, early engagement with the LLFA and the EA is recommended to determine requirements for the site to manage the impact to surrounding watercourses. Consideration of water quality is likely to be of high importance and demonstrated through the use of the Simple Index Approach.
- The site is not located within a historic landfill site.
- 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 RoFSW mapping indicates the presence of surface water flow paths on the roads south and east outside of the site boundary during the 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.

## **6.2 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, helping meet requirements for the Nitrate Vulnerable Zone. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Local Planning Authority, Lead Local Flood Authority, and EA) at an early stage to understand possible constraints.
- The southeastern side of the site along Lyme Brook should be integrated into the site drainage strategy as blue-green infrastructure.
- 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 (Lyme Brook) and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. Lyme Brook is currently assessed to be in poor ecological status.
- 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.



## 7 NPPF and planning implications

### 7.1 Exception test requirements

The Local Planning 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 NPPF classifies residential development as 'More Vulnerable'.

Should More Vulnerable development be proposed within the extent of Flood Zone 3a, the Exception test is required for this site.

### 7.2 Requirements and guidance for site-specific Flood Risk Assessment

At the planning application stage, a site-specific FRA will be required as the proposed development site:

- Is in Flood Zones 2 and 3.
- Is subject to surface water flooding.
- Is at significant risk of groundwater emergence.
- Is identified as being at increased flood risk in the future, due to climate change.

All sources of flooding should be considered as part of a site-specific FRA, including the residual risk to the site of potential culvert blockages or failure of the engineered high ground.

Guidance on the requirements for site-specific FRAs can be found in the accompanying Level 2 SFRA report.

### 7.3 Guidance for site design and making development safe

Development should be steered outside of the area of fluvial and surface water flood risk in the southeast corner of the site. Developers should consider utilising this area as a location for SuDS.

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, with areas of surface water ponding used as open space and SuDS or water compatible/essential infrastructure uses only.

Given the high likelihood of groundwater emergence on the site, additional site investigation work may be required to support the detailed design of the drainage system. Infiltration may not be appropriate at the site but should be confirmed through site-specific assessment. Below ground development such as basements are not appropriate at this site.

Arrangements for safe access and escape routes will need to be provided for the 1% AEP fluvial and surface 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.

Provisions for safe access and escape routes 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.

## 8 Conclusions

The site is adjacent to the Lyme Brook, located within 15m south of its channel. The southeast corner of the site is at risk of both fluvial and surface water flooding. However, only 1% or less of the site is at risk. The site is also potentially at significant risk of groundwater flooding.

All fluvial flood risk events are classified as 'Danger for All', with depths nearing 2m or higher. However, due to the site's close proximity to the Lyme Brook, and the delineation of the modelling, it is likely the values observed are influenced by the channel. The southeast corner of the site experiences minimal surface water flooding in the 1% AEP event, with the risk extending marginally in the 0.1% AEP event and 1% AEP event plus 45% uplift for climate change.

Should 'More Vulnerable' development be proposed within the extent of Flood Zone 3a, the Exception test is required for this site. A site-specific FRA will be required, because the proposed development site is one hectare or greater in Flood Zone 1, at risk of groundwater and surface water flooding, and identified as being at increased flood risk in the future.

The following points should be considered in development of this site:

- A buffer of at least 8 metres should be maintained between Lyme Brook and any built development on the site.
- All development should be steered away from the areas of highest risk in the southeast corner of the site. Developers should consider utilising this area as a location for SuDS.
- Safe access and escape routes should be demonstrated in the 1% AEP plus climate change surface water event.
- The risk to the site from groundwater should be confirmed as part of site-specific flood risk assessment, and any FRA should demonstrate users of the site can be kept safe in the event of groundwater emergence/flooding.
- A carefully considered and integrated flood resilient and sustainable drainage design should be put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed modelling.
- Flood mitigation measures should be implemented then tested to check that they will not displace water elsewhere (for example, if land is raised to permit development in one area, compensatory flood storage will be required in another).

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