

11. Water Resources, Flood Risk & Drainage

Appendix 11.1

BASELINE ASSESSMENT

Baseline conditions

Existing land use

The site is approximately 9 hectares and is bounded to the north by the United Utilities waste water plant and the Sandon Half Tide Lock, to the east by Regent Road, to the south by Nelson Dock and to the west by the River Mersey. The site predominantly comprises a dock waterbody, surrounded by a Grade II Listed dock retaining wall and hardstanding. A Hydraulic Engine House (Grade II listed) is situated in the northeast corner of the site. A two-storey brick structure sits at the western end of the north wharf and a shed structure sits on the southern wharf. The site was recently used for aggregate storage and distribution, operated by Mersey Sands. However, the lease for this land use expired in August 2019. The site remains occupied by Svitzer (operating tugboat services) and Cataclean, until their leases expire in December 2019.

Existing site levels

Existing ground levels within the application site typically range between 6.6m AOD (top of dock wall level) and 6.8m AOD. Along the eastern edge of the site ground levels rise gradually to meet the Regent Road level of 7.1m AOD to 7.2m AOD. Higher levels were recorded during the topographical survey at the location of the sand stockpiles described above.

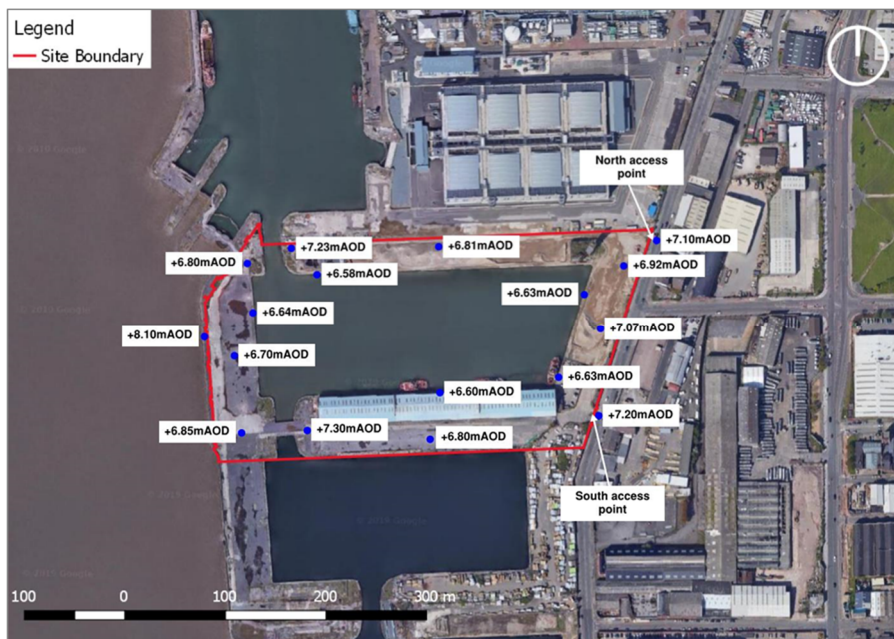


Figure 1 Site plan showing the two existing access points to the proposed development (Background: Map data ©2018 Google)

The retained water level within the dock system is isolated from the tidal River Mersey via a system of lock gates at Canada Dock, approximately 1.4km to the north. According to the Nelson Dock isolation structure drawing (L24298/01) provided as an appendix to the Liverpool Waters FRA, the water levels in BMD are understood to be maintained within an operational range of 4.55m AOD and 5.16m AOD.

Existing foul water drainage

A full description and drawings of the existing drainage infrastructure is provided in the drainage strategies, (Appendix 12.4). For the purpose of this ES chapter a brief summary is provided below.

Private

The nature of the site would make it unlikely that there is much in the way of existing services or drainage to consider. The existing site is used as warehouse storage and stockpiling of dredged sand and has a generally

low workforce population. A number of derelict and functional buildings are present, with some toilets and other sanitary facilities identified.

A visual survey of below ground chambers within the site and the adjacent Regent Road was completed on 13th June 2017 and October 2019. The survey did not identify any significant below ground foul water infrastructure on site. The survey was not exhaustive but it is assumed that existing foul water is discharged to the public sewers within Regent Road, via local connections.

Public

Two existing combined public sewers run down Regent Road, adjacent to the site, and discharge to the United Utilities (UU) Waste Water Treatment Works (WWTW) that is located immediately north of the site.

- The Mersey Estuary Pollution Alleviation Scheme (MEPAS) tunnel. This was constructed in the 1990's to intercept combined outfalls to the Mersey and direct flows to the treatment works. It is c2.5m in diameter and approximately 10m below ground next to the site. The system is used for storage of effluent generated during heavy rainfall and flows are controlled by a series of gates along its run.
- A Combined sewer serving a local catchment, c5m deep to invert and 675/920mm in dia.

Existing surface water drainage

Private

The existing site appears to have very little in the way of formal surface water drainage infrastructure. The majority of rainwater falling onto the site flows across the paved areas to drop directly over dock walls and into the docks.

From a number of historic gullies and a line of deep chambers have been observed from the topographic survey on the site. These appear to contain sluice gate mechanisms and run in a straight line between Nelson Dock and the River Mersey. Their purpose is unconfirmed but it is assumed they were used to regulate water levels and/or allow silt to be flushed out from the base of the docks at low tide. Further investigation is required to confirm their purpose.

All surface water drains directly over edge into the docks or directly into the Mersey and all drainage within the site is privately owned, with maintenance responsibility falling to the landowner.

Public

There is no dedicated public surface water network in proximity to the site. As discussed in the Existing foul water drainage section there is a large combined deep culvert (the MEPAS sewer) and a secondary combined large diameter sewer pipe in Regent Road that take combined flows.

Surface water features

The nearest surface water features are:

- The Docks (BMD, Nelson Dock, Sandon Half -tide Dock, Salisbury Dock)
- River Mersey- borders the site to the west;
- The Leeds & Liverpool Canal, which runs from north to South through Stanley Dock and beyond;

To the northwest of BMD lies Sandon Half-tide Dock, which remains connected to BMD via a pair of dock gates. To the south of BMD, lies Nelson Dock, with hydraulic connectivity. There are eight 600mm diameter pipes with sluice gates within the isolation structure which provide hydraulic connectivity between north and south when the gates are open.

Docks and River Mersey water quality

All surface water drains directly over edge into the docks or directly into the Mersey. Therefore, there is potential for on-site activities to influence the water quality of these water bodies through these connections both during demolition/construction and operational phases of the development.

The European Water Framework Directive (WFD) was transposed into national law through the Water Environment WFD (England and Wales) Regulations 2003 (Statutory Instrument 2003 No. 3242). The aim of this Directive is to provide an integrated, Europe-wide approach to the management of water resources, particularly water quality. As part of the Directive, River Basin Management Plans have been established.

River Mersey, Sandon Half-Tide Dock and Nelson Dock fall within the Mersey Estuary that is an operational catchment of North West River Bain District.

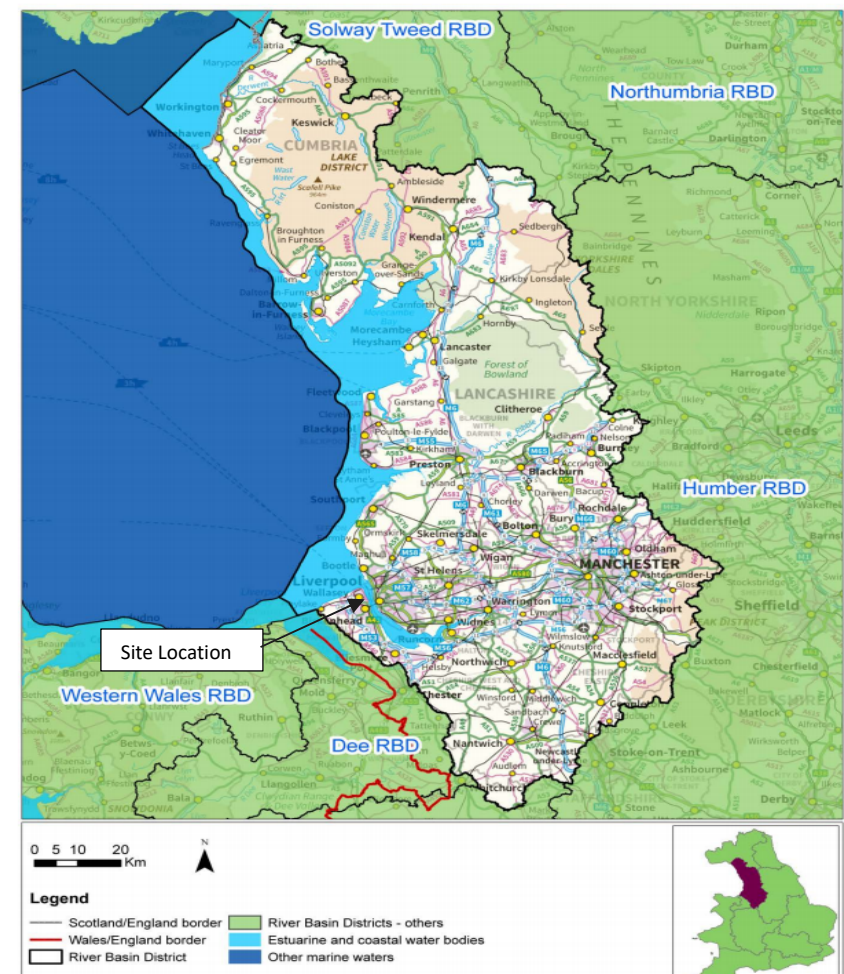


Figure 2 Location of site in relation to North West River Basin (© Crown Copyright and database rights 2018, from River basin management plant issued 2015, accessed: 03/10/2019)

The associated River basin Management Plan establishes a number of requirements that must be met to comply with the WFD.

The Mersey Estuary is classified as heavily modified under the Water Framework Directive and have an obligation to achieve 'Good ecological potential'. By definition, artificial and heavily modified water bodies are not able to achieve natural conditions. Instead the classification and objectives for these water bodies, and the biology and habitat structure they provide an environment for, are measured against ecological potential rather than status.

The overall water body of the Mersey Estuary is classified as 'moderate'. With ecological status classified as 'moderate' and the chemical status is classified as 'fail'. The rivers are expected to maintain this status at the end of the previous WFD planning cycle.

The chemical status in 2016 was Fail however the potential Chemical Status by 2027 is to achieve 'Good Chemical Status'

Number of water bodies	Ecological status or potential					Chemical status	
	Bad	Poor	Moderate	Good	High	Fail	Good
1	0	0	1	0	0	1	0

Figure 3 WFD classification of the Mersey Estuary (EA Catchment Data Explorer, accessed 03/10/2019)

Groundwater

Issues associated with ground contamination, mobilisation of ground contaminants and hydrogeology are covered in Chapter 18. Ground Conditions. A summary of ground conditions and groundwater is provided here for context.

Tidal Flat Deposits are designated as Unproductive Strata, rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. The Glacial Till is defined as a Secondary Aquifer, defined as permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers. The Chester Formation is a Principal Aquifer. This means the formation has high intergranular and / or fracture permeability and usually provides a high level of water storage and may support water supply and / or river base flow on a strategic scale. There are no groundwater or potable water abstraction licenses within 2km of the site.

Groundwater levels found near surface in Made Ground between about 3.2 and 6.4mAOD (generally above dock water level). Deeper groundwater recorded in Glacial Till, Tidal Flat Deposits and the Chester Formation showed tidal influence in response to levels in BMD and / or the River Mersey.

Once fill material has been deposited in BMD to create the stadium building platform, the groundwater underneath the stadium is anticipated to be in hydraulic conductivity with the new water channel. The water channel will be tidally influenced; the risk of groundwater flooding will be limited by the tidal cycle which will reduce the duration over which elevated river levels may impact groundwater levels

Water supply and existing demand

The Site is served by UU for potable water. The level of water stress for the UU region was identified as 'moderate stress' in the final classifications of the 2013 Water Stressed Areas policy paper issued by the EA, under the current and future scenarios. This was classed as 'not serious'.

UU's current Water Resource Management Plan (WRMP) for 2020-2045 (published in 2019, also referred to as FWRMP19) identifies a surplus of water available to meet the projected demand over the next 20 years to 2040, with a deficit occurring from 2041 to 2045.

There is an existing 280mm dia main which is running in Regent Road adjacent the site. There are a series of abandoned water mains in the docks which are roughly as shown on the existing services drawing

There is an existing private main that runs to serve the dock sheds for the tug boats. There are also a series of hydrants running down. It is likely these would be abandoned or removed during construction works.

The existing daily water demand of the Site will be limited to the existing uses i.e. a small welfare area for the tug boat company facilities and they fill the tugboats themselves.

Existing on-site flood risk

Detailed assessment of existing flood risk to the site and a full summary of consultations with the EA is provided in the FRA (Appendix A). A summary is provided here.

Historical flooding

The EA has no records of flooding affecting the site.

Fluvial and Tidal flooding

The western end of the site is bounded by the River Mersey. The River Mersey has the second highest tidal range in the UK, varying from 4m at neaps to 10m at spring tides. The river flow is about 1% of the tidal flow. The consequences and impacts of flooding from the sea and tidal waters are more severe than flooding from rivers.

The most severe flood risk is likely due to high tidal levels, however the EA flood maps for planning do not differentiate between fluvial and tidal flooding

The EA flood zone mapping, as shown in Figure 4 indicates the four areas of the application site within flood zones 1 to 3 as follows:

- West wharf: predominantly flood zone 3
- South wharf: predominantly flood zone 2
- East wharf: predominantly flood zone 1, with small areas of flood zone 2
- North wharf: predominantly flood zone 1, with some areas of flood zone 2

It is also noted that the adjacent Regent Road is also shown as Flood Zone 1.



Figure 4 - Environment Agency's flood zone mapping with indicative red line boundary (Flood extents: © Environment Agency copyright and/or database right 2019. All rights reserved. Background map: Map data ©2019 Google)

Flood Zone 3a is defined as an area with a 1% or greater annual probability of river flooding, or a 0.5% or greater annual probability of flooding from the sea in any given year. According to the NPPF, the risk of flooding from rivers or the sea in Flood Zone 3a is classified as high.

Flood Zone 2 is defined as an area with an annual probability between 1% and 0.1% for river flooding, and between 0.5% and 0.1% for flooding from the sea in any given year.

The Mersey Estuary 2018 Study Flood Levels showed the flood levels for the site for both the defended and undefended scenarios are similar (6.15m AOD for 1 in 100 year and 6.48m AOD for 1 in 1000 year). The flood levels are still water levels within the River Mersey.

Inspection of the site-specific topographic survey data and the flood level data indicates that the EA flood zone mapping overestimates the level of flood risk at the application site. The site-specific topographic survey indicates that existing ground levels generally vary between 6.6m AOD and 7.3mAOD throughout the application site. There is a very small area in the northwest corner of the application site within which levels drop as low as 6.46mAOD, this is however surrounded by higher levels. On this basis the application site is deemed to be in Flood Zone 1.

EA provided predicted flood levels for 2065 and 2115 to account for climate change and sea level rise (SLR). With existing site levels generally below 6.8m AOD, the vast majority of the site would move into Flood Zone 3 by 2115 (6.97m AOD) (i.e. high risk of flooding), assuming no benefit from existing or proposed defences. At approximately 7.1m AOD Regent Road would remain free from flooding in 2115.

Flooding from surface water and sewers

Surface water flooding occurs when the infiltration capacity during a storm event is low, or when drainage systems do not drain away rainwater. This type of flooding is usually localised and associated with short-duration heavy downpours of rain.

The Liverpool Integrated Model surface water flood map (see Figure 5) was provided by the LCC following consultations in February 2019. The map is considered more accurate than the EA flood maps and shows that there is a low flood risk from surface water within or at the vicinity of the application site. The flood maps do not take into account the effects of climate change.

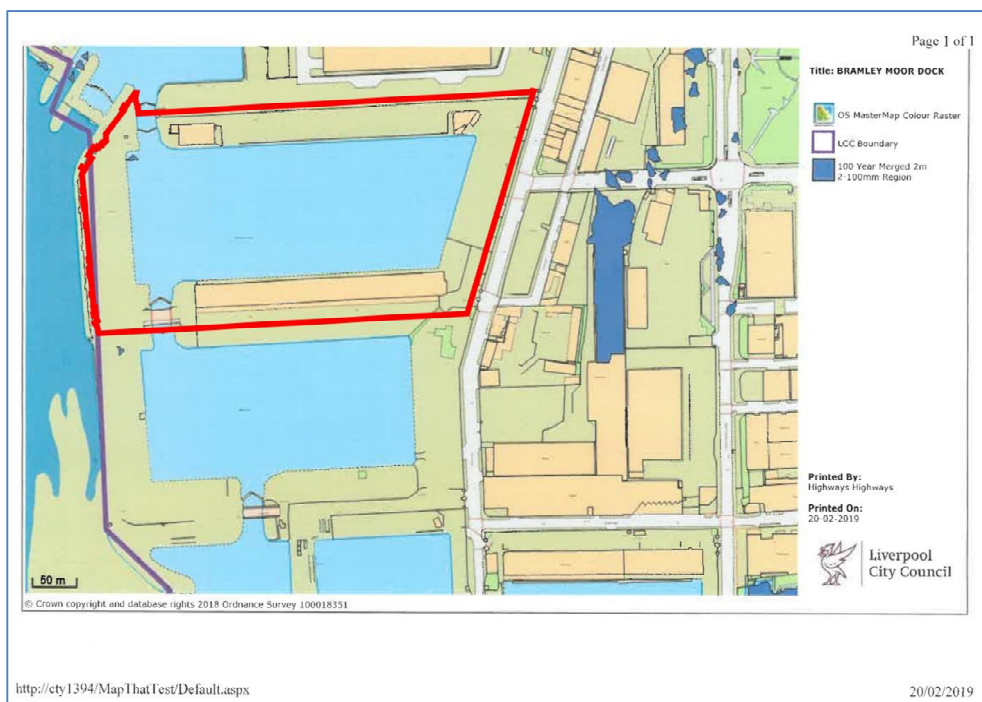


Figure 5 Surface water flood extents map for the 1 in 100 year flood event (Liverpool Integrated Model, provided by LCC on 20/02/2019)

Information on higher order events such as the 1 in 1000 year even, can be attained from the EA's flood maps for surface water flooding. As shown in Figure 6, there are areas adjacent to the site shown to be at low risk from surface water flooding (1 in 1000 year event). These areas include Regent Road immediately outside the site with depths predicted to be less than 300mm. Considering the low flood levels, it is anticipated that access

to and from the site can be attained safely via Regent Road during up to the 1 in 1000 year surface water flood event. The surface water flood risk at the application site is considered *low to very low*.

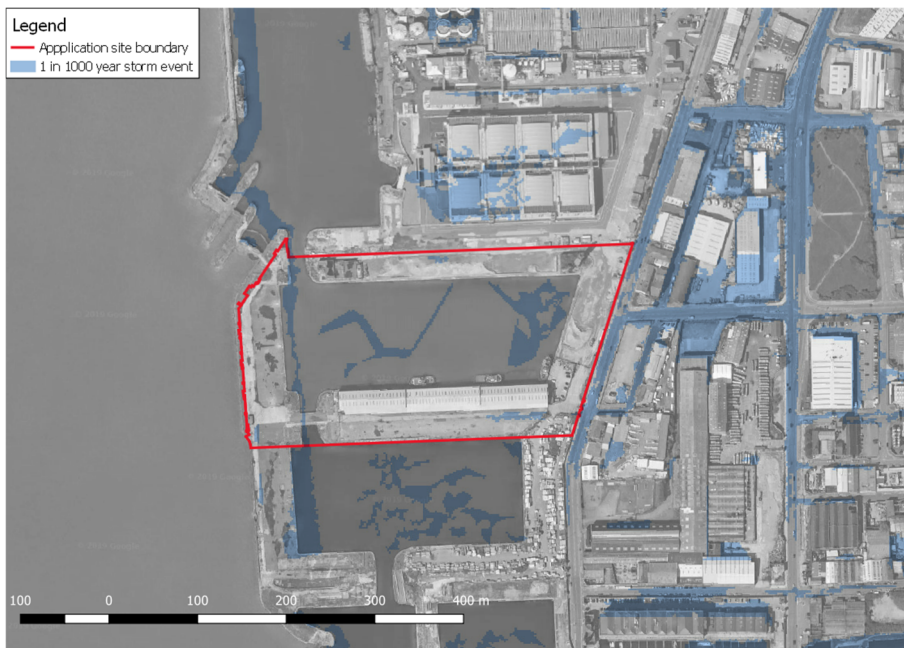


Figure 6 - Environment Agency's surface water flood extents map for the 1 in 1000 year flood event (EA, 29/10/2019)

United Utilities have been consulted on incidences of sewer and infrastructure flooding in the local area. The sewer networks surrounding the site are generally combined systems, where both rain water and foul effluent drain to the same pipes. This means rain water runoff becomes contaminated and needs to be treated prior to disposal. A large upgrade of the sewer systems in the area was completed in 1989, including construction of the United Utilities Wastewater Treatment Works and the Mersey Estuary Pollution Alleviation Scheme (MEPAS) Tunnel that runs beneath Regent Road. The latter provides a large volume of storage to retain the runoff from large rainfall events and allow its treatment at the Sandon Dock works prior to discharge to the Mersey. Please refer to Figure 7 for the United Utilities assets map.

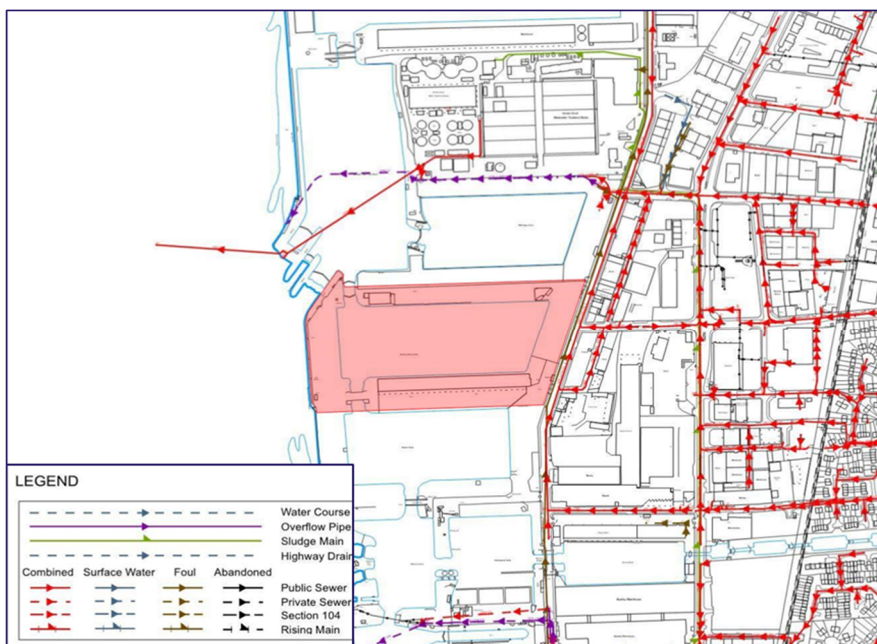


Figure 7 United Utilities map of public sewers around the site (site boundary shown in red fill)

Flooding due to sewer failure since the upgrade works have only occurred during very heavy intense storm conditions coinciding with a high tide.

The large storage capacity of the MEPAS tunnel and its gated systems of outfalls make flooding rare and United Utilities have no recorded incidents or knowledge of any flooding in the vicinity of Bramley-Moore Dock.

A trunk water main is present beneath Regent Road to the north-west of the site and smaller distribution mains run north-south along the road. A failure of these mains could lead to flooding within Regent Road.

Flooding from groundwater

Flooding from groundwater occurs when the water table in permeable rocks such as chalk and limestone rises to enter underground spaces such as basements and cellars or reaches a sufficient level to emanate from the ground surface itself.

According to the LCC Preliminary Flood Risk Assessment (PFRA, 2011), there are no known records of groundwater flood risk in Liverpool. This could be attributed to the recording mechanism and the fact that it is unlikely such an event to have been correctly diagnosed.

Groundwater level within Made Ground has been found to be relatively consistent, except for a peak in early January 2018 (likely in response to rainfall) followed by a decline back to approximate average levels by mid-January.

There are differences in levels of groundwater in Made Ground on each of the four wharves, suggesting the water bodies are not in hydraulic continuity and that they relate to levels of impermeable materials on each of the wharves.

Flooding from reservoirs, canals and other artificial sources

The Environment Agency map shows that there are no reservoirs located within the vicinity of the site and that the site does not lie within a breach flood flow path of a reservoir. According to the PFRA, there are no LCC records of canal flooding and British Waterways' records show no canal breaches within Liverpool since a breach in 1940 caused by bombing.

Wave overtopping

Wave overtopping can occur due to a combination of a high still water level and waves meeting a structure such as the river wall or lock entrance isolation structures. The Mersey River wall protects the west part of the site up to and including a 1 in 100 year and 1 in 2-year event for vehicles and pedestrians respectively under present day conditions. The level of protection decreases to a 1 in 5 year event for vehicles under the climate change condition. Areas along the western boundary are not considered safe for pedestrians during any storm, under climate change conditions.

Flood risk summary

The primary flood risk is Tidal flooding from the River Mersey. The maximum water levels are expected to be 6.97m AOD in 2115, No formal flood defences are at the vicinity of the site.

The site is at low risk of flooding from groundwater.

The site is at low risk of flooding from other sources including surface water, failure of reservoirs, and rivers.

Areas along the western boundary are at risk of wave overtopping. The area within 15m of the front face of the river wall is not considered safe for pedestrians and vehicles for the majority of storm return period events.