



Plot 7 Flood Risk Assessment

Addendum to Liverpool Waters FRA, 2010

Liverpool City Council

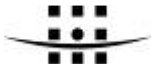
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Draft Report

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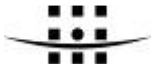
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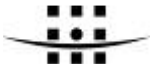


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1 INTRODUCTION

1.1 Scope

Royal Haskoning have been commissioned by Liverpool City Council to formulate a planning application for the construction of a temporary cruise terminal located on the east bank of the Mersey Estuary, at the junction of Princes Parade and St Nicholas Place (grid reference SJ 3382196018). This document forms the Flood Risk Assessment (FRA) required as part of the planning application.

1.2 Liverpool Waters

An outline planning application (reference 10O/2424) was submitted to Liverpool City Council by Peel Land and Property (Ports) Ltd on the 4th October 2010 with an updated Addendum submitted November 2011 for the redevelopment of a site stretching from Bramley Moore Dock to Princes Dock. The development area, referred to as 'Liverpool Waters' covers an area of 60ha of mixed use development and is subdivided into a number of development plots. The proposed development discussed within this FRA report is located on Plot 7 (also known as Plot 1A within the Liverpool Waters Scheme).

A previous FRA and Addendum¹ was submitted as part of the Liverpool Waters planning application, covering the entire 60ha site, with a scope deemed as equivalent to an Outline FRA (as specified within PPS25²). Due to a lack of detailed information available at the time, the report concluded that more detailed FRAs would be required as addendums to the original report, assessing the flood risk to individual development plots within the Liverpool Waters development area, as planning applications come forward. As such this FRA provides a more detailed assessment of the flood risk to Plot 7 and is very closely connected to the previous document, drawing upon the information and conclusions held within that report.

This FRA has been written to reflect the requirements of PPS25 and the completed Pro Forma is included in **Appendix C**, referring to the relevant sections of this report to demonstrate compliance.

¹ 'Liverpool Waters Flood Risk Assessment & Addendum', November 2010, reference A024649

² Planning Policy Statement 25: Development and Flood Risk, March 2010

2 DEVELOPMENT DESCRIPTION AND LOCATION

2.1 Site Location and Existing Features

Plot 7 covers an area of just under 0.8ha and is located within the Liverpool Waters development area as shown in **Figure 2.1** below. An aerial image demarking the boundaries of the site in relation to Princes Parade, St Nicholas Place, the River Mersey and Princes Dock is provided in **Figure 2.2**. The site is currently derelict, covered by a mix of hard standing and rubble.

Figure 2.1 - Location of Plot 7 within Liverpool Waters

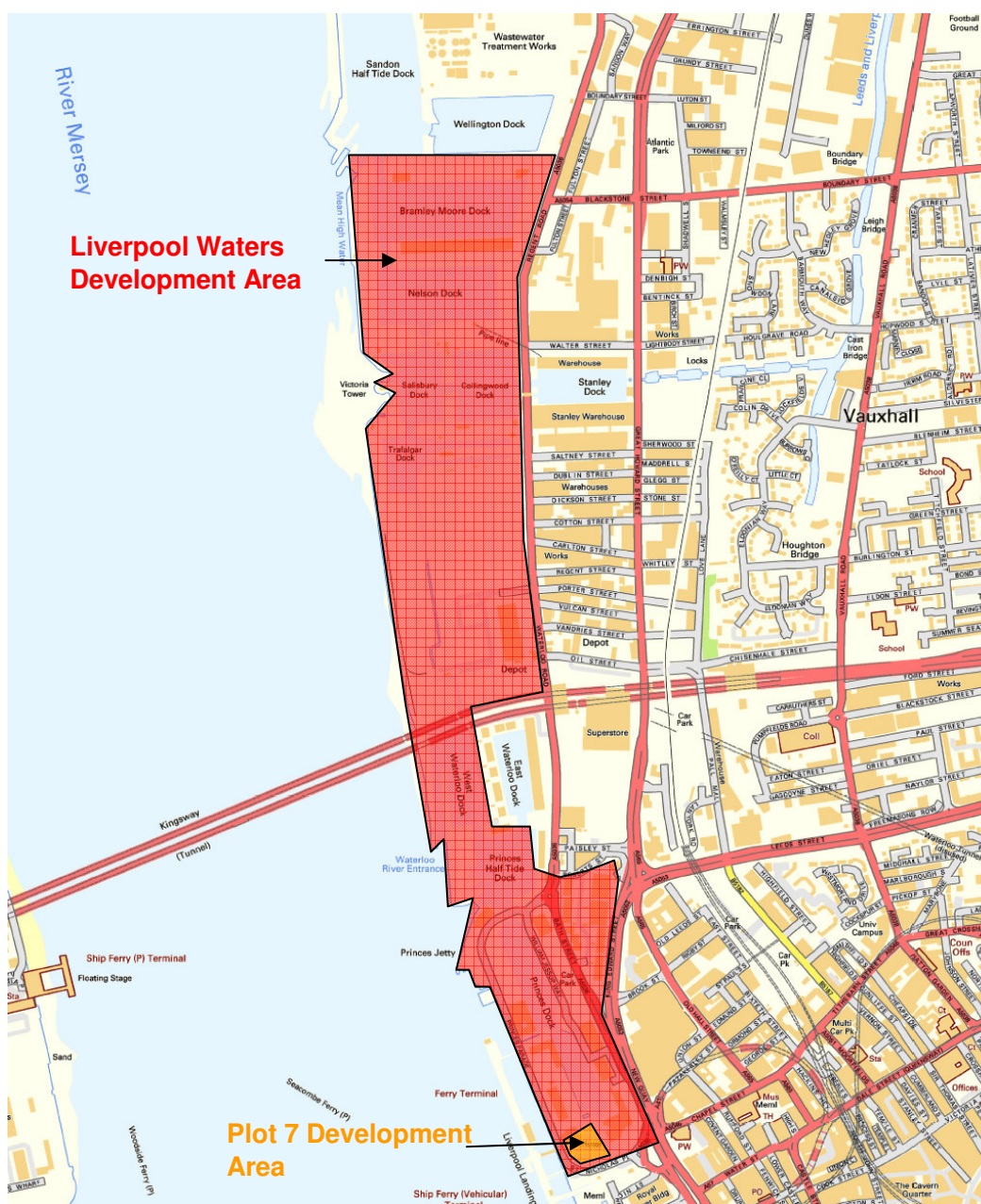


Figure 2.2 - Aerial View of Plot 7



2.2 Topography

A detailed topographic survey of the site was undertaken in October 2011 and included in **Appendix A** of this FRA. This shows the site to be relatively flat with some undulations and slightly raised above the level of Princes Parade.

2.3 Nature of the Proposed Development

The proposed development is for the construction of a temporary baggage hall and associated access roads close to the western boundary of Plot 7, impacting on an area of just over 0.3ha of the site. The baggage hall will be constructed from a lightweight steel portal frame with a canvass roof and solid walls to the sides and gable ends, similar to a pitched roof marquee. Due to its temporary nature the building does not have an elevated threshold, although the area of Plot 7 to be developed will be levelled at 7.2mAOD.

A schematic of the proposed development layout is provided in **Appendix B**. The marquee structure will house a baggage hall, utilised for the collection and depositing of luggage by cruise ship passengers, an HM customs office, a UK Border Agency office and a store cupboard. A line of portakabin toilets will be located outside the northern



end of the hall. Access roads will surround the baggage hall, utilised by passenger mini-busses, passenger coaches and baggage trains. As such the development is classified as 'Less Vulnerable' as per Table D.2 of PPS25.

It is intended that the structure is utilised for one day per week, for the scheduled cruise liner docking, covering six months of the year for a maximum of five years.

3 DEFINITION OF THE FLOOD HAZARD AND PROBABILITY

The potential sources of flooding to the area were summarised within the Liverpool Waters FRA. Based on that information, which included an assessment of the Liverpool City SFRA the sources of flood risk to Plot 7 are listed below.

3.1 Still Water Tidal Flood Risk

The site is located on the right bank of the estuary of the River Mersey, within the tidal limit, and on the boundary of the Environment Agency's Flood Zone 2³ and Flood Zone 3⁴ extents (as shown in *Figure 2* of the Liverpool Waters FRA, *Page 21*). The extent of these zones is debated within the Liverpool Waters FRA and the conclusions within that report are upheld for Plot 7. **Table 3.1** states the flood level estimates provided within the Liverpool Waters FRA. As shown in the recent topographic survey, Princes Parade is at a level of 6.7mAOD and therefore higher than the still water level of the 0.1% (1 in 1000) risk of tidal flooding in any one year. This places Plot 7 above the level at risk of flooding and entirely within Flood Zone 1. Corresponding to this, there are no known records of fluvial or tidal historical flooding to the site (Liverpool Waters FRA, page 5).

Table 3.1 - River Mersey Estuary Extreme Water Levels

Risk of Tidal Flooding in Any One Year	Water Level (mAOD)*
1% (1 in 100)	6.0
0.5% (1 in 200)	6.11
0.1% (1 in 1000)	6.37

* Results provided from the Extreme Sea Level Study, Environment Agency, 2008

3.2 Tidal Overtopping Flood Risk

As extreme wave height overtopping was not assessed as part of the Liverpool Waters FRA, an assessment for Plot 7 has been undertaken as part of this FRA. This has been based on the topographic survey carried out in October 2011, the River Mersey extreme water levels shown in **Table 3.1**, the results of a recent assessment of wave heights in the Mersey Estuary and consideration of the wave attenuation resulting from the cruise liner pontoon (see **Figure 2.2**).

The topographic survey indicated the crest level at the quay wall varies between 6.85mAOD at the northern end and 6.7mAOD at the southern end of Plot 7. The carriageway of Princes Parade is approximately 7m wide and is typically 6.7mAOD at its

³ Between 0.5% (1 in 200) and 0.1% (1 in 1000) probability of sea flooding in any one year

⁴ Greater than 0.5% (1 in 200) probability of sea flooding in any one year



centre. As stated above this removes the risk of flooding to the site during still water conditions. Recent assessment of wave heights in the Mersey show a relatively consistent predicted wave height along the waterfront vicinity of Plot 7. Wave heights vary with offshore wave direction, between 0.4m from 270°, to 1.1m from 330°. As a result, this assessment takes the worst case wave height of 1.1m just offshore of the quay wall. The wave period is taken as 5.5seconds.

It is considered that the floating pontoon located adjacent to Plot 7 (see **Figure 2.2**), which acts as the Cruise Liner berth, will act as a floating breakwater, providing shelter to the quay behind. Wave transmission past floating breakwaters is critically dependant on the breadth of the structure in comparison with wave length. Longer period waves tend to pass beneath such pontoons. As the pontoon is some 10m wide (B) and the inshore wave length (L) of a 5.5 second period wave in 16m depth of water is 46m, the ratio of B/L is 0.22. Typically wave transmission for this ratio would be approximately 0.3 of incident wave height but could increase to 0.5 of incident wave height. As a result, the maximum wave height of 1.1m can be considered to be reduced to between 0.3m to an upper limit of 0.5m, impacting on the actual quay wall.

Using this information an assessment of overtopping discharge has been undertaken using Eurotop (HR Wallingford) methodology to provide the following results:

Water level condition	Level m	Crest Level		Overtopping discharge (l/s/m)*	
		Level	Position	0.5m wave height	0.3m wave height
Present day:	AOD				
1:100	6.0	6.7	Quay wall	1 - 4	0.5 - 0.1
1:200	6.11	6.7	Quay wall	5 - 2	0.9 - 0.2
1:1000	6.37	6.7	Quay wall	13 - 8	3.9 - 1.8
1:100	6.0	6.8	Back of road*	2 - 1	0.3 - 0.04
1:200	6.11	6.8	Back of road*	4 - 1	0.55 - 0.1
1:1000	6.37	6.8	Back of road*	9 - 5	2.3 - 0.8
1:200	6.11	7.2	Recommended development level **	0.7 - 0.12	zero

Notes:

* Water overtopping the quay wall would reduce further as it progresses across Princes parade (7m wide). These values are therefore high.

** Water overtopping the quay wall would reduce further as it progressed across Princes Parade (7m). Only under sea level rise conditions would water be expected to reach the development plot, which is a scenario not relevant to this development - see **Section 4**

+ Eurotop, allows both a probabilistic and deterministic value of discharge to be determined. The range of values is presented in the table giving an upper and probable lower limit.

The conclusions that can be drawn from this overtopping analysis are that under present day conditions, there could be some overtopping of Princes Parade. Depending on the wave attenuation by the pontoon, the discharge could be significant under an extreme event to result in closure of the Parade to pedestrians. However, the seaward slope of the parade and the rise in land to Plot 7 would result in water being shed back to the river. Flooding would therefore be limited to the road and would not accumulate. As such, there is not deemed to be a risk to the proposed development.



3.3 Surface Water

There are no Liverpool City Council Highways department records referring to incidences of highways flooding in the vicinity of the development site (see Liverpool Waters FRA page 6) and no records of surface water flooding to the site. Following the proposed levelling of the development area of Plot 7, surface water will not accumulate on site, instead draining to the highways drainage network and into the Mersey Estuary. Due to the elevated nature of the site above the road network if surface water was to drain towards the development site from surrounding land it would be routed around the site and into the Mersey Estuary.

3.4 Sewer Flooding

The Liverpool Waters FRA states one known occurrence of sewer flooding in a low spot of St Nicholas Place, which forms the southern boundary of Plot 7. The topographic survey indicates that the low spot on St Nicholas Place is 6.36mAOD. This is significantly lower than the proposed levelled threshold of 7.2mAOD for the development and is therefore, as stated within the Liverpool Waters FRA, not deemed to pose a risk to the development should it reoccur. As the proposed development will not be connected to the sewer network there is no risk of internal flooding from a drainage network exceedence event.

3.5 Groundwater Flooding

The risk from groundwater flooding is considered 'low' (see Liverpool Waters FRA, page 6) and therefore not considered within this FRA.

3.6 Canal Infrastructure Flooding

The risk from groundwater flooding is considered 'low' (see Liverpool Waters FRA, page 6) and therefore not considered within this FRA.

4 CLIMATE CHANGE IMPACTS

As this planning application is for the erection of a temporary structure with a maximum life span of five years, it is not considered necessary to account for climate change scenarios within this FRA. However, if the building life is extended this FRA should be reviewed with up-to-date water levels, accounting for any sea level rise or increases in peak rainfall intensity and the appropriate flood risk mitigation measures undertaken if necessary.

5 DEVELOPMENT PLANS

The Liverpool Waters FRA states that the regeneration of the area fits within the City Council's development plans and, as the site is located within Flood Zone 1 the PPS25 Sequential Test has been passed.



6 FLOOD RISK MANAGEMENT MEASURES

As the site is located in Flood Zone 1 and there is deemed to be very minimal flood risk posed from other sources no flood risk management measures are being implemented as part of this proposal. This is, however, reliant upon the upkeep of the current level of the Princes Parade road. Although unlikely, should this level be adjusted during the lifespan of this development, the impact on flood risk to this development site should be reviewed.

7 OFF SITE IMPACTS

7.1 Tidal Flooding

As the site is located in Flood Zone 1, the levelling of part of the site surface will not impact on flood plain storage or have any effect on neighbouring properties.

7.2 Surface Water

As the site is currently covered in hard standing, the proposed development will not change the infiltration characteristics of the site and impact on runoff will be negligible. It is proposed that site drainage remains as the current situation whereby runoff from the site drains to the surrounding highways and the Mersey Estuary. It is appreciated that even within Flood Zone 1, PPS25 recommends a reduction in runoff from developments. However, due to small scale (0.3ha) and temporary nature of this development it does not seem appropriate in this case, although should be implemented in the development of any future permanent structure on the site, as recommended within the Liverpool Waters FRA.

8 RESIDUAL RISKS

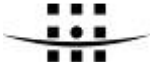
As the site is located in Flood Zone 1 and will not be connected to the drainage network, the residual risks of flooding to the site are deemed to be minimal. Given the intended use of the building, in the unlikely scenario that the conditions in the Mersey Estuary reach sufficient severity to cause the extreme overtopping scenarios outlined in Section 3.1.2 to be exceeded, it is highly unlikely that the cruise liner will be able to dock and, as such, the development site will not be in use.



9 CONCLUSIONS

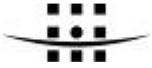
This FRA has reached the following conclusions:

1. The Liverpool Waters FRA, 2010, is directly applicable to this development application and should be referred to in conjunction with this FRA;
2. Although located on the border of the Environment Agency's Flood Zone 3, a comparison of the topographic survey with recently modelled water levels concludes that this development site is located within Flood Zone 1;
3. Due to its location in Flood Zone 1 and compliance with the City Council's development plans, the Sequential Test has been passed;
4. Extreme wave overtopping analysis has been undertaken and no risk to the development site under current conditions has been identified;
5. Due to the short life span of the development it was not deemed necessary to assess the impact of climate change to the site. This must be reassessed if the temporary structure exceeds its proposed 5 year lifespan;
6. There is limited risk of surface water flood to the site, with any potential ponding being mitigated against through ground levelling;
7. One sewer flooding incident has been recorded in proximity to the site, but, due to variations in ground level and lack of sewer connections to the site, the risk of such an event effecting the proposed development is deemed to be low;
8. There is no identified risk of flooding from any other sources;
9. Although no flood risk mitigation measures are being implemented as part of this development, the assessment undertaken as part of this FRA is reliant upon the upkeep of the pontoon and level of Princes Parade. Should either of these change, the impact upon flood risk to this development site should be reviewed;
10. No offsite flood impacts are expected from this development;
11. It is not deemed appropriate to reduce surface water runoff for this temporary development. However, a drainage strategy should be implemented for any future permanent development;
12. Residual risks to the development site are deemed to be minimal as it is highly unlikely the site will be used if flooding was to occur;
13. Due to the location of the site within Flood Zone 1 and the size of the development area as less than 1ha, no further flood risk assessment is required for this site.



Appendix A

Topographic Survey



Appendix B

Development Layout



Appendix C

PPS25 Pro Forma





PLANNING POLICY STATEMENT 25 REQUIREMENTS (December 2009)	FRA REPORT COMPLIANT SECTION
1 Development description and location	
1a. What type of development is proposed and where will it be located? Include whether it is new development, an extension to existing development or change of use etc.	<i>Section 2</i>
1b. What is its vulnerability classification?	<i>Section 2.3</i>
1c. Is the proposed development consistent with the Local Development Documents?	<i>Section 5</i>
1d. Please provide evidence that the Sequential Test and, where necessary, the Exception Test has been applied in the selection of this site for this development type?	<i>Section 5</i>
1e. Will the proposal increase overall the number of occupants and/or users of the building/land; or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people?	<i>Section 2.3 & Section 8</i>
2. Definition of the flood hazard	
2a. What sources of flooding could affect the site? (see Annex C PPS25).	<i>Section 3</i>
2b. For each identified source, describe how flooding would occur, with reference to any historic records wherever these are available.	<i>Section 3</i>
2c. What are the existing surface water drainage arrangements for the Site?	<i>Section 3.3 & Section 7.2</i>
3. Probability	
3a Which flood zone is the site within?	<i>Section 3.1</i>
3b If there is a Strategic Flood Risk Assessment covering this site, what does it show?	<i>Sections 3</i>
3c What is the probability of the site flooding taking account of the contents of the SFRA and of any further site-specific assessment?	<i>Section 3</i>
3d What are the existing rates and volumes of run-off generated by the site?	<i>Section 3.3 & 7.2</i>
4. Climate change	
4a How is flood risk at the site likely to be affected by climate change?	<i>Section 4</i>



5. Detailed development proposals	
5 Where appropriate, are you able to demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding, including providing details of the development layout?	<i>Section 2.3</i>
6. Flood risk management measures	
6. How will the site be protected from flooding, including the potential impacts of climate change, over the development's lifetime?	<i>Section 6</i>
7. Off site impacts	
7a How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?	<i>Section 7</i>
7b How will you prevent run-off from the completed development causing an impact elsewhere?	<i>Section 7</i>
8. Residual risks	
8a What flood-related risks will remain after you have implemented the measures to protect the site from flooding?	<i>Section 8</i>
8b How, and by whom, will these risks be managed over the lifetime of the development?	<i>N/A - see Section 8</i>