

# Preliminary

## Police and Crime Commissioner for Merseyside Police - OCC

### Flood Risk Assessment

Curtins Ref: 37770B / FRA

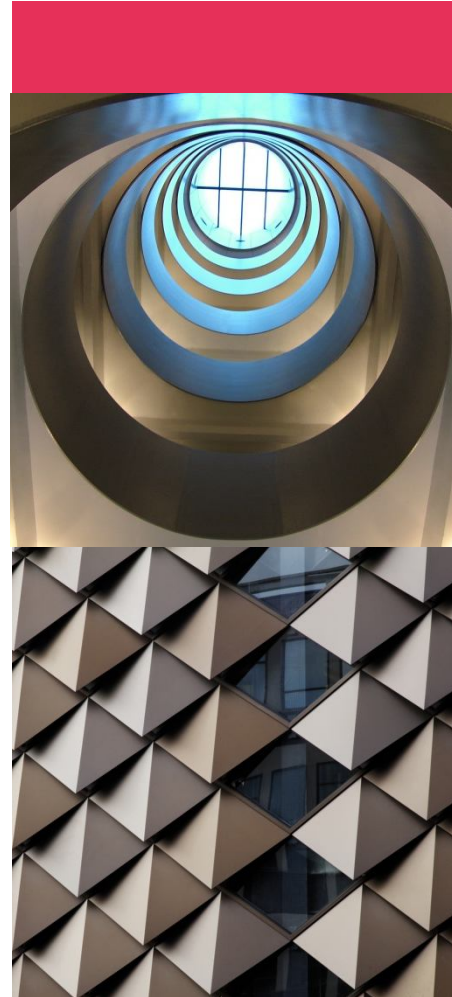
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## Control Sheet

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## Revisions

Revision	Date/ by	Description of Revision
1.1	AMO	Proposed drainage description updated to suit revised proposed site layout.

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Existing Site Layout

Proposed Layout

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Proposed Hardstanding Layout

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Existing Drainage Layout

Proposed Drainage Layout

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## Executive Summary

The following Flood Risk Assessment was commissioned by Merseyside Police Authority for the new development on Leeward Drive, Estuary Banks, Liverpool.

The Flood Risk Assessment reviewed the following information:

- The EA flood maps for rivers and sea flooding, surface water flooding and reservoir flooding.
- Preliminary Flood Risk Assessment (PFRA) for Liverpool City Council dated June 2011.
- United Utilities Public Sewer Records

After reviewing the information, the conclusions are:

- The site is located within Flood Zone 1 and classified as 'Highly Vulnerable' development, the sequential and exception test are not required to be undertaken, therefore the development is appropriate at this location
- There is currently no flood risk identified on the Environment Agency and SFRA flood maps for this area for fluvial, tidal and reservoir flooding the site is therefore regarded to be at low risk from these types of flooding.
- The PFRA highlights that the site is not within an area susceptible for groundwater flooding. The site is therefore considered to be at low risk from groundwater flooding.
- There have been no recorded flooding events at the site. The site has not been subject to any historical flood events. The Environment Agency Surface Water flood map for the area indicates that the site is at very low risk of surface water flooding. Therefore risk of flooding to the site from surface water flooding is considered very low.
- Providing the principles set out within the report are followed and developed at detailed design stage, the site can be considered to have a low probability of suffering from any form of flooding and not increasing the probability of flood risk to other properties within the local catchment area.

The recommendations are:

- The proposed external levels should fall away from the building so that low points are not created, encouraging surface water to fall away from the proposed buildings.
- A pathway for flood water should be created working with the existing site levels to allow free passage of any overland flows through the site, located to avoid the building and other important structures.
- The surface water from the proposed development is proposed to be collected by the use SUDS systems prior to discharge into the existing adopted surface water sewer in Estuary Banks at an agreed restricted rate.

- A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.

## 1.0 Introduction

### 1.1 Project Background

- 1.1.1 Curtins was appointed on behalf of Merseyside Police Authority to provide a Flood Risk Assessment (FRA) for the proposed development at Leeward Drive, Estuary Banks, Liverpool. The FRA provides information on the nature of flood risk at the site and follows Government guidance with regards to development and flood risk.
- 1.1.2 The report is based on current available information and preliminary discussions.
- 1.1.3 Proposals contained or forming part of this report represent the design intent and maybe subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material deviation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.
- 1.1.4 Where the proposed works to which this report refers are undertaken more than twelve months following the issue of this report, Curtins shall reserve the right to re-validate the findings and conclusions by undertaking appropriate further investigations at no cost to Curtins.

### 1.2 Scope of Flood Risk Assessment

- 1.2.1 The assessment is to be undertaken in accordance with the standing advice and requirements of the Environment Agency (EA) for Flood Risk Assessments as outlined in the Communities and Local Governments Planning Policy Guidance to the National Planning Policy Framework (NPPF).
- 1.2.2 The assessment will:
  - Investigate all potential risks of flooding to the site,
  - Consider the impact the development may have elsewhere with regards to flooding; and
  - Consider outline design proposals to mitigate any potential risk of flooding determined to be present.



## 2.0 Legislation, Policy and Guidance

### 2.1 National Policies

2.1.1 NPPF (National Planning Policy Framework) sets out the Government's national policies on different aspects of land use planning in England

2.1.2 Section 10: Meeting the challenge of climate change, flooding and coastal change states that *"Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimension of sustainable development"*

2.1.3 Paragraph 100 of NPPF states:

Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. Local plans should be supported by Strategic Flood Risk Assessments and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies such as lead local flood authorities and internal drainage boards. Local Plans should apply a sequential, risk based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change by:

- Applying the Sequential Test;
- If necessary, applying the Exception Test;
- Safeguarding land from development that is required to reduce the causes and impacts of flooding; and
- Where climate change is expected to increase the flood risk so that some existing development may not be suitable in the long-term, seeking opportunities to facilitate the relocation of development, including housing to more sustainable locations.

2.1.4 The Sequential Test is applied by the Local Planning Authority to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed.

2.1.5 If following the application of the Sequential Test, it is not possible or consistent with wider sustainability objectives for the development to be located in zones of lower probability of flooding; the Exception Test can be applied. This test provides a method of managing flood risk while still allowing necessary development to occur.

2.1.6 Using Table D2 from NPPF Technical Guidance, this site's Flood Risk Vulnerability classification is More Vulnerable. See below for table extract.

Table 2.1: NPPF Technical Guidance Table 2	
Highly Vulnerable	<ul style="list-style-type: none"> <li>• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding;</li> <li>• Emergency dispersal points;</li> <li>• Basement dwellings;</li> <li>• Caravans, mobile homes and park homes intended for permanent residential use<sup>3</sup>;</li> <li>• Installations requiring hazardous substance consent<sup>4</sup>. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")<sup>5</sup>.</li> </ul>

<sup>3</sup> For any proposal involving a change of land to a caravan, camping or chalet site, or to a mobile home site or park home site, the Sequential and Exception Tests should be applied.

<sup>4</sup> See Circular 04/00: Planning controls for hazardous substances (paragraph 18) at: [www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols](http://www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols)

<sup>5</sup> In considering any development proposal for such an installation, local planning authorities should have regard to planning policy on pollution in the National Planning Policy Framework.

2.1.7 Using NPPF Technical Guidance Table 3, as shown below, as a simple chart, it shows as a simple check whether the development should be or shouldn't be permitted and whether further information will be required for the planning application.

Table 2.2: NPPF Technical Guidance Table 3						
Flood Risk Vulnerability Classification (See Table D2)		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (See Table D1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
	Zone 3b 'Functional Flood Plain'	Exception Test required	✓	✗	✗	✗

- 2.1.8 The proposed development is located within zone 1. The proposed development, in accordance with Table 2.1 has a More Vulnerable classification, and therefore, in accordance with the above Table 2.2, no Exception Test is required and the development should be permitted.
- 2.1.9 The impacts of climate change on flooding from land, rivers and sea must be assessed as part of a Flood Risk Assessment (FRA). Sensitivity ranges, as shown in NPPF Technical Guidance – Table 5, provide precautionary values to uncertainty on climate change and its impacts on rainfall intensities, river flow, and wave height. Table 2.3 below replicates NPPF Technical Guidance Table 5:

<b>Table 2.3: NPPF Technical Guidance Table 5</b>				
Parameters	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall Intensity	+5%	+ 10%	<b>+ 20% Non-Residential</b>	+ 30%
Peak River Flow	+ 10%	+ 20%		
Offshore wind speed	+ 5%		+ 10%	
Extreme wave height	+ 5%		+ 10%	

- 2.1.10 For the purpose of this report, the figure used to estimate the Peak Rainfall Intensity for the Application Site will be 20%.

## 2.2 Local Policy

- 2.2.1 The core Strategy for Liverpool City Council is currently awaiting adoption, however there are current policies within the UDP which are appropriate to this development. Within the UDP. Policy EP12: Protection of Water Resources states:

- 1 Planning permission will not be granted for development which, in the opinion of the City council following consultation with the Environment Agency, would adversely affect the quality of supply of surface water or groundwater as a result of:
  - i. The nature of the surface or waste water discharge; or
  - ii. Unsatisfactory arrangements for the disposal of foul sewage, trade effluent or surface water; or
  - iii. The disturbance of contaminated land; or
  - iv. The spillage or leakage of stored oil or chemicals.

- 2 Planning permission will not be granted for developments involving local abstraction of surface or groundwater which in the opinion of the City Council following consultation with the Environment Agency would:

- i. Increase requirements for water, unless adequate water supply already exists or would be provided in time to serve the development; or
- ii. Pose an unacceptable risk to the current supply of water users; or

2.2.2 Also within the Liverpool UDP, Policy EP13 states:

- 1 Unless appropriate alleviation of mitigation measures are carried out, planning permission will not be granted for development which would:

- i. Be at direct unacceptable risk from flooding;
- ii. Be likely to increase the risk of flooding elsewhere;
- iii. Cause loss of access to watercourse for future maintenance;
- iv. Result in an adverse impact on the water environment due to additional surface water run off; or
- v. Have adverse effects upon the integrity of tidal and fluvial defences.

- 2 All works in, under, over or adjacent to watercourses, waterbodies and the coast will need to be approved by the Environment Agency's Environmental Appraisal Procedure. Culverting and diversion will not be permitted except to enable reasonable access over a watercourse.

2.2.3 A Preliminary flood Risk Assessment has been produced by Liverpool City Council. The PFRA does not yet contain information from the Surface Water Management Plan and the Water Cycle Study as both of these reports are still to be completed. Historical flooding identified within the PFRA does not include the Development Site. It is also reported in the PFRA that there are no historical instances of any groundwater flooding within the Liverpool area. Recommendations within the PFRA have been included within this FRA.

## 3.0 Existing Site

### 3.1 Site Description

- 3.1.1 The site is located approximately 10km to the south east of Liverpool city centre. The site is bounded by an existing development north, Speke Hall Avenue to the east, Estuary Banks to the south & Leeward Drive to the west. Refer to Figure 1 for the aerial photograph of the site.
- 3.1.2 The existing site consists of a land which has been prepared for development and form part of the Estuary Banks development site.

**Figure 1: Aerial Photograph**



### 3.2 Existing Water bodies

- 3.2.1 The nearest water body to the site is the River Mersey which is located approximately 1.5km to the south west of the site.

### 3.3 Topography

- 3.3.1 A topographical survey has been carried out on the site, all information relating to levels presented in this report have been taken from this topographical survey.

3.3.2 The highest land on the site is located in the north east corner of the site (26.00m ODN), with the lowest land located in the south west of the site (25.31m ODN).

3.3.3 The topographical survey drawing is enclosed in Appendix A.

### **3.4 Hydrogeological Setting**

3.4.1 The environment Agency's website Groundwater Protection Map shows that the Application site is not located within any Groundwater source protection zone.

3.4.2 Information contained within the Phase 2 Intrusive Investigation report, indicates that the site is underlain by an unproductive aquifer for the superficial deposits and a principal aquifer for the bedrock, refer to the Phase 2 Intrusive Investigation report for further details.

### **3.5 Existing Run off**

3.5.1 Factors influencing the amount of run off generated for the Application Site include its extent and type of surface cover. The site extends to approximately 4.62ha; with the site occupied with landscaping / grass, therefore the site is 100% permeable.

3.5.2 The existing Greenfield rate for the site should not be exceeded with the proposed discharge rate into the existing public sewer.

3.5.3 Using the UK Suds Tools website, for this exact location, the greenfield rate has been calculated based upon the Wallingford procedure, and equates to the following:

- $Q_{bar} \text{ (l/s)} = 24.90$
- 1 in 1 yr (l/s) = 21.66
- 1 in 30 yrs (l/s) = 42.33
- 1 in 100 yrs (l/s) = 51.79

3.5.4 Using the Rural Run off option (ICP SUDS) within the Source Control module of Microdrainage the greenfield rate equates to the following:

- $Q_{bar} \text{ (l/s)} = 51.7$
- 1 in 1 yr (l/s) = 45.0
- 1 in 30 yrs (l/s) = 76.3
- 1 in 100 yrs (l/s) = 83.8

3.5.5 As there appears to be quite a difference with the above calculated rates, the lowest rate of 21.66 l/s should be the maximum allowable rate off site.



## 4.0 Hydrological Assessment

### 4.1 Summary of Flood Risk

- 4.1.1 This study assesses the risk from different types of flooding to the development and the risk of flooding from the development, taking into consideration climate change, as well as how flood risks should be managed. From the evidence collated and subsequent negotiations the main types of flooding that may apply to the proposed development site are as follows: rising groundwater and surface water flooding (from sewers or overland flows). The approach to assessing flood risk at the development site was informed by the requirements of NPPF in conjunction with the Client and Environment Agency requirements.

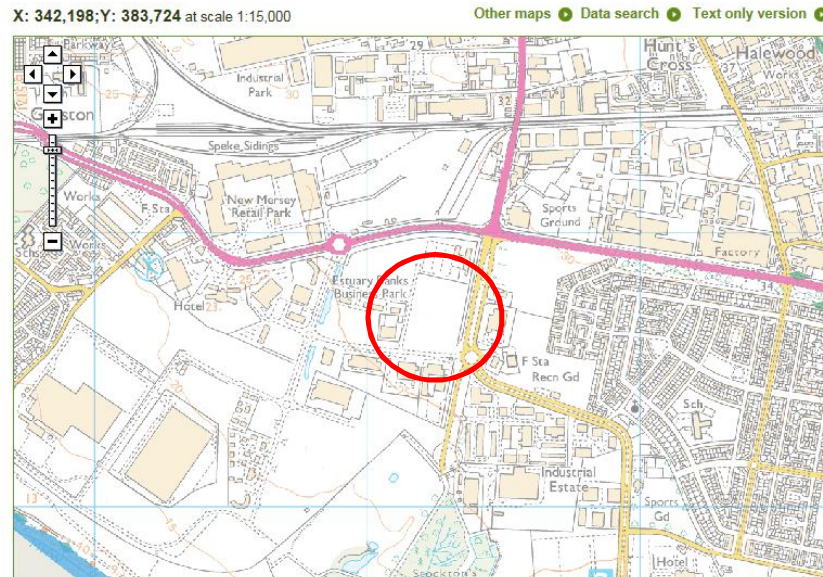
### 4.2 Fluvial Flooding (Rivers and Streams)

- 4.2.1 The site is located approximately 1.3km to the east of the River Mersey and there is currently no flood risk identified on the Environment Agency flood maps for this area, the site is therefore regarded to be at low risk from fluvial flooding.

### 4.3 Tidal Flooding (Coastal or Estuarine)

- 4.3.1 The site is located approximately 1.3km to the east of the River Mersey and there is currently no flood risk identified on the Environment Agency flood maps for this area, the site is therefore regarded to be at low risk from tidal flooding.
- 4.3.2 From the Environment Agency flooding from rivers and seas map:
- Where a site is located in a dark blue shaded zone, this indicates that the site is within Flood Zone 3b where there is a chance of flooding of greater than 1 in 30 (3.3%).
  - Where a site is located in a blue shaded zone, this indicates that the site is within Flood Zone 3a where there is a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).
  - Where a site is located in a turquoise shaded zone; this indicates that the site is within Flood Zone 2 where there is a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%).
  - Where a site is located in a white (unshaded) area, it is generally deemed to be classified as Flood Zone 1 where there is a chance of flooding of less than 1 in 1000 (0.1%).
- 4.3.3 Flooding to the site from rivers and seas is indicated in Figure 2 and it can be seen that the site is clear of the blue and turquoise shading and is classified as Flood Zone 1.

**Figure 2: Environment Agency Map (Flooding from Rivers and Seas)**

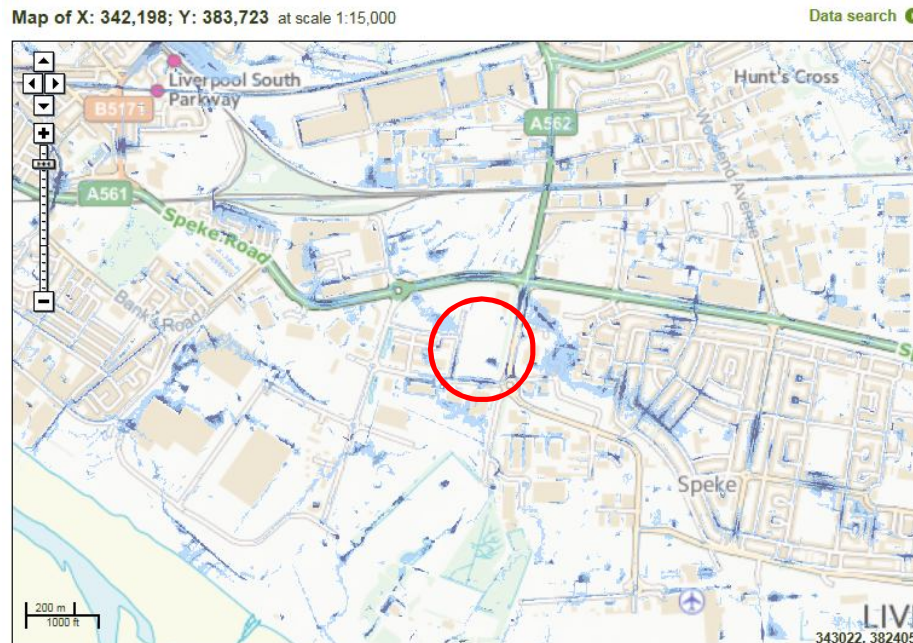


#### 4.4 Surface Water Flooding to the site

- 4.4.1 Surface water flooding can be caused when rainwater during extreme rainfall events does not drain away through the normal drainage system or soak into the ground with flooding occurring, principally from manholes and gullies. Surcharging sewers can result in overland flows which if originating at a higher elevation than a development site can potentially pose a flood risk.
- 4.4.2 The Environment Agency Surface Water flood map for the area indicates that the site has a localised area within the site which is susceptible to surface water flooding and is classified as at high risk of surface water flooding. It is also identified that Estuary Banks, to the south of the site is also susceptible to high risk surface water flooding.
- 4.4.3 From the Environment Agency flooding from surface water map:
- Where a site is located in a dark blue shaded zone, this indicates that the site is at high risk of flooding where there is a chance of flooding of greater than 1 in 30 (3.3%).
  - Where a site is located in a blue shaded zone, this indicates that the site is at medium risk of flooding where there is a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).
  - Where a site is located in a turquoise shaded zone; this indicates that the site is at low risk of flooding where there is a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%).
  - Where a site is located in a white (unshaded) area; this indicates that the site is at very low risk of flooding where there is a chance of flooding of less than 1 in 1000 (0.1%).
- 4.4.4 Flooding to the site from surface water is indicated in Figure 3 and it can be seen that the site has a small pocket of surface water flooding and is classified as at high risk of surface water flooding.



**Figure 3: Environment Agency Map (Flooding from Surface Water)**



## 4.5 Surface Water Flooding from the site

- 4.5.1 Developers are responsible for ensuring that new development does not increase the flood risk elsewhere. The proposed surface water drainage network shall be designed to not flood for the critical 1 in 30 year storm event plus 20% for climate change and flood water generated up to the critical 1 in 100 year plus climate change storm event shall be constrained within areas on site so not to cause damage to buildings, essential services or adjoining developments and services.
- 4.5.2 Where additional hard surfaces are introduced for example roads, car parks, building roofs and temporary site accommodation the development may have the potential to increase flood risk.
- 4.5.3 A detailed assessment of the proposed surface flows is carried out within the Drainage Strategy within Section 7 of this report.

## 4.6 Reservoir Flooding

- 4.6.1 The site is located approximately 10 km to the south west of the Pex Hill Reservoirs, and approximately 12km to the south west of Number 4 Reservoir at Prescott. The site is located outside of any areas susceptible to reservoir flooding and is therefore classified as at very low risk of reservoir flooding.
- 4.6.2 Flooding to the site from reservoirs is indicated in Figure 4 and it can be seen that that the site is located outside of any areas susceptible to reservoir flooding and is therefore classified as at very low risk of reservoir flooding.

**Figure 4: Environment Agency Map (Flooding from Reservoirs)**



## 4.7 Groundwater Flooding

- 4.7.1 The PFRA indicates that flooding records do not show instances of Groundwater flooding, however this is due to the nature of the recordings and are unlikely to have been diagnosed as Groundwater flooding. The PFRA does highlight areas susceptible to Groundwater flooding and indicates that the site is not within an area susceptible for groundwater flooding. The site is therefore considered to be at low risk from groundwater flooding.

## 4.8 Public Sewers or Highway Drainage Flooding (Infrastructure Failure)

- 4.8.1 There are public sewers within the vicinity of the site. These are maintained by United Utilities. There are no records to indicate there have been any occurrences of flooding of these sewers.

## 4.9 Historical Flooding

- 4.9.1 Historical flood events are noted within the PFRA and it appears that there is no record of any historical flooding on the site.

## 5.0 Existing Drainage

5.1.1 The public sewer records have been obtained from United Utilities for the development site. The records indicate that the following sewers are located in the vicinity of the site:

- There is an existing 525mm diameter concrete surface water public sewer to the east of the site in Speke Hall Avenue and flows in a north to south direction;
- There is an existing 1450 x 970 concrete foul water public sewer to the east of the site in Speke Hall Avenue and flows in a north to south direction;
- There is an existing 1050 diameter concrete surface water private sewer to the west of the site in Leeward Drive and flows in a north to south direction and connects onto an existing 1050 diameter surface water sewer located in Estuary Banks and flows in a west to east direction, both of these surface water sewers are currently in the process of being offered for adoption to United Utilities;
- There is an existing 150 diameter foul water private sewer to the south of the site in Estuary Banks and flows in an east to west direction, this sewer is currently in the process of being offered for adoption to United Utilities.

5.1.2 No further public or private sewers were observed in the vicinity of the proposed site.

5.1.3 The public sewer records are enclosed in Appendix A.

5.1.4 There are no private sewers within the site boundary

## 6.0 Proposed Development

- 6.1.1 The site development proposals include a private fuelling facility, 24 dog kennels and runs, one single storey building and one 3 storey building, associated car parking facilities and access road along with landscaping to incorporate swales and a surface water run off storage pond.
- 6.1.2 The buildings will serve various aspects of police work.
- 6.1.3 The Proposed Layout is enclosed in Appendix A.

## 7.0 Drainage Strategy

### 7.1 Proposed Foul Water Drainage

- 7.1.1 The foul drainage from the development is proposed to be collected by use of a new private foul drain which will serve the proposed refuelling area, the proposed dog kennel facility and the proposed two buildings. The system will then discharge into the existing adopted foul sewer located in Estuary Banks.
- 7.1.2 It is proposed to incorporate the use of two petrol separators at the site; one to serve the proposed fuelling area which is to be a Class 2 full retention 'forecourt' separator with alarm. The second is to serve the proposed garage within the proposed building which is to be a Class 2 full retention separator with alarm.
- 7.1.3 The locations of the proposed soil vent pipes have not been confirmed, however from the Architects internal layouts for the building it has been possible to calculate the expected discharge rate. The peak flow rate has been calculated based on BS EN 12056 System III, and the total rate off site is anticipated to be 13.6 l/s
- 7.1.4 Early discussions with United Utilities has confirmed that the existing sewer can accept the proposed development.

### 7.2 Proposed Surface Water Drainage

- 7.2.1 Any new development site drainage should be designed in accordance with current best practice to provide adequate capacity not to flood for the critical 1 in 30 year storm event plus 20% allowance for climate change and flood water generated for up to the critical 1 in 100 year plus 20% allowance for climate change storm event shall be constrained within the areas on site so not to cause damage to buildings, essential services or adjoining developments and services.
- 7.2.2 In following the standard hierarchy of drainage solutions, consideration should firstly be given to the discharge of surface water runoff by sustainable methods such as infiltration. Information taken from the Phase 2 Intrusive Investigation report indicates that due to the presence of clays on site, infiltration is not suitable on the site.
- 7.2.3 The proposed surface water drainage will incorporate SUDS systems and will discharge into the existing sewer located in Estuary Banks.
- 7.2.4 The proposed surface water system will comprise of a siphonic roof drainage for one building with a traditional down pipe system on the second building. The proposed parking bays will be constructed as a permeable surfacing with cellular storage below and will connect into the main drainage system for the site. There is to be a swale / pond structure which is located to the south of the site

- 7.2.5 The swale / pond will be used for treatment, conveyance and storage. By use of the permeable surfacing swale / pond, this provides two treatments, it is proposed to incorporate a catch pit style manhole prior to discharging into the existing sewer which will provide a third treatment to the surface water, this will remove the requirement for petrol interceptors for the surface water run-off from the trafficked areas.
- 7.2.6 The total impermeable area for the proposed site layout is anticipated to be 32,958m<sup>2</sup>, which, using a basic calculation for a 1 in 1 year event at a rainfall intensity of 50mm/hr it is expected that the total unrestricted discharge rate of 461.4 l/s.
- 7.2.7 As the site is to be designed with a restricted discharge rate of 21.66 l/s, using the Microdrainage Quick Storage Estimation option within the Source Control module, with an allowance of 20% for climate change, it is anticipated that between 1786m<sup>3</sup> and 2428m<sup>3</sup> of storage will be required. It is expected that the swale / storage ponds will provide approximately 875m<sup>3</sup> of storage. The cellular storage beneath the parking bays equates to provide an approximate total storage of 1700m<sup>3</sup>.
- 7.2.8 During the detailed design stage it is recommended that a permeable surfacing specialist is consulted to assist in the design along with a specialist cellular storage manufacturer to enable interaction with the main drainage system.
- 7.2.9 There will be a requirement to develop a maintenance schedule for the swale / pond and permeable surfacing, this should be completed in accordance with Ciria C697 The SUDs Manual.
- 7.2.10 The Proposed Drainage Layout is enclosed in Appendix A.

### **7.3 Maintenance**

- 7.3.1 A copy of the as built drainage layout should be provided in the Operations and Maintenance Manual.
- 7.3.2 A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.
- 7.3.3 It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event. Significant sediment deposition is likely in areas used for storage, so a post clean-up operation may be required including the removal of litter, vegetation, sewerage debris and larger objects.



## 8.0 Mitigation

### 8.1 Fluvial / Tidal / Reservoir Flood Mitigation

- 8.1.1 The development site lies within Flood Zone 1 and therefore there is low risk of fluvial and tidal flooding.
- 8.1.2 The site is surrounded by Flood Zone 1 and therefore finished floor levels lower than existing ground levels should not affect the Zone 1 flood risk classification.
- 8.1.3 The nearest reservoir is located 10km to the north east of the site and using the Environment Agency's website it is considered to be at low risk of flooding from reservoirs.
- 8.1.4 The site is considered to be at low risk of flooding from fluvial, tidal and reservoir flooding and no mitigation is required.

### 8.2 Groundwater Flood Mitigation

- 8.2.1 Groundwater flooding tends to be more persistent than other sources of flooding, typically lasting for weeks or months rather than hours or days. Groundwater flooding does not generally pose a significant risk to life due to the slow rate at which the water level rises; however, it can cause significant risk to property.
- 8.2.2 The risk of groundwater flooding to this site is considered to be low, however it is recommended that groundwater levels are monitored during any further ground investigation works to determine site specific groundwater levels.

### 8.3 Surface Water Flooding to the site Mitigation

- 8.3.1 The Environment Agency Surface Water flood map for the area indicates that the development is at very low risk of surface water flooding. Therefore risk of flooding to the site from surface water flooding is considered very low.
- 8.3.2 It is recommended that proposed external ground levels across the site should fall away from the proposed buildings so that it does not create low points that encourage any surface water to fall towards the building. The flooding risk to the development site from the surrounding areas is therefore considered low.

#### **8.4 Surface Water Flooding from the site Mitigation**

- 8.4.1 Any new development site drainage should be designed in accordance with current best practice to provide adequate capacity not to flood for the critical 1 in 30 year storm event plus climate change and flood water generated from up to the critical 1 in 100 year plus climate change storm event shall be constrained within the areas on site so not to cause damage to buildings, essential services or adjoining developments and services.
- 8.4.2 In following the standard hierarchy of drainage solutions, consideration should firstly be given to the discharge of surface water runoff by sustainable methods such as infiltration. However, information taken from the Phase 2 Intrusive Investigation Report, infiltration is not suitable on the site
- 8.4.3 It shall be assumed that when the site is developed, the surface water drainage network is proposed to outfall into the existing adopted sewer located in Estuary Banks.
- 8.4.4 Assuming that the proposed drainage system is designed to provide adequate capacity as outlined in Section 7.3 and that the private drainage and SUDS features will be maintained, it can be assumed risk of flood from blockage or overloading is minimal.
- 8.4.5 Providing the mitigation measures recommended are incorporated, the site can be regarded as low risk from all primary and secondary flood mechanisms as required to be investigated by NPPF.



## 9.0 Conclusions and Recommendations

- 9.1.1 Curtins was appointed on behalf of Merseyside Police Authority to provide a Flood Risk Assessment (FRA) for the proposed development at Estuary Banks, Liverpool. The FRA provides information on the nature of flood risk at the site and follows Government guidance with regards to development and flood risk.
- 9.1.2 The report is based on current available information and preliminary discussions.
- 9.1.3 The assessment has been undertaken in accordance with the standing advice and requirements of the Environment Agency (EA) for Flood Risk Assessments as outlined in the Communities and Local Governments Planning Policy Guidance to the National Planning Policy Framework (NPPF).
- 9.1.4 The assessment has:
- Investigated all potential risks of flooding to the site,
  - Considered the impact the development may have elsewhere with regards to flooding; and
  - Considered outline design proposals to mitigate any potential risk of flooding determined to be present.
- 9.1.5 The report concludes that:
- The site is located within Flood Zone 1 and classified as 'Highly Vulnerable' development, the sequential and exception test are not required to be undertaken, therefore the development is appropriate at this location
  - There is currently no flood risk identified on the Environment Agency and SFRA flood maps for this area for fluvial, tidal and reservoir flooding the site is therefore regarded to be at low risk from these types of flooding.
  - The PFRA highlights that the site is not within an area susceptible for groundwater flooding. The site is therefore considered to be at low risk from groundwater flooding.
  - There have been no recorded flooding events at the site. The site has not been subject to any historical flood events. The Environment Agency Surface Water flood map for the area indicates that the site is at very low risk of surface water flooding. Therefore risk of flooding to the site from surface water flooding is considered very low.
  - Providing the principles set out within the report are followed and developed at detailed design stage, the site can be considered to have a low probability of suffering from any form of flooding and not increasing the probability of flood risk to other properties within the local catchment area.

9.1.6 Recommendations include:

- The proposed external levels should fall away from the building so that low points are not created, encouraging surface water to fall away from the proposed buildings.
- A pathway for flood water should be created working with the existing site levels to allow free passage of any overland flows through the site, located to avoid the building and other important structures.
- The surface water from the proposed development is proposed to be collected by the use SUDS systems prior to discharge into the existing adopted surface water sewer in Estuary Banks at an agreed restricted rate.
- A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.

**Therefore, if the principles set out within the previous sections of this report are followed and developed at detailed design stage by the design engineer, the site can be considered to be appropriate and at low risk of flooding.**