

SEEDA

Centenary Quay, Woolston

Flood Risk Assessment

April 2008



CAPITA SYMONDS

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Executive Summary

The proposed development site is located on the eastern bank of the River Itchen, Woolston, Southampton. The site is currently vacant and considered Brownfield. The proposed development site has been allocated within the Southampton City Council Local Development Plan and is detailed in Policy MSA 18 within this document.

Consultation with the Environment Agency¹ has confirmed that the proposed development is located partly within Flood Zones 2 and 3, with the remainder of the site located in Flood Zone 1. The site is considered to be 'mixed use' development and as such is a combination of 'more vulnerable' and 'less vulnerable' development as defined within Planning Policy Statement 25 – Development and Flood Risk.

The River Itchen is considered tidal at the proposed development site and has its confluence with the River Test just downstream of the site. Flood Risk to the site arises from tidal flood hazard from the River Itchen. There are no watercourses located on the site, the nearest ordinary watercourse is located approximately 100m south of the site and is not considered to be a flood hazard to the proposed development as defined by EA Flood Zone Mapping.

Sea level rise within southern England is identified as being a potential hazard in coastal locations. Planning Policy Statement 25 redefines predictions for sea levels rise to the design year of 2115 and predicted tide levels in Table 6.1 has been calculated using the guidelines within Annex B of this document.

Given the tidal nature of the environment loss of floodplain storage is not considered to be a relevant issue. To make the site 'safe' as defined within PPS25 it is proposed that the entire site be raised (where necessary) above the 0.5%AEP tidal water level for the lifetime of the development as defined by the vulnerability of this development within Annex D of PPS25. The development will therefore take place upon a 'raised development platform'. Minimum ground levels for the site have been set at the tidal level for the appropriate design year with the inclusion of 500mm freeboard to account for low intensity wave action and changes in sea level rise that are beyond our current forecasting techniques.

For the commercial section to the north of the site, much of this area is above the 0.1%AEP extreme tidal water level. The exception is North Quay, land raising where necessary will make the area 'safe' for the 'less vulnerable' land uses that are proposed.

In addition the proposed land raise will tie in with high ground to the east of the site bounded by Victoria Road. This will provide safe access and egress for residents and emergency services for the lifetime of the development.

It has been shown by the proposals that the land raise will effectively place the entire development well within Flood Zone 1 and that it will be safe for the operational lifetime. The development will not increase flood risk to downstream receptors as a result of building within the tidal floodplain.

Finally an assessment of the impact to the surface water management regime has been made. The site is currently considered to be 100% impermeable surface cover and it has been shown that for the post development scenario the inclusion of Sustainable Drainage Systems (SUDS) within the overall design will significantly reduce runoff from the development and provide betterment to the existing situation. The issue of tidelocking where discharge from surface water outfalls becomes inhibited prevents a hazard particularly during exceedance events. The 'extreme' scenario, the coincidence of a 1%AEP pluvial event and the 0.5%AEP tidal event (for the appropriate design year) was investigated and it has been shown that surface water in these extreme (and rare) events can be adequately designed for and the site made safe. The Strategic Drainage Strategy for the site can be referred to for details on the outline designs.

¹ Mr J Smith, Environment Agency Southern Region 2007

Contents

1. Introduction	2
2. Policy and Guidance	3
3. Scheme Description and Location	5
4. Definition of the Flood Hazard	9
5. Flood Risk	11
6. Climate Change	12
7. Surface Water Drainage	13
8. Flood Risk Management	14
10. Conclusion	20

Figures

CS/004622/FR1/001	Extreme Flood Levels
Dwg 100 Rev P1	Planning Application Boundary
Dwg 103-01 B	Underground Parking
Dwg 401B	
TSDG-001-06	Proposed Landuse
TSDG-001-03	Proposed Ground Levels
Dwg 13800-SK-002	
TSDG-001-08	Underground Car Parking
Dwg 05034 401 B	Section Study
TSDG-050-10	Phasing Strategy
CS/004622/GEN/002	River Terraces
CS/004622/DR/001/G	Drainage
13800-GE-200A	
CS/004622/DR/002/E	Exceedence Flow
CS/004622/DR/004/D	Outline SUDS
13800-GE-602-E	

Appendices

Topographic Survey
Tidal Curve for Southampton Water
EA Consultation
Sequential Test

1. Introduction

- 1.1.1 Capita Symonds have been appointed by SEEDA to undertake a Flood Risk Assessment (FRA) for the redevelopment of the former Vosper Thorneycroft site referred to as Woolston Riverside Development, Southampton.
- 1.1.2 The objectives of the study are:
- To identify available data relating to flood risk at the site;
 - Determine the risk of flooding to the proposed development as a result of tidal inundation;
 - Investigate surface water discharge from the site and assess the impact to the proposed development during a tidelocked situation and;
 - Comment on the proposed Surface Water Drainage Strategy².
- 1.1.3 The scope of data available is summarised in this report and in the associated plans. An assessment of areas potentially at risk from flooding has been made and the redevelopment proposals have been examined in relation to their potential to create impacts, on and off site in relation to flood risk.
- 1.1.4 This report replaces an existing Flood Risk Assessment (FRA) for the site and as compliant with the principals and guidelines within Planning Policy Statement 25: Development and Flood Risk. The report will accompany a detailed planning application for part of the Marine Employment Quarter at Centenary Quay, Southampton, but covers the comprehensive proposals for the whole of Centenary Quay as set out in the Environmental Impact Assessment that will also accompany the detailed SEEDA 2008 Application.

² Drainage Strategy, Centenary Quay, Woolston, Capita Symonds 2007

2. Policy and Guidance

2.1 PLANNING POLICY STATEMENT 25 – DEVELOPMENT AND FLOOD RISK, DOCG DECEMBER 2006

- 2.1.1 As of December 2006 PPS 25 has replaced PPG 25 as the relevant planning policy for development and flood risk. PPS 25 advises that a strategic approach should be adopted in keeping with the Governments aims to ensure that new development is sustainable. The document recognises that positive planning has an important role in delivering sustainable development and applying the Governments policy on flood risk management.
- 2.1.2 The sequential risk based approach to determining the suitability of land for development in flood risk areas is central to the policy statement and should be applied to all levels of the planning process. In addition, the following is pertinent to the central policy:
- The concept of classification of the vulnerability of development to flood risk;
 - The need to conform to the requirements of the “Exception Test” in circumstances where it is deemed necessary to locate new development in “high risk” zones; and
 - It identifies the need to apply Strategic Flood Risk Assessment to decisions taken at all levels of planning, i.e. the need for assessment at the Regional Spatial Strategy.
- 2.1.3 Additionally the PPS introduces the concept of Flood Risk Reduction, particularly in circumstances where development has been sanctioned on the basis of the “Exception Test”.
- 2.1.4 The Exception Test is that:
- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk.
 - The development should be on previously developed land and that there are no reasonable alternatives on previously developed land, and,
 - Demonstration must be made that the development is safe.

2.2 ENVIRONMENT AGENCY: SOUTHERN REGION LAND DRAINAGE BYELAWS (LAND DRAINAGE ACT 1976)

- 2.2.1 The Environment Agency encroachment policies are not part of the Southern Region Bylaws. The byelaws allow the Environment Agency to consent works within 15m of a tidal sea defence and protect the environment whilst carrying out the duties.
- 2.2.2 The Environment Agency encroachment policy have no statutory status but provides guidance used to fulfil their duties under the Environment Act 1995 that are namely setup to enhance and protect the environment while carrying out our duties.
- 2.2.3 The Byelaws are applicable for securing the efficient working of the drainage system in the Southern Water Area. Unless otherwise stated they shall apply only to the main rivers and the sea and tidal defences of the Authorities area.

2.2.4 Paragraph 27 relates to erections, excavations etc. for affecting Sea Defences and states that a line drawn 15 metres from the landward side of the sea defences should be maintained to allow access and maintenance works to the sea defences.

2.3 DEVELOPMENT AND FLOOD RISK – GUIDANCE FOR THE CONSTRUCTION INDUSTRY, CIRIA 2004

2.3.1 This document provides guidance to developers and the construction industry on the implementation of good practice in relation to flood risk and the development process. The following should be important considerations:

- All developments even those that lie outside Flood Zone 2 or 3, may lead to an increase in downstream flood risk due to increased runoff rates and volumes. Therefore, all new developments should be designed so that runoff from the development is considered and, if appropriate, controlled.
- Safe access to and from the development should be allowed for during a flood event, and
- The development design should be such that future users will not have difficulty obtaining insurance or mortgage finance as a result of flood risk issues.

2.3.2 The foregoing conditions should be met for the lifetime of the development including considerations for climate change.

2.4 ENVIRONMENT AGENCY SOUTHERN REGION DEVELOPMENT CONTROL GUIDANCE

2.4.1 Consultation with the Environment Agency has been continuous throughout the assessment stage of the Flood Risk Assessment for the site. Primarily the EA have indicated that the site must be safe with maintained access and egress throughout the lifetime of the development.

- Ground levels for the site to be raised to the 1 in 200 year return period event plus 500mm freeboard. The development 'lifetime' is based on the vulnerability classification in Annex D of PPS25.
- A surface water strategy to include the appropriate use of SUDS and safe management of the runoff generated from the 1%AEP pluvial event in combination with the 0.5%AEP tidal event to the appropriate design year.

3. Scheme Description and Location

3.1 SITE DESCRIPTION

- 3.1.1 The application boundary for the proposed development can be seen in Dwg TSDG-001-06. It is situated on the eastern bank of the River Itchen located at approximately NGR SU 435085 to the north of the confluence of the River Test with Southampton Water.
- 3.1.2 The A3025 Itchen Road to the north of the site provides access to Southampton city centre, Central Rail Station and Southampton International Airport to the north east. Southampton is an important commercial and civil port within the Southern Region.
- 3.1.3 The Woolston Riverside site covers an area of approximately 12ha and is currently unoccupied. The site has a history of industrial use that is associated with the construction and maintenance of ships and is considered to be heavily contaminated as a result. Many of the existing buildings have been demolished, with the exception of a large industrial unit and a crane located on the existing quay side. The site is considered to be 'Brownfield'.
- 3.1.4 The existing site frontage to the River Itchen comprises a combination of structures including sheet pile walls, concrete posts with timber infill and reinforced steel structures. There is also evidence of slipways that mark the historic boat building use of the site. A river frontage condition survey and topographic survey indicates that crest heights on the frontage vary from approximately 2.0-5.0mAOD and that the existing frontage is in varying degrees of condition. It was reported that the residual life in the site frontage varied from nil to upwards of 30 years³.
- 3.1.5 A site visit was undertaken in March 2007. The site has few buildings remaining and the ground surface is a combination of hardstanding and concrete in various condition. It was evident from this visit that any remaining defences belonging to the site were damaged in many places. There was no evidence of any watercourses on the site.
- 3.1.6 The site is bounded to the north by residential properties and similar properties lie adjacent to Victoria Road to the east. To the south of the site is Woolston Sewage Treatment Plant (STW), operated by Southern Water.
- 3.1.7 Approximately 500m of the application site accounts for river frontage on the River Itchen. The intertidal boundary beyond the landward side of this frontage is currently classified as a Special Protection Area (SPA).

³ River Frontages Report, Beckett Rankine Partnership, July 2004

3.2 HYDROGEOLOGY AND GEOLOGY

- 3.2.1 The River Itchen discharges to Southampton Water and is considered to be tidal at the site. The tidal boundary for the River Itchen is located approximately 4km upstream of the site at Gators Mill. Mean High Water Spring Level and Mean High Water Neap Level is 1.8mAOD and 1.0mAOD respectively. Refer to the Strategic Drainage Strategy for a summary of the different tide levels⁴.
- 3.2.2 There is a small watercourse located to the south of the site boundary, discharging to the River Itchen at approximately NGR SU 435104 close to the existing STW. There are no watercourses within the site boundary.
- 3.2.3 The underlying geology for the site is currently classified by the Bracklesham Beds beneath the Solent Estuarine system. The site is primarily underlain by made ground and alluvial soils.

3.3 TOPOGRAPHIC SURVEY

- 3.3.1 Existing site levels can be seen in the Topographic survey (Appendix 1). The general fall across the site is from a north east to the south west, and from Victoria road in the east to the banks of the River Itchen to the west. Levels across the site, vary from approximately 10mAOD along Victoria Road, and 8.5mAOD to the north west of the site to approximately 1.5mAOD towards the River Itchen. To the north, much of the site is above 5.0mAOD with levels in the region of 3.0 – 3.5mAOD to the west of Wharf Road.

3.4 DEVELOPMENT FLOOD OVERVIEW

- 3.4.1 Dwg. 100 Rev P1 shows the planning application boundary for the site. The site is proposed as a combination of light industrial marine employment to the north, and residential properties of varying densities to the south. The river frontage will be dominated by the presence of three high rise residential buildings, with more conventional residential buildings located on the inland side of the site towards Victoria road. In addition; the following is proposed and Drawing No. 001.06 indicate the proposed land uses to the north of the site.

- Retail units are to be located to the north-west corner of the site.
- Commercial (marine) section to be located to the north;
- A hotel which will be located in the north east of the site adjacent to Victoria Road;
- Offices, car-parking and boathouses;
- River frontage that will include pontoons and provision for boat moorings.

⁴ Drainage Strategy, Centenary Quay Woolston, Capita Symonds, September 2007

3.5 VULNERABILITY CLASSIFICATION – PPS25 ANNEX D

- 3.5.1 Proposals for the site include residential dwellings and underground car parks in the high probability areas identified on the Flood Zone Maps. Table D2 within PPS 25 classifies residential dwellings as being a 'more vulnerable' land use. Although underground car parks are not specifically identified, their use is more appropriately classified as 'less vulnerable'.
- 3.5.2 Marine employment potentially falls within two categories. Boat building and repairs, marinas and boat houses would be considered a 'water compatible' land use where as offices and marine related retail would be considered to be 'less vulnerable'.
- 3.5.3 Within Flood Zone 3a 'more vulnerable' uses are permitted if the Exception Test is passed. 'Less vulnerable and 'water compatible' land uses are considered appropriate in Flood Zone 3a.
- 3.5.4 Annex D of PPS25, highlights the aim to steer all new development to areas at the lowest probability (Flood Zone 1). Where it is not possible to steer development away from Flood Zones 2 and 3, decision makers allocating land in spatial plans or determining applications for development at any particular location should demonstrate that there are no reasonable options available in a lower risk category and should take into account the flood risk vulnerability of land uses. The preparation and review of Regional Spatial Strategies (RSS's) and Local Development Documents should be used to review existing and proposed development patterns and allocations and identify opportunities to allocate land in lower flood risk zones suitable for existing uses already in medium and high flood zones.

3.6 THE SEQUENTIAL TEST

- 3.6.1 PPS25 identifies that land assessed as being within Flood Zone 2 or 3 must pass the risk based Sequential Test. The Local Planning Authority should apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed. The aim is to where possible steer new development to areas at the lowest probability of flooding (Flood Zone 1).
- 3.6.2 Flood Zone Mapping is the starting point for the sequential approach. A Strategic Flood Risk Assessment (SFRA) will refine information on the probability of flooding in a broad regional context and provide the basis for applying the Sequential Test on the basis of the Zones defined in Table D1 of PPS25. Where an SFRA is not available, the Sequential Test should be based on Environment Agency Flood Zone Mapping.
- 3.6.3 Details outlining the suitability of the proposed development in this location are located within the Appendix.

3.7 THE EXCEPTION TEST

- 3.7.1 Following the satisfactory application of the Sequential Test, areas of the application site with more vulnerable land uses proposed are subject to the Exception Test. Less vulnerable and water compatible land uses do not require the Exception Test as defined in Table D3 of PPS25.
- 3.7.2 As a result of land raising across the site and placing 'more vulnerable' development out of Flood Zone 3 the site should no longer be subject to the Exception Test however it can be demonstrated that the proposed development is able to satisfy parts a, b and c of the test. The EA have indicated in correspondence (Appendix 4) that they are in principal happy with the details outlined in Appendix 5.

4. Definition of the Flood Hazard

4.1 KEY SOURCES OF FLOODING

- 4.1.1 The sources of flooding that could potentially affect the site include groundwater, flooding from rivers, flooding from the sea flooding from land and flooding from sewers.
- 4.1.2 PPS25 requires that all sources of flooding are assessed when determining flood risk to a development. The Practice Guide Companion to PPS25 identifies key sources of flooding in Table 2.2 and is the first section in the source pathway receptor model for the identification of flood risk.
- 4.1.3 Fluvial Flooding – River flooding occurs when the capacity of the river channel is exceeded. The River Test and River Itchen are located in close proximity to the site, however are considered tidal in this location and are assessed under tidal flood risks. There are no watercourses on or adjacent to the proposed development site.
- 4.1.4 Tidal Flooding – Given the coastal location of the site, the risk of tidal inundation from the River Itchen is the main source of flooding to the site. Southampton Water is considered to have mild wave climate due to the limited fetch distances and the orientation of the development site⁵. Refer to section 5 for further details.
- 4.1.5 Groundwater – Groundwater flooding occurs when water levels in the ground rise above surface elevations. It is most likely to occur in low-lying areas underlain by permeable rocks. The immediate underlying ground is made ground that is currently overlain in many places with hardcore and tarmac. Based on the low permeability of the underlying ground condition the results from the Campbell Reith borehole survey indicate that flooding on site from groundwater is not likely to be an issue. Previous studies⁶ have indicated that groundwater levels fall from east to west across the site indicating that groundwater is in hydraulic connectivity with the River Itchen.
- 4.1.6 Sewer flooding – Flooding from sewers occurs when the sewer is overwhelmed by heavy rainfall, becomes blocked or is of inadequate capacity. Sewers are generally designed to cope with mid to low order rainfall events surcharging at the 3.3%AEP. The site is already serviced by an existing sewerage system which is detailed within the drainage strategy appending this report. Surface water drainage is currently discharged to the River Itchen via outfalls or overland flow. It is proposed that the existing system be replaced as part of the development proposals.
- 4.1.7 Surface Water – Intense rainfall that is unable to soak into the ground or enter drainage systems can result in localised flooding. At present rainfall appearing as overland flow will generally flow east west direction and will leave the site discharging to the River Itchen. Approximately 30 % of surface water from the site drains to Victoria Road, and flows off site⁷. There is a potential risk of flooding from overland flow due to a tidelocked scenario causing water to back up within the system and flood the site. Overland flow from off-site sources is not considered a low flood risk issue given the lower elevations found at Victoria road to the east of the site.

⁵ Hydrodynamic Study of the River Itchen, ABPmer 2007

⁶ Land Quality Statement Vol 1. Campbell Reith October 2004

⁷ Flood Risk Assessment – Woolston Riverside, Campbell Reith 2005

4.1.8 Infrastructure failure - There is a small risk that a private sewerage system can pose a flood risk due to damage over time and general siltation if not properly managed. However any surface water prevented from entering the existing system will drain to the River Itchen. Given that this is a tidal environment, the River Itchen is not regarded as a potential receptor with regard to volumes and drainage from the site.

5. Flood Risk

5.1 FLOOD ZONE MAPPING

- 5.1.1 Environment Agency Flood Zone Mapping (EA FZM) indicates the Woolston Riverside application site to be partly located within Flood Zone 3 and Flood Zone 2. Flood Zone 3 is defined as having a 'High Probability' of flooding within Table D.1 of PPS25. In this instance land within Flood Zone 3 is assessed as having a 1 in 200 year annual probability of tidal flooding (<0.5%) without consideration of existing flood defences.
- 5.1.2 The remainder of the site is located within Flood Zone 1. Land falling within this Flood Zone is defined as land assessed as having an annual probability of flooding of less than a 1 in 1000 year annual probability (0.1%AEP). All land uses are appropriate for this Flood Zone. Flood Zones defined by Environment Agency mapping are indicative only.

5.2 TIDAL FLOOD RISK

- 5.2.1 The existing 0.5%AEP tidal water level for the proposed development site is predicted to be approximately 3.0mAOD⁸. The flood extent can be seen on Figure CS/004622/Fig001 and indicates that much of the site is already above this existing level and within Flood Zone 1. This is based on existing ground levels at the site.
- 5.2.2 Proposals for the site will include a wholesale land raise for the residential section of the site and topographic survey indicates that much of the commercial section of the site is already above 5.0mAOD. Dwg TSDG-001-03 shows the proposed final ground levels. Minimum levels will be set at 5.35mAOD for the commercial section and 6.0m for the residential areas. There is approximately 2.3m and 3m freeboard available for the commercial and residential areas respectively.
- 5.2.3 Finished floor levels for North Quay in the commercial section of the site will be set at 3.95mAOD and detail can be seen in Dwg 13800-SK-002. There is 0.95m freeboard available on the present day level. Levels on the river frontage at North Quay will be set at 3.6mAOD, however this area will be used for vehicle manoeuvre and parking and 3.6mAOD provides 0.6m freeboard which is considered suitable for less vulnerable land use.
- 5.2.4 Underground car-parking is proposed across the proposed development site. To the north, within the commercial section the minimum floor level for underground parking will be set at 5.35mAOD towards the rear of the site near Victoria Road.
- 5.2.5 Within the residential area, the minimum level for underground car parking will be set at 2.5mAOD.
- 5.2.6 In raising the site levels the proposed the pathway for the potential tidal flood hazard is removed and the risk of flooding from this source is appropriately managed.

⁸ English Channel Extreme Tide Level Review , ABPmer 2004

5.3 SAFE ACCESS AND EXIT

- 5.3.1 As per the 'Flood Risk Assessment Guidance for New Developments R&D Technical Report FD2320', safe access and exit during a flood event, needs to be assessed for new developments.
- 5.3.2 The document states that the 'safe access or exit route' is required to enable the evacuation of people from the development, provide the emergency services with access to the development during a flood and to enable flood defence authorities to carryout any necessary duties during the period of flood.
- 5.3.3 The guidance recommends that an access route be determined even when the development is above the floodplain. The proposed development is located partly in Flood Zone 2 and 3 (Figure CS\004622\Fig001) with the remainder of the site being located in Flood Zone 1. The site is to be raised to ensure that the development is located entirely within Flood Zone 1 and is defined as having a 'low' probability of flooding for the operational lifetime.
- 5.3.4 The site can be accessed and exited through Victoria Road which, due to higher ground levels, (Appendix1, Drawing 007_Rev1), is unlikely to experience inundation during to a flood event.

6. Climate Change

6.1 GENERAL CONSIDERATIONS

- 6.1.1 Annex B of PPS25 refers specifically to the effects of climate change at a regional level. For the UK, projections of future climate change indicate that more frequent short-duration, high intensity rainfall and more frequent periods of long duration rainfall could be expected. In addition, global sea level will continue to rise.
- 6.1.2 Allowances for the regional rates of relative sea level rise for England are indicated within Table B1 of PPS25. The application site falls within the administrative region that includes south east England. Base level rise has been obtained from previous studies⁹ and the net sea level rise provided within this table is relative to the base sea level of 1990.
- 6.1.3 Using Table B1 and base sea level figures, Table 6.1 shows the predicted sea level for the southern region of England. Calculations are in accordance with guidelines within the 'Practice Guide Companion to PPS25' and EA advice.

Table 6.1 Extreme Tidal Levels for the River Itchen

Year	Water Level (mAOD)	
	0.5%AEP	0.1%AEP
2000	3.03	3.21
2060	3.45	3.63
2115	4.20	4.38

- 6.1.4 Section 8 presents how the inputs of climate change will be sustainably managed on site.

⁹ English Channel Extreme Tidal Level Review , ABPMer, 2004

7. Surface Water Drainage

7.1 GENERAL

- 7.1.1 Annex F of PPS25, 'Managing Surface Water' states that flooding result both from sources external to the development site and rain falling onto and around the site. The sustainable management of surface water is an essential element of reducing future flood risk to both the site and its surrounding.
- 7.1.2 Consultation with the EA has indicated that with respect to flood risk the proposed development site must be able to 'appropriately manage' runoff generated from the co-incidence of the 1.0%AEP (with an allowance for climate change) pluvial event and the 0.5%AEP tidal event (with allowance for climate change).
- 7.1.3 For further details on surface water management refer to the Strategic Drainage Strategy prepared as part of this planning application. Sections 1 – 4 detail the design criteria, methodology and results of modelling for exceedance flows. In addition, outline designs for positive piped drainage are also presented showing how the site will accommodate events with higher probabilities of occurrence. The positive drainage system is designed to surcharge at 3.33%AEP without flooding above manhole cover levels.
- 7.1.4 Drawings CS/004622/DR/001/C, 13800-GE-200A, CS/004622/DR/002/E, CS/004622/DR/004/D and 13800-GE-602-E show the results of the drainage strategy and how surface water will be sustainably managed across the site.

8. Flood Risk Management

8.1 GENERAL

8.1.1 Subject to the proposals passing the sequential test the consequences of flooding from identified sources have been fully assessed in Chapters 5 , with the impact of climate change assessed in Chapter 6 and. The following proposals aim to present a flood risk management strategy that includes suitable mitigation measures that may be incorporated into the design. This is in accordance with the Practice Companion Guide to PPS25. The main consequences of flooding arising from the proposed development at Centenary Quay are;

- Tidal inundation from the River Itchen; and
- Increase in surface water flooding as a result of the development.

8.2 TIDAL INUNDATION

8.2.1 Proposals for the residential section of the site will include wholesale landraising from the river frontage back to Victoria Road. The land raise will wrap around the development and tie in with existing high ground. This will provide a 'development platform' and will create a sustainable flood risk management strategy for the site.

8.2.2 The minimum level for the development platform for the residential section of the site is to be set at 6.0mAOD. All development with the exception of underground parking will take place on this development platform and will provide the development with an appropriate level of protection from tidal inundation. Drawing TSDG-001-03 indicates the proposed ground levels for the site.

8.2.3 Buildings J1, I1 and G indicated on Drawing No. 001.06 will be built on land raised to a minimum of 6.0mAOD. Access to and from these buildings will be set at a minimum level of 6.0m AOD and will tie in with the main development platform as indicated.

8.2.4 The proposed frontage of the raised development platform will consist of a 'river walkway' that will have a minimum level set at 6.0mAOD. The river walkway will be graded down towards the River Itchen, vegetated with maritime heathland and shingle species to blend with the existing intertidal zone of the River Itchen. Drawing No CS/004622/GEN/002/B indicates the proposed river edge terraces.

8.2.5 Underground car-parking is proposed for the application site. Minimum floor levels for the car-parks can be seen in Dwg. TSDG-001-08 and, Drawing No 401B. Minimum levels for the car-parks in the residential section of the site will be set at 2.5mAOD, minimum levels within the marine employment section will be set at 5.35mAOD.

8.2.6 The hotel will be located adjacent to Victoria Road and will consist of 4 stories. Reference to Figure CS/004622/FR/001 indicates that this is located within Flood Zone 1.

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- 8.2.7 Proposed land raising for the commercial section will see ground levels set at a minimum of 5.35m AOD and will tie in with high ground to the east of the site at Victoria Road. Detail for North Quay to the west of Wharf Road is indicated on Dwg No 13800-200-SK where it can be seen that the finished floor levels for the buildings are set at 3.95m AOD with a fall down to the site front where the ground level is shown to be 3.6m AOD.
- 8.2.8 The proposals for the development will be projected to the design year 2115 for the residential areas and 2060 for the commercial areas.
- 8.2.9 The consequence of flooding from tidal inundation is negated by the proposed land raise across the site to the levels described in Chapters 5, 6 and 7. Proposed levels for the site can be seen in Drawings 001.03 and Drawing 13800-SK-002. This is considered a sustainable method of flood risk management as it will provide protection from the extreme tidal water level predicted in Table 6.2. for the lifetime of the development.

Climate Change

- 8.2.10 The 'design year' for the residential and commercial sections of the site are 2115 and 2060 respectively and based on the vulnerability assigned to each land use. In addition, the EA have indicated that an additional 500mm would need to be added to the water levels in Table 6.1 in order to achieve a precautionary approach to managing flood risk. This freeboard would be sufficient to account for uncertainties in predicted sea level rise and the minimal wind and wave action expected at this location on the River Itchen.
- 8.2.11 The development platform provided by the land raise proposals will be set at a minimum of 6.0m AOD for the residential section of the proposed development site. This is above the predicted 0.5%AEP and 0.1%AEP return period extreme tidal water levels for 2115. Table 6.1 shows that an additional freeboard of 1.8m and 1.6m is therefore provided for the 0.5%AEP and the 0.1%AEP extreme tidal water levels respectively.
- 8.2.12 With the exception of the North Quay, land raise proposals will be set at a minimum of 5.35m AOD for the commercial section of the proposed development site. This is above the predicted 0.5%AEP and the 0.1%AEP extreme tidal water levels for 2060. Table 6.1 shows an additional freeboard of approximately 1.9m and 1.75m is available for the 0.5%AEP and 0.1%AEP extreme tidal water levels respectively.

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- 8.2.13 Finished floor levels for North Quay in the commercial section of the site will be set at 3.95mAOD which is above the 0.5%AEP extreme tidal water level. Table 6.1 shows there is 0.5m freeboard available for the units in this area. Levels on the river frontage at North Quay will be set at 3.6mAOD, however this area will be used for vehicle manoeuvre and parking. 3.6mAOD provides 0.15m freeboard at this point.
- 8.2.14 Detail regarding the North Quay section of the commercial area of the site can be seen in Dwg 13800-SK-002 Rev A. The river frontage for this area of the site has a minimum level of 3.6mAOD. Whilst this does not include the 500mm freeboard allowance it is above the predicted 0.5%AEP water level as seen in Table 6.1 and provides a freeboard of 0.15m in addition. Access from building N is provided by higher ground located to the north east of Building N, here the minimum ground level on this access route on Wharf Road is indicated to be 3.91mAOD which is 0.04m below the proposed level for Building N. Given that the proposed land use for North Quay is considered to be 'less vulnerable' this is considered an appropriate access route from this section of the site.
- 8.2.15 Underground car-parking for the residential area is shown on Dwg Nos 103-01. Minimum floor levels for the car-parks are shown to be 2.5mAOD which is below the predicted 0.5%AEP year return period extreme water level.
- 8.2.16 The development platform will be set at 6.0mAOD where car-park entrances and exits are located which is above the 0.1%AEP extreme tidal water level inhibiting flow routes to underground car parks. The car parks will be designed such that they remain at low risk of flooding during extreme tidal event for the development life.
- 8.2.17 Underground car-parking for the marine employment area is shown on Dwg No 401B. Minimum floor levels are set at 5.35mAOD which is above the 0.1%AEP extreme tidal water level and located within Flood Zone 1 for the climate change scenario.
- 8.2.18 The development platform provided by land raising across the site locates the development within Flood Zone 1. North Quay is also located within Flood Zone 1 with sufficient freeboard for the building N and access from building N to higher ground along Wharf Road.

Phased approach to construction

- 8.2.19 It is proposed that a phased approach be employed during the construction of the proposed development (refer Dwg No. 050-10). Ground elevations are highest where Phases 1 and 2 are shown. Reference to CS/004622/FR1/001 indicates that phases 1, 2 and 6 are outside the flood envelope indicated by the 0.5%AEP tidal water level and are not at flood risk from tidal inundation. Phases 3, 4 and 5 are adjacent to the River Frontage and shown to be partly within Flood Zones 2 and 3, however landraising will be completed before the onset of construction and development will take place on the raised development platform located in Flood Zone 1.
- 8.2.20 The strategy will ensure that areas of the site already in Flood Zone 1 (low probability of flooding) will be developed first with those areas in Flood Zones 2 and 3 developed at the later stages. For the commercial section, the phased approach will link with existing infrastructure and higher ground to the rear of the proposed development site. The phased approach means there will be safe access and egress from the onset of the development and that the potential hazard of tidal inundation during the construction phase is fully mitigated for.

River Frontage

- 8.2.21 The riverside vegetated terracing proposed for the majority of the residential section of the site can be seen in Dwg CS/004622/GEN/002/D and will comprise rip rap boulders as part of the design. Such features will dissipate the low energy wave action that may be anticipated for this location on the River Itchen. The terraces will provide visual amenity and will be of ecological benefit to the Special Protection Area located in the intertidal zone of the River Itchen. They will also provide a 'polishing' effect to overland flow generated on the site during a rainfall event before entering the River Itchen.
- 8.2.22 River frontage to the commercial section will comprise pontoons. Dwg TSDG-001-06 indicates how this arrangement will tie in with land raised frontage for the commercial section of the site. Whilst not the primary function; such structures will assist in dissipating the low energy wave action that may be anticipated. Given that the proposed land use behind the pontoons is to comprise 'less vulnerable' land uses as defined by PPS25 the risk posed by the mild wave climate is appropriately mitigated.

Building Design

- 8.2.23 The design of the development with consideration of flood risk will be undertaken at detailed design stage and whilst most buildings will meet or exceed the standards within the Building Regulations 2000. Further guidance can be obtained from CIRIA 635 'Designing for Exceedance in Urban Drainage' (Balmouth et al 2006) and DEFRA/Environment Agency 'Improving the Flood Performance of New Buildings', (DCLG 2007). Such methods including the selection of building materials, venting, waterproofing and regard to further modifications to separate dwellings post development, for example. It is likely that a combination of these and other methodologies that are appropriate to the development will result in an increase in the level of protection afforded to property against the risk of flooding from surface water. Choosing which measures are best suited will depend on the level of risk of flooding identified across the site (i.e. more resilient methodologies and techniques used for the low lying areas).

8.3 SUSTAINABLE DRAINAGE STRATEGY

- 8.3.1 The sustainable drainage strategy aims to provide a sustainable solution for the management of surface water for the lifetime of the proposed scheme. Chapter 7 of this report outlines the proposed drainage strategy that provides betterment to the existing situation and is in accordance with the guidelines within Annex F of PPS25 and Chapter 4 of the companion guide to the PPS guidance.

Tidal Defence Consent (Land Drainage Consent)

- 8.3.2 All works within 15m of the River Itchen will be consented under the Land Drainage and Sea Defence Byelaws (Southern Region).

9. Residual Risk

- 9.1.1 The need to manage residual risks is identified within Annex G of PPS25. Residual risks are the risk remaining after applying the sequential approach and taking mitigating actions (Chapter 8). Flood risk to people and property can be managed but it can never be completely removed; a residual risk will remain after flood management or mitigation measures have been put in place.
- 9.1.2 There is potential for a flood event with a greater annual probability of 0.1%AEP to occur. Whilst this is possible such an event would be considered extremely rare. Given the proposed ground levels for the development it is unlikely that there would be an event with a water level greater than ground levels proposed for the site. The exception is North Quay, however given the rarity of the event and the vulnerability of the proposed land use and the duration of the potential event flood risk to this section of the site is reduced, albeit not removed. To account for this flood resilient construction techniques should be employed as outlined in Section 8.2.23.
- 9.1.3 Limited flooding in North Quay is a potential residual risk. The appropriateness of limited flooding along this access route is also defined by the fact that use of building 'N' will be with daily working hours and the duration of the potential tidal event (Practice Guide Companion to PPS25). In addition it will not be used by those more vulnerable the flood hazard (elderly, infirm and children) as described in 'Flood Risks to People'¹⁰. The tidal curve for Southampton can be seen in Appendix 3 and it can be seen that flood waters will start to recede as soon as the peak has passed and that the duration of the maximum flood is less than 1 hour. Safe refuge for flood events during working hours could be provided for in building 'N' until after the peak of the flood has passed and the waters recede. Safe access will be maintained by appropriate signage and alert that flood waters have receded and the area is safe.
- 9.1.4 Designs for the surface water system account for the coincidence of the 1%AEP pluvial event and the 0.5%AEP tidal event. This scenario is considered extreme and rare, and would cause the surface water system to exceed its capacity, resulting in ponding in low areas and overland flow. Detailed design will consider appropriate management of this residual risk using appropriate methods such as ensuring that flow pathways are designed correctly so that overland flow does not take the default route. Definition of these routes can be where necessary confirmed by Digital Terrain Models and will be heavily influenced by the development layout. Surface storage and capacity of overland pathways have already been designed within the Drainage Strategy that accompanies this planning application where it can be seen that overland flow rates are low for the extreme scenario. Design building layout and detail will incorporate guidance provided in CIRIA C635 '*Designing for Exceedence in Urban Drainage*' (Balmforth et al.). This document provides information on flood protection measures such as increasing threshold levels and attention to entrance details - particular relevance with respect to the underground car-parks for example.
- 9.1.5 Safe access and egress needs will be provided for within the buildings provided design details outlined in 9.1.4 have been undertaken. It may also be necessary to install early warning and evacuation procedures so that access to the higher areas on the site are maintained in advance of an extreme event or tidelocked scenario. The existing design layout for the proposed development details four entrances and exits (Dwg TSDG-001-06) which would provide access and exit routes for the emergency services.

¹⁰ Flood Risks to People, FD2321/TR2, Defra/Environment Agency.

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- 9.1.6 CIRIA 632 'Standards for the repair of buildings following flooding' (Garvin et al 2005), would be important guidance on attempting to mitigate for any potential increase in flood risk beyond our current forecasting techniques.
- 9.1.7 Finally, when flood waters recede, an exceedance event may leave debris or even pollution in storage areas and overland flow paths. In such designated areas procedures for a timely clean-up operation by responsible stakeholder should be agreed.

10. Conclusion

- 10.1.1 Following the application of the Sequential Test it has been ascertained that there is no other suitable site for this development within the LDP boundary for Southampton City Council. The site is located partially in Flood Zone 2 and 3 at present.
- 10.1.2 This flood risk assessment has investigated the flood hazard arising from the tidal River Itchen and surface water sources. It has been shown that land raising the entire site to the levels indicated is a sustainable solution to mitigate the potential hazard of tidal flooding.
- 10.1.3 A combination of good site design and construction techniques will ensure that where possible residual risks arising from extreme tidal events are appropriately managed.
- 10.1.4 Designs for the riverside vegetated terraces that will form the frontage to the southern part of the site will provide ecological benefit to the SPA adjacent to the site in the River Itchen and visual amenity to the users of the proposed development. This represents significant betterment to the existing situation.
- 10.1.5 The management of surface water has been appropriately addressed within the Drainage Strategy that accompanies this planning application and deals with the flood hazard and probability arising from surface water sources. In particular, the extreme tidelocked scenario where the capacity of the piped surface water system is exceeded. The drainage strategy shows how with the inclusion of SUDS and a new positive piped drainage system, runoff from this extreme scenario can be appropriately managed.
- 10.1.6 Flood risk arising from the development within Flood Zone 3 can be successfully mitigated for and managed without increasing flood risk to offsite or downstream receptors.

Figures

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