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121 Garland Road

Parkeston, Harwich, Essex CO12 4PA

Flood Risk Assessment

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Project Revision Sheet

Revision No	Date	Status	Changes	Author	Approved
-	20/12/2010	Final	N/A	JRC	SJC
A	10/08/2011	Final	FRA updated following EA consultation to remove all single storey ground floor units, therefore providing safe refuge to all units.	JRC	SJC
B	15/05/2012	Final	See Section 1.6.	JRC	SJC

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1 Introduction

1.1 MLM Consulting Engineers Ltd has been appointed by Suffolk Property Developments Ltd to undertake a Flood Risk Assessment (FRA) associated with the proposed re-development of 121 Garland Road, Parkeston, Harwich CO12 4PA.

1.2 The site is shown on the Environment Agency (EA) flood map to lie in Flood Zone 3 (the high probability flood area). However, the area is shown on the online EA flood maps to be defended.

1.3 This report has been prepared for the sole use of Suffolk Property Developments Ltd and the contents should not be relied upon by others without the express written authority of MLM Consulting Engineers Ltd. If any unauthorised third party makes use of this report they do so at their own risk and MLM owes them no duty of care of skill.

1.4 This Assessment is prepared in accordance with the National Planning Policy Framework (NPPF) and its Technical Guidance document dated March 2012 and is based upon information in our possession at the time of writing.

1.5 Revision A of this report follows EA comments in its letter dated 11 July 2011 (see Appendix J) and subsequent discussions with the EA. The principal change is the amendment of the layout, removing the units solely consisting of ground floor accommodation and therefore providing refuge to all occupants in the event of a flood. The main changes are in paragraphs 1.5, 4.6, 5.4.8, 5.7.3 and 7.6.

1.6 Revision B of this report updates paragraph 2.2.1 to describe the development proposals as per the drawings contained in Appendix C, and updates the report to suit the NPPF and the associated Technical Guidance document dated March 2012.

2 Site Description & Proposal

2.1 Existing Site

2.1.1 The site is located at 121 Garland Road and comprises a derelict bungalow and land in between No.121 and No.113 in Parkeston, Harwich. There is also evidence of another building adjacent to No.121 (possibly No.119) which has been demolished. The approximate grid reference of the site is 623960, 232180. The site location is indicated on drawing 613665/100 in Appendix A.

2.1.2 The site is brownfield land extending to some 1350m^2 is approximately 6% impermeable. A topographical survey (see Appendix B) relates to GPS datum and shows ground levels from 0.18mAOD to 1.37mAOD.

2.1.3 Directly to the east and south of the site is public open space. To the west is the property 113 Garland Road and to the north is Parkeston Road. Approximately 90m to the north-east of the site is the Port of Harwich.

2.1.4 Approximately 100m to the south of the site is the Dovercourt Dock River, which is the last part of the Ramsey Creek before it is pumped into the Bathside Bay. The pumping station for this is approximately 300m to the east of the site. The River Stour is about 500m to the north of the site.

2.2 Proposed Site

2.2.1 The proposals for the site are for 5no. two storey houses and 1no. first floor flat. Parking will be provided to the rear of the development at existing ground levels so that there is no loss of flood storage for a fluvial flood event. Living accommodation is provided mainly at ground floor level, with all sleeping accommodation and a bathroom in each house at first floor level. The flat is situated at first floor level above a driveway, with access via enclosed stairs from ground level. Plans and elevations are shown on Mark Perkins Partnership drawings in Appendix C.

2.2.2 The development will include new vehicular access to the site from Garland Road, as shown on drawing 837/01 in Appendix C. Proposed ground levels will be similar to existing.

2.2.3 The finished ground floor levels for the proposed buildings are expected to be set around 600mm above existing ground levels, as shown on drawing 837/03. This gives a floor level of approximately 1.9mAOD.

2.2.4 The proposed residential development has a flood risk vulnerability classification of 'more vulnerable', in accordance with table 2 of the Technical Guidance to the NPPF. The current EA guidelines require that 100 years should be used as the design horizon for residential developments when assessing the estimated impacts of climate change.

3 Planning Background

3.1 General

3.1.1 The proposed development site is not referred to in the emerging Local Development Framework (LDF). However, there is a general consensus that the greater Harwich area is in need of regeneration, particularly of run-down and derelict buildings, for the benefit of residents and Harwich in general.

3.2 Sequential Test

3.2.1 The Local Planning Authority (LPA) should carry out the Sequential Test as required by the Technical Guidance to the NPPF, for all sites, during the site allocation process. This site is not included in the emerging Tendring LDF and as such evidence will need to be provided to the LPA to enable the Sequential Test to be undertaken.

3.2.2 The site is located within Flood Zone 3, as shown on the EA flood map extract in Appendix A. However, the site may be considered sequentially preferable because of its urban location, and the current site condition is in need of significant improvement for the benefit of local residents. The development would also help to meet the demand for residential properties in this area. Many environmental features are also attributed to the design of the development which makes it sustainable in the long-term.

3.2.3 Tendring District Council (TDC) published its Stage 1 Strategic Flood Risk Assessment (SFRA) in April 2008. The final Stage 2 SFRA was published in August 2008 (SFRA –see section 3.3).

3.3 Strategic Flood Risk Assessment

3.3.1 TDC published its SFRA –Stage 1 in April 2008. This report contains the results of some breach analysis and flood related data which is relevant to this site. The Harwich Strategic Flood Risk Assessment Final Level 2 report was published in August 2008. This has been reviewed and does not add anything further to the Stage 1 report which is of relevance to this site.

3.3.2 Fluvial and tidal flooding has been considered in the SFRA, and numerous Figures produced which have been reviewed. However, more recent flood modelling has been undertaken by the EA with regard to the fluvial River Ramsey. As this is the latest modelling available for the River Ramsey it will be used to inform this SFRA.

4 Fluvial Flooding

4.1 The EA has undertaken 1D hydraulic modelling of the fluvial River Ramsey, the results of which have been made available to inform this FRA. The data from the EA is contained within Appendix E. The flood levels relevant to the site (taken from Node RAM_00445) are:

Return Period	5% (1:20)	5% (1:20+CC)	1% (1:100)	1% (1:100 +CC)	0.1% (1:1000)	0.1% (1:1000 +CC)
Flood Level (m AOD)	-0.003	0.156	0.233	0.423	0.543	0.704

Table 1 –Site Relevant Flood Levels

4.2 There are no defences along the line of the River Ramsey. The ground surrounding the line of the River is generally used for agriculture except for the area east of the A136 Station Road where the land has been used for warehousing and a supermarket.

4.3 The River Ramsey discharges to the Stour Estuary via a pumping station. There are a total of three pumps; two operational and one backup. Each has a capacity of $1m^3/s$. In addition to the safeguard of the backup pump, should there be a mechanical failure of one of the pumps, there is also a backup generator if there should be a power failure to the pumping station.

4.4 No information has been supplied by the EA with regard to flood depths in the event of failure of the pumping station. However, given the backup systems in place, this is an unlikely scenario. If, however, this did occur it is unlikely that the proposed buildings would suffer internal flooding due to the proposed floor level being in the order of 1.9mAOD. It is also unlikely that the safe access/egress route would flood as this is at a minimum level of 1.3mAOD immediately outside the site with the remainder of the route being at a higher level.

4.5 Drawing 613665/110 in Appendix C shows the site overlaid with the topographical survey (existing buildings removed) and the proposed layout. This shows that the site does not lie in Flood Zone 3b but that Flood Zone 3a does affect the site.

4.6 The revised development proposals do not extend into the 0.1% Annual Exceedance Probability (AEP) Flood Zone, therefore flood compensatory storage is not required as the proposed buildings lie in fluvial flood zone 1 and there will be no ground raising on the site. The extent of the flood zones is shown on drawing 613665/110 in Appendix C.

4.7 The development is therefore not at risk of flooding from fluvial sources and does not increase flood risk to others.

5 Tidal Flooding

5.1 General

5.1.1 The EA website flood map, shown in Appendix A, shows that the entire site lies within Flood Zone 3, i.e. the area at high risk of flooding. We understand that this map does not provide flood depths, nor does it take account of the presence of flood defences or climate change and it does not clarify whether the flooding is fluvial or tidal flooding. However, from the EA data supplied from the River Ramsey modelling we can deduce that the flooding is related to a tidal event.

5.2 Peak Tidal Flood Levels

5.2.1 The EA has provided the 2007 tidal flood level data, this data has been amended using the applicable climate change to give the 2010 tidal level, see Table 2. Also given in Table 2 is the predicted 2110 tidal levels relating to the same return periods. These tide levels relate to the seaward side of the flood defence.

Return Period	2010 Tidal Flood Levels (mAOD)	2110 Flood Levels (m AOD)
1:1	2.692	3.742
1:20	3.372	4.422
1:50	3.582	4.632
1:100	3.742	4.792
1:200	3.902	4.952
1:1000	4.272	5.322

Table 2 –Predicted Tidal Flood Levels at Harwich

5.2.2 The tide levels given in the SFRA appear to be incorrect. Appendix C of the Extreme Tide Level report gives modelled levels as of 2007, and 4mm for climate change needs to be added to this to give a 2010 starting level, as has been done in Table 2.

5.3 Flood Defences and Design Event Flood Risk

5.3.1 The area of Harwich in which the site is located is protected by existing flood defences. The defence closest to the site is an earth embankment protecting against flooding from Bathside Bay.

5.3.2 Information relating to other defences protecting the Parkeston area is described in Table 3 and the associated photographs.

5.3.3 When comparing the flood defence crest levels with the peak tidal flood levels provided in Section 5.2, it is evident that there should be no overtopping of defences during the 0.5% AEP event. There is in fact approximately 800mm freeboard to the top of the lowest defence relevant to the site at the Harwich International Port, see drawing 613665/101 in Appendix B.

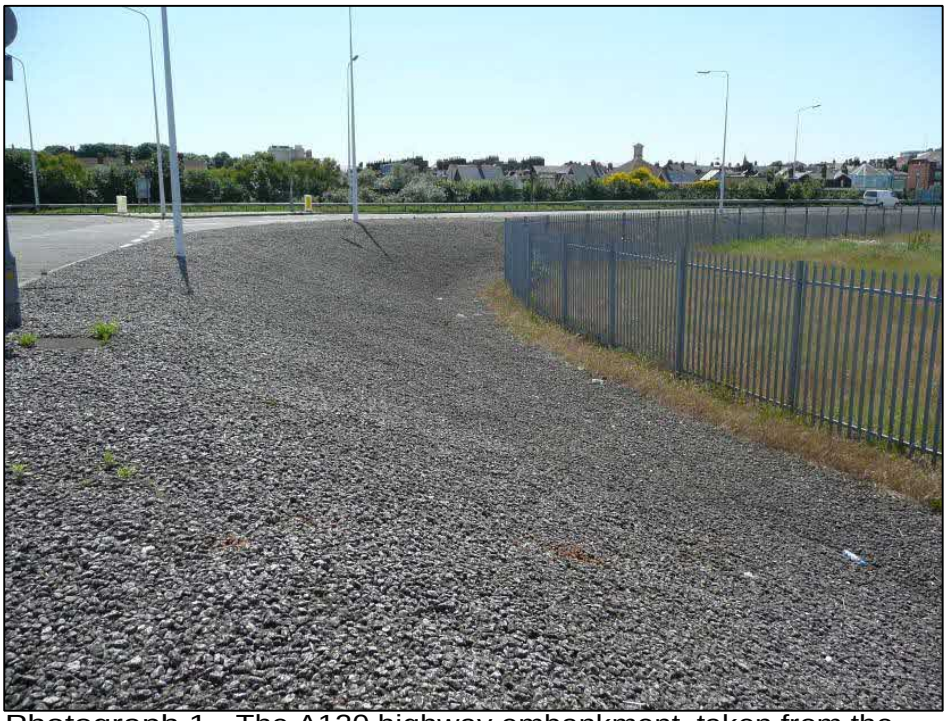
5.3.4 During the 0.5% AEP plus climate change event, overtopping of some of the defences may occur. The defences at Harwich International Port will be overtopped by 252mm which will lead to flooding behind the defences.

LOCATION AND TYPE OF DEFENCE	LEVELS GIVEN IN PREVIOUS EA CORRESPONDANCE	LEVELS GIVEN IN HARWICH STRATEGIC FLOOD RISK ASSESSMENT STAGE 1 DATED APRIL 2008	LEVELS GIVEN BY PORT OF HARWICH ENGINEER
A120 Highway Embankment ¤	6.0mAOD		
Seawalls Heading Towards Parkeston	BUILT TO 6.0mAOD MAINTAINED TO 5.4mAOD		
Parkeston Ferry (Type Unknown)		4.7mAOD	
Bathside Bay (Earth Embankment) ø		5.0mAOD	
All Around Port Ownership			5.4mAOD

¤ = See Photograph 1 ø = See Photograph 2

Table 3 –Flood Defence Crest Levels

5.3.5 Calculations have been undertaken to determine the flood level that would occur behind the defences if overtopping at Harwich International Port occurred during a 0.5% AEP event inclusive of climate change, see Appendix F. Based on overtopping occurring along the entire length of the port, approximately 1390m, the total volume of flood water overtopping the defences would be 1,033,447m^3. This flood water would flow both towards the site to the east of the Ramsey Ray (local high point) and away from the site through the Refinery to the west of the Ramsey Ray. Based on contours derived from LiDAR data, the Ramsey River valley would flood to a level of 1mAOD during this scenario, see drawing 613665/104 in Appendix C. This would mean that the properties would remain dry and safe dry access and egress would remain available.



Photograph 1 - The A120 highway embankment, taken from the Ingestre Street roundabout looking west along the A120 highway.

Photograph 2 - Looking towards Harwich International Port, earth embankments protecting against Bathside Bay.

5.4 Residual Risk

5.4.1 The 0.1% AEP event tide level is lower than the defence crest level at the lowest point (Harwich International Port) by 428mm. Therefore there would be no flooding of the site in the extreme event scenario.

5.4.2 There is the risk of breach of the earth embankment to the east of the site; this scenario was modelled in the Harwich Level 1 SFRA. Model output data has been obtained for this scenario and is presented in Appendix D.

5.4.3 The data from the SFRA is suitable to use as the breach location, as shown on Figure D1 in Appendix D, as it is located in a suitable position for the proposed development site. A breach in the sea wall to the east of the site would not be suitable as the railway embankment would impede the flooding of the flood cell, reducing the flood hazards.

5.4.4 The flood depth and velocity information from the SFRA was acquired with the permission of TDC. Information was obtained for specific locations along the access/egress route (see drawing 613665/103 in Appendix B). These locations were chosen using Figure D6 of the SFRA (see Appendix D) as representing the location of changes in flood hazard rating along the access/egress route. This data was manipulated to produce the flood hazards at each location based on the formulae in paragraph 13.7.2 of FD2320-TR2.

5.4.5 The maximum flood hazards at the site and along the access/egress route in the event of a breach are summarised in Table 4 below. Refer to drawing 613665/103 in Appendix B for Location Plan.

Return Period	200 Year (2108) (water level 3.17mAOD)			1,000 Year (2108) (water level 4.83mAOD)		
Location	Depth (m)	Velocity (m/s)	Hazard	Depth (m)	Velocity (m/s)	Hazard
1	2.16	0.13	2.24	3.82	0.60	4.99
2	1.41	0.08	1.74	3.07	0.47	3.75
3	1.00	0.03	1.53	2.67	0.49	3.37
4	0.50	0.03	1.13	2.17	0.55	2.97
5	0.37	0.87	1.50	2.14	2.42	5.09

Table 4 – Maximum flood hazards

5.4.6 The results confirm the SFRA Figure D6 rating of “Danger to All” at the site in the breach event and show that this is the worst flood hazard on the access/egress route. The access/egress route along Garland Road reduces to “no hazard” rating before it reaches Station Road. There is a section of approximately 140m on Station Road where flooding is shown, on Figure D6 of the SFRA, which reaches a maximum hazard rating of “Danger to Most”.

5.4.7 It is recommended that all residents are signed up to the EA’s flood warning service.

5.4.8 In the event of a breach of the flood defences, safe refuge is available on the first floor of the development for all properties. The finished floor level of the ground floor will be approximately 1.9mAOD which would lead to a first floor level of approximately 4.5mAOD. This is well above the 0.5% return period breach level inclusive of climate change of 3.17mAOD and above the 0.1% tide level of 4.272mAOD.

5.5 Future Flood Frequency

5.5.1 When comparing the predicted flood levels against the existing tidal defence level, overtopping by a 0.5% annual probability event could occur in approximately 70 years time.

5.6 Past Flooding

5.6.1 The SFRA confirms that this area of Harwich was flooded during the 1953 tidal flooding. The River Ramsey flooded in 1958, but this event did not reach the site. Figure 3 from the SFRA (see Appendix D) shows the approximate flood outlines from these events.

5.7 Flood Warning & Response

5.7.1 This part of Harwich is served by the Environment Agency's flood warning service. It is recommended that all residents are signed up to this service.

5.7.2 It is likely that if flooding did occur at the site that flow velocities and depths would present a danger to all. Since flooding at the site would be extremely likely in the event of a breach, there may not be much time for residents to react. It is therefore recommended that all residents remain inside the building during a flood event and seek refuge on the first floor should this be necessary.

5.7.3 A Flood Management Plan has been prepared and is contained within Appendix I.

5.8 Flood Resilience

5.8.1 The Communities and Local Government document "Improving the Flood Performance of New Buildings: Flood Resilient Construction" document makes general recommendations for the construction of new buildings, to provide a reasonable level of flood resistance to their structural elements and finishes. The following summarises the wet proofing measures that will be incorporated into the building design and construction:

5.8.2 Floor

Where voids exist under the ground floor they shall be accessible to allow for drainage and ventilation.
Insulation to floor slabs is to be material with very low water absorption.
A waterproofed sand/cement screed is to be applied to the ground floors.

5.8.3 Walls

Materials will be chosen to limit water penetration during flooding with more dense materials being specified to provide greater flood resistance.
The structure of the building is to take into account potential hydraulic loading from rising, falling and flowing flood water.
Where practicable all fixings and accessories at or below floor level are to be corrosion resistant, e.g. stainless steel wall ties to be used for cavity walls.
Insulation materials below flood level are to be low water absorption materials.
Quilted insulation materials, or 'blown in' insulation are not to be used below floor level.
Careful detailing of movement joints in walls and finishes will be required to minimise water penetration of cavities, etc.
Services entries sealed with closed cell material.
Service meters located above flood level where possible.
Wiring should run at ceiling level and drop down to service points where possible.
Suitable insulation in distribution ducts of communications cabling using service providers' recommended method.

5.9 Hydrostatic & Hydrodynamic Forces

5.9.1 The building will be constructed around a frame of either steel or reinforced concrete columns which will enable the building to remain standing in the event of significant hydrodynamic forces. The columns will be founded on either piles/pilecaps or deep strip foundations which will prevent scour undermining the foundations. Sketch 613665/01 in Appendix C shows the proposed location of columns/piles within the development. The first floor will be supported off beams spanning between the columns. These measures will mean that safe refuge will be available on the first floor if a breach of the defences occurs.

5.9.2 Typical details of piles and strip foundations are shown on sketches 613665/02 and 03 respectively, both of which are included in Appendix C.

6 Surface Water Drainage

6.1 Existing Drainage

6.1.1 The Anglian Water (AW) sewer plans given in Appendix G show that a 535mm surface water sewer runs along the southern boundary and a 375mm surface water sewer runs along the eastern side of the site.

6.1.2 It is not known if surface water is currently connected to the public surface water sewer, however, the superficial geology at the site is alluvium and is likely to support a high ground water table which is not condusive to soakaways.

6.1.3 Site investigations will be required before detailed design to determine the geological make up of the ground, the level of the water table and if appropriate, the porosity of the soils. If the soils are sufficiently porous and the water table at a sufficient depth then soakaways will be utilised to dispose of the surface water runoff.

6.2 Proposed Drainage

6.2.1 As the rate of discharge of surface water from the site to the public sewer is unknown, it is assumed for the purpose of this FRA that a maximum discharge rate of 5l/s will be allowed to the sewer. This rate is the practicable minimum rate to reduce the risk of blockage of the flow control device.

6.2.2 The total hard paved area of the site is 740m^2 of the total site area of 1350m^2. Microdrainage has been used to determine the volume of attenuation required to restrict discharge from the site to a maximum of 5l/s in the 1% AEP event inclusive of climate change. The calculations in Appendix H demonstrate that a volume of approximately 36m^3 is required. Drawing 613665/120 in Appendix H shows the proposed layout of the surface water drainage, including the location of hydrobrake chamber and attenuation.

6.2.3 This solution demonstrates that surface water runoff from the site can be restricted to a minimum practicable rate, however, if further investigation reveals that the existing property of 121 Garland Road discharges surface water to the public sewer then the existing discharge rate may be used to determine the discharge rate from the site.

7 Conclusions

7.1 The site is protected by existing flood defences which have a crest level above the current predicted 1,000 year return period tidal flood level.

7.2 Although the benefits of future improvements to defences can not be considered in this report, it is reasonable to expect that the defences protecting a large urban area such as Harwich, which includes prime port facilities and a large residential presence, will be improved in the future. The development of Bathside Bay as an extension to the International Port will almost certainly include new defences to at least the existing level of the existing port defences.

7.3 Surface water will be discharged to the surface water sewer to the south of the site. However, if SI reveals that soakaways could be utilised at this site then surface water drainage will be by soakaway.

7.4 When considering the possible rise in sea level which could occur due to future climate change, there may be overtopping of some of the defences occurring in approximately 60/70 years time during a 200 year return period event. This assumes there are no improvements to the existing defences and sea level rises due to climate change occur as predicted.

7.5 Overtopping of the flood defences in 100 years time will lead to flooding of the River Ramsey valley to a level of approximately 1mAOD. In this event the development will remain dry and safe access and egress is available.

7.6 In a residual risk breach scenario there would be a maximum of 2.15m depth of flooding on Garland Road outside the development. Safe refuge would be available on the first floor of the development for all of the individual properties.

7.7 The site is located in fluvial flood zone 3. The building will be raised above the 1% AER flood level and safe dry access is available. A small volume of flood storage will be lost due to the positioning of the proposed building however this will be replaced by the regrading of the car parking area on site.

7.8 A full assessment of the hydrodynamic and hydrostatic forces acting on the building during the design flood event should be carried out at detailed design stage to inform the design of the buildings. This can be controlled via a planning condition if considered necessary.

7.9 Finished ground floor levels for residential accommodation will be set 600mm above existing ground levels at a level of approximately 1.9mAOD.

7.10 Flood resilience measure will be incorporated into the design of the building to reduce the period the building is unoccupied for in the event of a flood.

7.11 TDC will need to confirm whether it has undertaken the Sequential Test. If it has not, and does not intend to, then this will need to be prepared by the Developer. As previously discussed, the development provides many benefits that may be considered to outweigh the risks from flooding.

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