



**MA10325-FRA-R04**

**Proposed Residential Development  
Middlegate Road, Kirton, Boston  
PE20 1BZ**

**Larkfleet Homes T/A Allison Homes**

**Flood Risk Assessment**

**May 2017**

**millward**

-  Civil & Structural Engineering
-  Environmental & Geotechnical
-  Flood Risk & Drainage
-  Highways & Infrastructure
-  Structural Inspections
-  Transportation

## REVISION

Reference	Revision	Author	Date
MA10325-FRA-R01	Initial text issue for team review	JMcK	27 June 2016
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MA10325-FRA-R03	Issue for Planning	JMcK	21 Sept 2016
MA10325-FRA-R04	Revised Issue for Planning	JMcK	05 May 2017

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## 1. INTRODUCTION

- 1.2 Millward have been appointed to undertake a Flood Risk Assessment (FRA) and Drainage Strategy (DS) for a proposed residential development for 195 plots on land adjacent to Middlegate Road (West), Kirton, Boston PE20 1BZ.
- 1.3 This FRA is undertaken in accordance with the National Planning Policy Framework and associated Technical Guidance Document March 2012 (NPPF).
- 1.4 This FRA discusses and provides both a qualitative assessment and quantitative assessment for the residential development in terms of flood risk, future flood risk over the anticipated lifetime of the development and reference to the sequential and exception test using a precautionary and risk based approach.



## 2 THE SITE

- 2.1 This proposed residential development is located to the northern side of Middlegate Road (West) on Greenfield Land in Kirton, Boston, Lincolnshire, totalling 10.02 Hectares (100,200m<sup>2</sup>) in area. The site is located on the northern extent of Kirton approximately 1.1 kilometres to the North East of Kirton Town Centre and approximately 5.3 kilometres to the South of the centre of Boston. The site location is shown on drawing MA10325/SK01 contained within Appendix A.
- 2.2 Vehicular access to the development will be via Middlegate Road (West) as per the architects drawing contained within Appendix A.
- 2.3 The site is not currently developed nor has been previously developed therefore the site is classified as Greenfield.
- 2.4 There is no evidence that the site is or has been formally drained previously and is currently used for agricultural.
- 2.5 Site levels within the development area vary from circa 3.57 to the South Eastern corner, 3.70 to the North Eastern corner, 2.65 to the North Western corner and 2.79 to the South Western corner, giving an average gradient across the site of circa 1 in 550.
- 2.6 The site is currently 100% Greenfield and therefore the site surface water run-off has been calculated by the ICP SUDS method, which confirms a Q-Bar (Mean annual flood flow) Greenfield run-off rate of 14.8 l/s with the 1 in 1 year run off rate calculated at 12.9 l/s. The WinDES results are contained within Appendix C.



### **3 CONSULTATIONS**

#### **3.1 Environment Agency (EA)**

- 3.1.1 The EA national flood risk maps available on their web site have been interrogated firstly to define in terms of planning what flood zone the site is contained within.
- 3.1.2 The development site is located within Flood Zone 3 which in accordance with Table 1 of the NPPF Technical Guidance document, is defined as High Probability having a 1 in 100 or greater annual probability of flooding from rivers (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year (National Planning Policy Framework Technical Guidance, March 2012).
- 3.1.3 The site and surrounding area benefit from significant tidal flood defences.
- 3.1.4 Therefore further information has been obtained from the EA relating to this site in the form of Hazard Mapping which is contained within Appendix B.
- 3.1.5 The information shows modelled breach locations and mapping showing anticipated depths, water velocities and maximum hazard ratings (FD 2320) for a range of events.
- 3.1.6 The range of events are 1 in 200 year event (Scenario years 2006 and 2115) and the 1 in 1000 year event (Scenario years 2006 and 2115).
- 3.1.7 The assessment of this data is undertaken in Section 7.1.

#### **3.2 Anglian Water (AW)**

- 3.2.1 As part of this assessment AW Pre-Planning Assessment Report has been obtained to determine the location of sewers in the vicinity of the site.
- 3.2.2 There are no public sewers or other assets owned by Anglian Water within the boundary or overlapping the site.



- 3.2.3 There are no public surface water sewers within the vicinity of the site however there is a watercourse maintained by the IDB running along the Eastern boundary adjacent to the A16 and one running through the centre of the site between the Northern and Southern boundaries. Infiltration and discharge into the watercourse will be considered as an initial way of treating and disposing of the surface water drainage.
- 3.2.4 Water Recycling Centre: - The foul drainage from the proposed development is in the catchment of Frampton Water Recycling Centre, which currently has capacity to treat the flows from the development site. Anglian Water cannot reserve capacity and the available capacity at the water recycling centre can be reduced at any time due to growth, environmental and regulation driven changes. At the time of logging the Pre Development Enquiry application the provisional number of dwelling was estimated at 200 which has now since revised to 195 upon further assessment of the site layout and master plan. Decreases in flows from the now 195 proposed dwellings are minimal and the assessment at 200 is considered robust.
- 3.2.5 Used Water Network: - Anglian Water have assessed that a gravity connection to the foul sewers may not be achievable due to the site topography and recommend a pumped connection at 3.8 l/s to the network. As there is insufficient capacity in the sewer to accommodate the proposed site and that there are known flooding issues in the area, Anglian Water have looked at an alternative solution of pumping directly to the Frampton Water Recycling Centre and have confirmed this may be a solution.
- 3.2.6 The site is within 400m of the Frampton Recycling Centre.
- 3.2.7 AW are currently undertaking further investigation works through their Senior Growth Planning Engineer. The Senior Growth Engineer will provide an engineering solution, for the development and identify the costs of any mitigation / reinforcement works required.



3.2.8 Any foul connections to any existing adoptable sewers are subject to a S106 sewer connection agreement which would be undertaken as part of the detailed design of the drainage for the development.



## 4 SEQUENTIAL AND EXCEPTION TESTS

### 4.1 Sequential Test

- 4.1.1 The site has been assessed in line with the NPPF technical guidance. The site is confirmed to be wholly within Flood Zone 3 (High probability) as defined in Table 1 (Flood zones) of the technical guidance document for the NPPF.
- 4.1.2 Table 2, (Flood risk vulnerability classification) of the same document confirms that residential development (buildings used for dwelling houses) is classified as 'More Vulnerable' development.
- 4.1.3 Table 3, (Flood risk vulnerability and flood zone 'compatibility') confirms that development classified as 'More vulnerable' development in Flood Zone 3a requires the exception test' to be carried out.
- 4.1.4 In terms of Sequential Test the site sits wholly within flood zone 3 which is the case for the vast majority of this borough.
- 4.1.5 The SFRA states that the EA flood zones will continue to be used by the Borough Council as the basis on which the Sequential Test is applied. The majority of the Borough Councils area is within Flood Zone 3 and Kirton has land in the Danger to Most category but with a low probability of flooding.
- 4.1.6 Therefore the EA have been consulted to provide the Hazard Mapping for the Fra024 site.
- 4.1.7 The Hazard mapping confirms that the 2115 scenario for the 1 in 200 year event the maximum hazard rating for the majority of the site Fra024 (Applicants site) is Danger for Most. Velocities are within the 0-0.3m depth bracket, which generally applies to the whole area of Kirton. Therefore the Hazard rating is dictated primarily by flood water depths, as velocities are pretty consistent in the Kirton area as a whole.



4.1.8 The Boston Borough Council SFRA (October 2010) states;

*It is apparent the majority of the Borough is in Flood Zone 3, so in order to assist the Borough Council apply the Sequential Test; two additional maps have been produced covering all of their borough.*

4.1.9 The two sets of maps show Flood Hazard Zones - Breach Scenario and Relative Probability of Flooding – Given the presence of defences.

4.1.10 The previous application was refused on the grounds of failure of the sequential test. Specifically that there was another site available in Kirton and that the benefits of the scheme did not outweigh the harm from flood risk. This was based on a perceived sequentially preferable site that at the time of the decision was identified as 'Kir037' in the preferred options Local Plan. Subsequently the LPA has advised that it will present no evidence on this reason for refusal at the Inquiry. This was following discussions with the LPA post determination of the original application whereby it was raised that such an approach was flawed. The applicant considers that the Local Plan is at too early a stage to warrant giving emerging sites sufficient weight to cause failure of the sequential test and in any event of the application site were to fail the sequential test, so would a significant proportion of the Local Plan. Please see planning statement for more details.

4.1.11 In looking at the housing numbers, 4,168 houses on preferred housing sites in the district are potentially located on land which is sequentially worse in terms of flood risk than the Larkfleet site.

4.1.12 Therefore taking into account the above assessment, we consider that this site passes the Sequential Test as the proposed site is located in a sequentially better position than proposed allocate sites within the Borough.



- 4.1.13 Through consultations with Anglian Water via a pre development enquiry, there is sufficient capacity at the Frampton Water Recycling Centre for up to 200 dwellings but the existing adopted sewer network connecting does not have capacity to receive the flows without major reinforcement works.
- 4.1.14 At the time of logging the Pre Development Enquiry application the provisional number of dwelling was estimated at 200 which has now been revised to 195 upon further assessment of the site layout and master plan. Decreases in flows from 195 proposed dwellings is minimal and the assessment if 200 dwellings is considered robust.
- 4.1.15 There is a potential option for the application site to pump direct into the Frampton Recycling Centre (Currently being investigated by AW).
- 4.1.16 In the South East Lincolnshire Local Plan Housing Paper, sewage treatment is highlighted as an issue for all potential housing sites. It is considered that the appellants site Fra024 is in the optimum position sequentially for dealing with the waste water drainage over and above other sites as it is just 350m south of the Frampton Recycling Centre, thus, requiring the least works in order to connect.



## 5 PROPOSED DEVELOPMENT

- 5.1 The proposed development proposals consist of circa 195 no dwellings in total with associated driveways and garages (off road) and garden areas to the rear of the proposed dwellings. The site is to be accessed off Middlegate Road (West) in line with the current master plan for the site contained within Appendix A.
- 5.2 The impermeable areas of the proposed site are estimated at 65% (6.329Ha). This is an increase in impermeable area on the site, which therefore will require mitigation measures in terms of surface water drainage to reduce the surface water run off to equivalent Greenfield rate of 12.9 l/s (1 in 1 year rate).
- 5.3 The site is essentially split into 9 housing zones which are served off internal collector roads which will be drained by roadside swales which convey water through to the pond areas.
- 5.4 Foul drainage would connect into the Frampton Water Recycling Centre via a pumped system either into the adopted foul sewer network or direct into the Frampton Water recycling centre (final works to be confirmed by AW) which is 350m to the north of this development site.
- 5.5 The existing IDB maintained drains will be cleared out as required and a 9m easement to each bank is to be applied for maintenance purposes as shown on drawing MA10325/200C contained within Appendix A.



## 6 PROPOSED DRAINAGE STRATEGY

- 6.1 The site topography is generally flat with falls along the Western boundary running South to North at an average gradient of circa 1 in 550, with levels varying from circa 2.79m to 3.57m AOD to the frontage of the site (Southern boundary) to circa 2.65m to 3.70m AOD to the rear of the site (Northern boundary).
- 6.2 The preliminary drainage strategy shown on drawing MA10325/200C is based upon the current master plan for the site and assumes that private driveways and shared drives will utilise permeable paving as part of the strategy.
- 6.3 Roadside swales will take the surface water run-off from the proposed carriageways before outfall into the pond areas (for storage) before ultimate outfall into the IDB maintained ditches at restricted discharge rates.
- 6.4 The cumulative discharge rate for surface water is not to exceed the 1 in 1 year Greenfield run off rate of 12.9 l/s for the whole development site.
- 6.5 The surface water drainage system to be designed for the site will ensure that there is no flooding from the site in the 1 in 100 year event including a 40% allowance for climate change whilst maintaining the 12.9 l/s maximum cumulative discharge rate which is equivalent to the 1 in 1 year Greenfield Run Off rate.
- 6.6 The volume of attenuation which is estimated to be required to accommodate the above criteria is between 4,688m<sup>3</sup> and 6,235m<sup>3</sup>. This has been calculated using WinDES source control quick storage estimate.
- 6.7 The ponds accommodate 4,700m<sup>3</sup> with the other potential attenuation of 1,535m<sup>3</sup> accommodated in the under-drained swale areas and permeable paving, Actual final attenuation requirements will be confirmed as part of the detailed design.



- 6.8 As the site is to be raised above adjacent ground levels, consideration of inclusion of perimeter land drains (especially at the boundaries of the existing dwellings which back onto the site along the southern and western boundaries of the site) which would intercept any water from the gardens of the proposed dwellings and prevent it entering the existing gardens. (Currently, there is no such facility to protect the existing gardens).
- 6.9 The surface water drainage strategy provides the required minimum 1 treatment train for roof areas and two treatment trains for the roads / driveways. (All areas flow through 2 treatment trains in line with CIRIA C697.
- 6.10 The pond structure, headwalls and flow control manholes / devices will be adopted and maintained by a private management company which will be funded through the residents of the development which this funding requirement secured through their deeds. This will ensure that the private management company is suitable funded throughout the lifetime of the development
- 6.11 The existing IDB maintained drains will be cleared out as required and a 9m easement to each bank is to be applied for maintenance purposes as shown on drawing MA10325/200C contained within Appendix A.
- 6.12 Analysis of the closest recorded borehole (trial pit) in proximity of the site (Borehole reference TF33NW13 – data taken from the British Geological Survey records online) located approximately at the South Western corner of the site is approximately 2.2m deep. The log confirms that between 0.3m to 2.1m below ground level the material is predominantly grey SILT of intermediate plasticity. This material sits on soft grey fine sandy SILT with traces of clay.
- 6.13 A Phase 1 and 2 Geo-Environmental Assessment has been undertaken which confirms that intrusive investigations conclude loose clayey silty sands and groundwater encountered at approximately 2.0 to 3.0m depths across the site.



- 6.14 Infiltration tests conducted as part of the Geo-Environmental assessment confirmed extremely low rates of infiltration and soakaways are not recommended as solution to surface water drainage of the site.
- 6.15 Therefore surface water is proposed to drain to the existing IDB maintained drains at the 1 in 1 year Greenfield run off rate of 12.9 l/s.
- 6.16 In terms of foul drainage it is proposed to have a gravity foul system within the site to convey flows to a central area where a wet well and pumping station compound be constructed (to AW adoptable standards) before a pumped discharge from the site at 3.8 l/s to an agreed discharge point either on the existing adopted sewer network or directly into the Frampton Water Recycling Centre (in accordance with AW requirements once the further analysis is undertaken).



## 7 FLOOD RISK

### 7.1 Flooding From Fluvial and Tidal Sources

- 7.1.1 The residential development area is shown within Flood Zone 3a as having a 1 in 100 or greater annual probability of flooding from rivers (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. (National Planning Policy Framework Technical Guidance, March 2012)
- 7.1.2 The Boston Borough Council Strategic Flood Risk Assessment (October 2010) provides district wide assessment of the flood risk including flood defence breach scenarios which have been assessed. The study area in the Boston SFRA shows the whole site to be in flood zone 3 with a flood hazard of Danger to Most.
- 7.1.3 The site has a watercourse running through the centre South to North which connects into the Frampton Town Drain and one on the Eastern boundary adjacent to the A16 running South to North which also connects into the Frampton Town Drain.
- 7.1.4 Kirton (as well as Boston) is defended by significant tidal flood defences and whilst the Flood Zone is 3a this does not take into account the presence of flood defences.
- 7.1.5 The use of the Relative Probability of Flooding maps in the Boston District Council SFRA shows that the site is at a low probability of flooding due to these flood defences.
- 7.1.6 As the risk of flooding is high (Flood Zone 3a) and the probability of flooding (due to the flood defences) low the residual risk of flooding from this source is **MODERATE**.
- 7.1.7 Upon further interrogation of the maximum depth hazard mapping there is a large variation in terms of anticipated depth, ranging from 0.5m to 2.0m. Looking at the level differences on the topographical survey between the southern and northern extents of the site there is only a circa 300mm fall in the northerly direction.



- 7.1.8 Therefore in assessing realistic anticipated depths, whilst part of the site is within the 1.0 to 2.0m depth range it is likely that the maximum depth is not going to be more than 1.6m.
- 7.1.9 This is justified by the fact that if we take the southern boundary, which is in the 0.5 to 1.0m depth range, and assume this is at the 1.0m limit of the range and then add the 300mm fall across the site then the maximum anticipated depth would be in the order of 1.3m depth. Therefore assuming 1.6m depth maximum gives 300mm freeboard allowance in the figures. We consider this to be a fair and pragmatic approach to flood risk and depth anticipated on this site.
- 7.1.10 Therefore mitigation measures are required to counteract this which involves raised floor levels in line with the Environment Agencies comments relating to mitigation measures in the South East Lincolnshire Local Plan: Housing Paper – Kirton (January 2016). The mitigation measures proposed are discussed further in Section 8.

## 7.2 Flooding From Land / Adjacent Development

- 7.2.1 The main risk of flooding to this site is from the south which is slightly higher in terms of topography. Due to the flat nature of the surrounding land and flooding from overland flow is likely to be slow and shallow site. The Boston Borough Council SFRA for potential surface flooding (Appendix B) shows an intermediate risk of flooding through the site.
- 7.2.2 Any overland flow from adjacent development site is likely to be shallow and there are no low points within the site which would create a localised depression in the ground which would be at risk of ponding / pooling water from this source.
- 7.2.3 Overall the risk of flooding from this source is considered to be **MODERATE**.
- 7.2.4 Therefore there are mitigation measures proposed as part of the development layout and levels to mitigate this risk which are discussed in Section 8.



### 7.3 Flooding From Infrastructure Failure

- 7.3.1 The site is not within an area deemed to be at risk of flooding from reservoirs (according to the data on the EA website).
- 7.3.2 As the site is outside the limits of any deemed flood extents from a reservoir failure, the risk of flooding to the site is considered **LOW**.

### 7.4 Flooding From Groundwater

- 7.4.1 There are no confirmed records of groundwater flooding in the vicinity of the site in the SFRA.
- 7.4.2 The Geo Environmental Assessment undertaken for this development site confirms the presence of groundwater between 2m and 3m depth which is quite shallow.
- 7.4.3 Overall the risk of flooding from this source is considered to be **LOW**. As there should not be any dwellings in localised low points within the site it is not considered further assessment is required to assess flooding from this source.
- 7.4.4 However, mitigation measures are proposed as part of measures to counteract other sources of flooding which will essentially further reduce any likelihood of flooding from this source.

### 7.5 Flooding From Sewers

- 7.5.1 Anglian Water have confirmed in their pre development enquiry response that the existing sewer network is essentially close to or exceeding capacity. Therefore there is a residual risk of flooding to deal with.
- 7.5.2 As the topography of the land is quite flat and the centre of Kirton at slightly elevated levels, then if any sewers to the south were to flood then potential flow routes are towards the site itself.



- 7.5.3 Flow velocities and depths are expected to be relatively slow and shallow respectively towards the site and likely to be constrained within the carriageways initially then directed into the IDB maintained drains realistically.
- 7.5.4 Overall taking into account the proximity of the sewers and topography of the area, the risk of flooding from this source is considered to be **MODERATE**.
- 7.5.5 However, mitigation measures are proposed as part of measures to counteract other sources of flooding which will essentially reduce any likelihood of flooding of properties on the site from this source.

## 7.6 Off-Site Flood Risks

- 7.6.1 The site proposals along with the proposed drainage strategy outlined in Section 6.1 will intercept drainage run off from the development in swales, potential perimeter land drains and the ponds which will be designed to accommodate the 1 in 100 year event scenario (including 40% allowance for climate change) without flooding of the pond or swales.
- 7.6.2 The ponds (to which all the swales / land drains outfall to before final outfall from the site) will have 300mm freeboard allowance over and above the highest water level at the 1 in 100 year event scenario. The pond will also have an overflow to deal with any exceedence flows from the development (over and above the 1 in 100 year plus 40% climate change scenario, or unlikely blockage of the flow control chamber) which will allow an overflow into the receiving watercourse.
- 7.6.3 Consideration at the detailed design stage will be given to either a land drain / land drains to intercept any surface water flow from the site which may approach the southern and western site boundaries where there are adjacent gardens to the site boundary. This would be reviewed at detailed design stage once final proposed floor levels, layout and finished level contours are produced to confirm any flow routes.



- 7.6.4 With regard to risk to areas off site, the residual risk is considered to be **LOW** as the onsite drainage system will be designed to accommodate the extreme events without flooding and there will be an overflow system in place to ensure any exceedence water does not flow into other land.
- 7.6.5 Existing dwelling gardens would be protected as required by a land drain to intercept any water that may approach the site boundaries adjacent to these properties. The final site layout would be designed with this requirement in mind.



## 7.7 Flooding from Climate Change

- 7.7.1 The NPPF Technical Guidance Document confirms in Table 5 that peak rainfall intensity is estimated to increase potentially up to 40% over the lifetime of this development (100 years) and peak river flows by 20%. Tidal aspects extreme wave heights could increase between 5% and 10%. Sea level rises in this area over the lifetime of the development would be anticipated to be circa 1.2m (to year 2115).
- 7.7.2 From the overtopping scenarios provided by the EA, the 1 in 200 year event at scenario year 2115 does not affect the site. The 1 in 200 year event breach scenarios from 2006 to 2115 do change due to the effects of climate change being applied. Hazard ratings increase in magnitude from 'Low Hazard' and 'Danger for Some' to predominantly 'Danger for Most' rating at the 2115 event.
- 7.7.3 The mitigation measures in Section 8 are designed to counteract this increase in risk.
- 7.7.4 The proposed site drainage will be designed not to flood at the 1 in 100 year event with an allowance of 30% for climate change in line with the NPPF technical guidance document. A further sensitivity test of the developments drainage will be undertaken at 40% climate change allowance to assess the effects and ensure that any flooding within the site itself is kept within the boundaries of the site. The surface water drainage will be designed to be restricted to the 1 in 1 year Greenfield Run off rate for the site of 12.9 l/s.
- 7.7.5 Overall the risk of flooding from the effects of climate change is considered to be **MODERATE**.



## 8 MITIGATION MEASURES

### 8.1 Essential Mitigation Measures

- 8.1.1 The assessment of flood risk in Section 7 of this assessment confirms a **MODERATE** risk of flooding from Fluvial / Tidal, adjacent land, sewers and climate change. There is a **LOW** risk of flooding from all other sources including infrastructure failure and groundwater.
- 8.1.2 Therefore there are several essential mitigation measures to be applied as part of the development.
- 8.1.3 Flood depths due a breach scenario are anticipated to be between 0.5m up to 1.6m based upon the Hazard maps provided by the Environment Agency (EA) and the justification in Section 7.1. Therefore, in line with the EA comments on the South East Lincolnshire Local Plan Housing Paper January 2016, for depths between 0.5m and 1m and also 1m to 1.6m, finished floor levels are to be raised 1m above existing ground levels with a minimum of 300mm flood resilient construction and removable flood gates to all ground floor entrance points. This mitigation measure applies to the whole site in line with EA requirements.
- 8.1.4 Surface water drainage for the site must be designed to accommodate the 1 in 100 year event storm scenarios including a 30% allowance for climate change without any flood waters leaving the development site and also sensitivity tested at 40% to ensure no properties flood within the site and no flood waters leave the site boundary.



## 8.2 Recommended Mitigation Measures

- 8.2.1 All dwellings should have concrete ground floors with damp proof membranes as they are regarded as the most flood resilient floor types with effective connections between the dpc and dpm and shall be constructed to a height of 150mm above the predicted flood level. The dpm should be between the surface screed and the concrete slab as this enables the concrete floor to dry out quickly and would also protect against any rising groundwater should flood risk from this source increase over the lifetime of the development.
- 8.2.2 Permeable paving to private driveways and parking areas should be utilised even if infiltration SUDS are not viable as permeable paving can be designed into a sealed system before outfall into the drainage ditch to the east of the site. This would form part of a SUDS treatment train in line with CIRIA C753, subject to SAB approvals.
- 8.2.3 It is recommended that FFL to properties should be above any adjacent roads levels.
- 8.2.4 Where external gradients are flat or towards the dwelling entrances, provision of linear drainage should be provided to all access points.
- 8.2.5 Electrical circuits are to be set at high level, essentially the wiring located in the cavity between ground and first floor, with the spurs fed down from the ceiling cavity to light switches and sockets which should be a minimum of 450mm above finished floor level at ground floor.
- 8.2.6 Plaster work at ground floor to be a lime based plaster which is more water resilient than traditional Gypsum based plasters.
- 8.2.7 All service meters and boilers to be a minimum 600mm above finished floor levels.
- 8.2.8 One way valves are to be fitted to both foul and surface water pipes which connect from the dwellings to prevent backing up into the houses should the systems surcharge due to a breach event.



## 9 CONCLUSIONS

- 9.1 This Flood Risk Assessment serves to review, assess and quantify (where applicable) the sources, or any potential flooding, the pathways of this flooding and potential receptors within the vicinity of the site.
- 9.2 The assessment of flood risk in Section 7 of this assessment confirms a **MODERATE** risk of flooding from Fluvial / Tidal, adjacent land, sewers and climate change. There is a **LOW** risk of flooding from infrastructure failure and groundwater.
- 9.3 The mitigation measures will provide further protection to the development and reduce any residual risk (however low) as far as practicable. It is recommended that compliance with the recommendations of this FRA are conditioned as part of any planning permission.
- 9.4 This assessment concludes that the site is suitable for development for residential use without unacceptable risk of flooding from all sources to the site itself and elsewhere for the lifetime of the development.



## ***Appendix A – Drawings***

***Site Location Plan: MA10325/SK01***

***Proposed Site Layout: 7343-L-03 RevB***

***Proposed Drainage Strategy: MA10325/200C***



## ***Appendix B – Consultations***

### ***Anglian Water Pre-planning assessment report Environment Agency Hazard Mapping Fra024 site***



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#### ***Source Control Surface Water Drainage – Provisional Attenuation Volumes required***



## ***Appendix D – Ground Investigation***

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