

Construction of 2 storey residential property at Quadring Eaudyke

Flood Risk Assessment

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1.0 Introduction

- 1.1 Mr. M. Clark owns an agricultural building located at Quadring Eaudyke. He wishes to replace the building with a 2 storey, 3 bedroom agricultural tied dwelling. He has appointed Jenny McIntee Architectural Practice to make the necessary planning application, on his behalf, and to collate any necessary supporting documentation.
- 1.2 This Flood Risk Assessment (FRA) has been prepared by Clive Mason C. Eng M.I.C.E and it is in accordance with the requirements of the National Planning Policy Framework (NPPF) and the accompanying Technical Guidance document.
- 1.3 Data has been obtained from the South Holland District Council's Strategic Flood Risk Assessment (SHDC – SFRA), from Catchment Flood Management Plans, from Welland and Deepings Internal Drainage Board's records, (WDIDB), Lincolnshire County Council's (LCC), Surface Water maps and from the Environment Agency's (EA) data bases. The assistance of the various authorities is gratefully acknowledged.

2.0 Site Description

- 2.1 The site is located to the north side of Water Gate in Quadring Eaudyke, Post Code PE11 4PZ. The farm building is close to the north bank of an arterial drain, the Mar Lode Drain, and the red lined site area is approximately 915m² – see Figure 1 – Location Plan.
- 2.2 The current use classification of the building in the NPPF is “less vulnerable” whereas the classification of the new building will be “more vulnerable”.
- 2.3 Access to the site is via a bridge over the Mar Lode and the land surrounding the site is agricultural (farmed by Mr. Clarke). There is an existing bridleway between the site and the Mar Lode, and there are residential properties to the south, west and south-east.
- 2.4 It is understood that occupation of the new property would be in connection with farming activities.

3.0 Flood Hazard

- 3.1 The potential sources of flooding identified in this assessment are:-
 - Fluvial and Tidal sources i.e. South Forty Foot Drain, the River Glen and the Tidal River Welland.
 - Arterial drainage systems – the Mar Lode – Risegate Eau system.
 - Highway Drains – from Water Gate
 - Underground sources
 - On site drainage systems
- 3.2 The three main sources of fluvial and tidal flooding are all relatively remote from the site. Indicative distances are – South Forty Foot – 8km to the west, River Glen – 5km to the south, Tidal River Welland – 5.6km to the south-east. The wash is some 14km away. The EA Maps, and various maps in SHDCs SFRA show that the risk of the

site being flooded from any of these sources is very LOW e.g. Maps 3, 5, 12 and 13. No extent of flooding is shown in the locality, for 1% fluvial and 0.5% tidal events up to year 2115.

- 3.3 The Mar Lode drains connects into the Risegate Eau system, approximately 1.5km to the south. This main arterial drain flows from west to east, and is eventually pumped into the tidal River Welland. The pumping station has 3 pumps which give a high degree of operational security, and water levels are controlled to different summer and winter levels (i.e. operating levels + 0.3m AoD in summer, and 0.3m AoD in winter). Generally, the WDIDB, design the arterial systems to give 900mm of freeboard at a 5% flow level. Flooding could occur in some areas, in a 1 in 100 year event, but it is likely to be shallow and widespread. Near the site, bed levels in the Mar Lode range from 0.5m AoD to -0.5m AoD and bank levels are around 2.6m to 2.8m AoD. Hence, flooding is unlikely except in very extreme events. No records have been found of any significant flooding from this source, in this locality.
- 3.4 Highway water from Water Gate drains into the Mar Lode, and the drain will, effectively, act as a “cut off” drain preventing highway water from reaching the site.
- 3.5 Flooding from underground sources is not a problem in SHDC area.
- 3.6 On site drainage systems will be very limited as areas around the building i.e. access drive, car parking areas and grassed areas, will be “free draining” i.e. they will have permeable, or pervious, surfaces such as gravel, stone etc. Roof water will be taken to a soakaway constructed to relevant Building Regulation standards, following interception by rainwater butts. Flooding from on-site systems is only likely to occur in extreme events and is unlikely to create danger to people or damage to property.

4.0 Probability

- 4.1 The probability of the site being flooded from the main fluvial or tidal sources is less than 0.1% i.e. more than 1 in 1000. The site is in Flood Zone 1 (see Figure 2 – Flood Zones).
- 4.2 The probability of the site being flooded from the arterial drainage system is less than 1% i.e. more than 1 in 100 (allowing for the “freeboard” capacity).
- 4.3 Very intense, short duration storms, may produce shallow flooding on the site, and this could happen with a 2% annual probability i.e. around 1 in 50. These situations may occur more frequently in the future, but they are more of “a nuisance”, rather than significant flooding events.
- 4.4 Overall, the probability of this site being flooded is relatively – VERY LOW.

5.0 Climate Change

- 5.1 Climate change is predicted to cause a rise in sea levels, in the future, together with causing increased river flows and peak rainfall intensities. These issues are referred to in the NPPF, in Table 4 and 5, which are reproduced below: -

Table 4 – Recommended contingency allowance for net sea level rise (related to 1990) in mm/yr

	1990-2025	2025-2055	2055-2085	2085-2115
East of England	4.0mm	8.5mm	12.0mm	15.0mm

Table 5 – Recommended national precautionary sensitivity ranges for peak rainfall intensities and peak river flows

Parameter	1990-2025	2025-2055	2055-2085	2085-2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%
Peak River Flows	+10%	+20%		

- 5.2 In the SHDC SFRA, Paragraph 4.4, Table 2 gives values which were used to take climate change into account in preparing the relevant, long term maps:-

	To year 2055	To year 2115
Sea Level Rise (m)	+0.33	+1.14
Extreme Wave Height	+10%	+10%
Peak River Flows	+20%	+20%
Peak Rainfall Intensity	+20%	+30%

Hence, it can be seen that appropriate allowances have been made in the SFRA, when compared to the values in the NPPF.

- 5.3 In the Catchment Flood Management Plans (CFMPs) related to the SHDC area, and in the Wash Shoreline Management Plan (SMP), it is stated that the policy of the EA will be “to sustain the present position as regards flood risk, countering as necessary the effects of climate change...”
- 5.4 Climate change will impact on tidal levels, and fluvial levels in the future, in the River Welland, the River Glen and the South Forty Foot. However, plans in the SHDC’s SFRA show that there will be no impact at the site. Similarly, WDIDB will monitor the situation in the arterial drainage systems, and take any necessary actions to retain flood defence standards at present levels.

6.0 Detailed Proposals

- 6.1 The detailed proposals are shown in Fig 3 – Proposed Layout and Fig 4 – Proposed Building.
- 6.2 The footprint of the new building, plus the patio, accessible parking space and concrete paths will be approximately 152m². The garage and new sheds will have a further 56m² of roof area. The total of 208m² is only slightly more than the roof areas of the barn, plus existing sheds (77.5 + 97.5m² = 175m²). Hence, the equivalent impermeable area will be very similar to that which currently exists.

- 6.3 Roof water will be intercepted and caught in rain-water butts for uses such as car washing etc. Depths up to 5mm will be stored in butts with a volume of around 0.4m^3 . Overflows will be discharged to a soakaway constructed in accordance with the requirements of the Building Regulations.
- 6.4 Foul sewage will be treated in either a Septic Tank or a Klargest type unit, with discharge of treated effluent to a “land drainage” type soakaway (i.e. drainage field). Note. Mr Clark owns the farmland surrounding the building, hence there is adequate room available for soakaways, treatment plant etc. At this stage, no direct connection of any drainage to the Mar Lode, is anticipated. However, if details change and a connection is necessary, approval will be sought from the WDIDB, under the requirements of their Byelaws.
- 6.5 Although the probability of flooding is very low, ground floor levels will be kept at least 150mm above surrounding ground levels to mitigate against any localised, shallow flooding which may occur.
- 6.6 The conversion will improve the overall drainage characteristics as it will introduce source control, by the use of limited rain-water harvesting, and by the use of “self draining” surfaces on surrounding areas. An allowance will be made for the impacts of climate change when calculating the size of pipes and soakaways (i.e. use a factor of +30% on peak rainfall values).
- 6.7 Using a M5-60 value of 20mm and Growth Curves of 2.45 for 30 years and 3.56 for 100 years, indicative calculations have shown that to balance to “greenfield” run-off rates, volumes would be required:-
- | | |
|-----------------------------|--|
| Attenuation volume | 2.9m^3 |
| Long term volumes | 7.5m^3 (1 in 100 year) |
| Climate change
duration) | 2.5m^3 (based on 115mm rising to 150mm – 6 hour |
| Total | <u>12.9m^3 say 13m^3</u> |
- This volume is easily achievable in soakaways and manholes (Note, the actual volume required will be less, depending on the available infiltration rate). If the “brownfield” situation is considered, there is probably no increase in the equivalent impermeable areas and, theoretically no extra balancing volume required to keep run-off rates similar to existing. Any volume provided will be an improvement.
- 6.8 There appears to be no specific need for extra flood resilience measures, or for a detailed flood plan. However, consideration should be given to a few basic precautionary measures such as self-closing covers on air-bricks, keeping electrical sockets well above floor level, and having a contingency plan for dealing with situations involving shallow, but prolonged flooding (e.g. keeping a store of sand bags and an emergency medical box with clean water etc.).

7.0 Off-Site Impacts

- 7.1 No adverse impacts on adjoining land are envisaged as a result of this replacement. There is agricultural land to the North, East and West of the property, with the Mar Lode drain to the south. If any overland flows did occur, they would be southwards, towards the arterial drainage system. None of the adjacent areas will be affected. The proposed siting for the foul sewage treatment unit is in Mr Clark's land.

8.0 Residual Risks

- 8.1 The residual risks in this assessment are:-
- Breeching in the banks of the main rivers
 - Pumping equipment failures at the Risegate Eau Pumping Station
 - Blockages in the arterial drainage system
 - Blockages in the on-site drainage system.
- 8.2 Figure 5 – Breach Locations, shows where breaches were considered in the SHDC SFRA on the main river systems. Map 16 shows that the site is not in any rapid inundation zone and other maps show that there is no (or very low) residual risk. At distances over 5km, the flood envelope from a breach would have to cover more than 25km², to reach the site. Flows would be partially intercepted by arterial drainage systems and the available static head would probably be insufficient to overcome the friction losses. Hence, it is very unlikely that the site will be affected by flood water from breaches. The EA carry out regular inspection and maintenance of the defences which are general in a good/fair condition.
- 8.3 It is understood that the pumping station which deals with flows from the Risegate Eau system contains 3 pumps, including a degree of “stand by” capacity in case a particular unit is “out of action”. Security levels are therefore high and residual risks low. There is a large capacity in the overall arterial drainage systems and the site is in a relatively “high” part of the catchment.
- 8.4 Blockages could occur in the arterial system, but the drain, culvert and sluices are regularly maintained by WDIDB and any significant restrictions would be quickly cleared.
- 8.5 The on-site drainage systems will require regular inspection and maintenance to avoid blockages in pipe lines, gulleys etc.
- 8.6 Overall, residual risks are low and can be mitigated by regular inspections and maintenance.

9.0 Flood Risk Management Measures

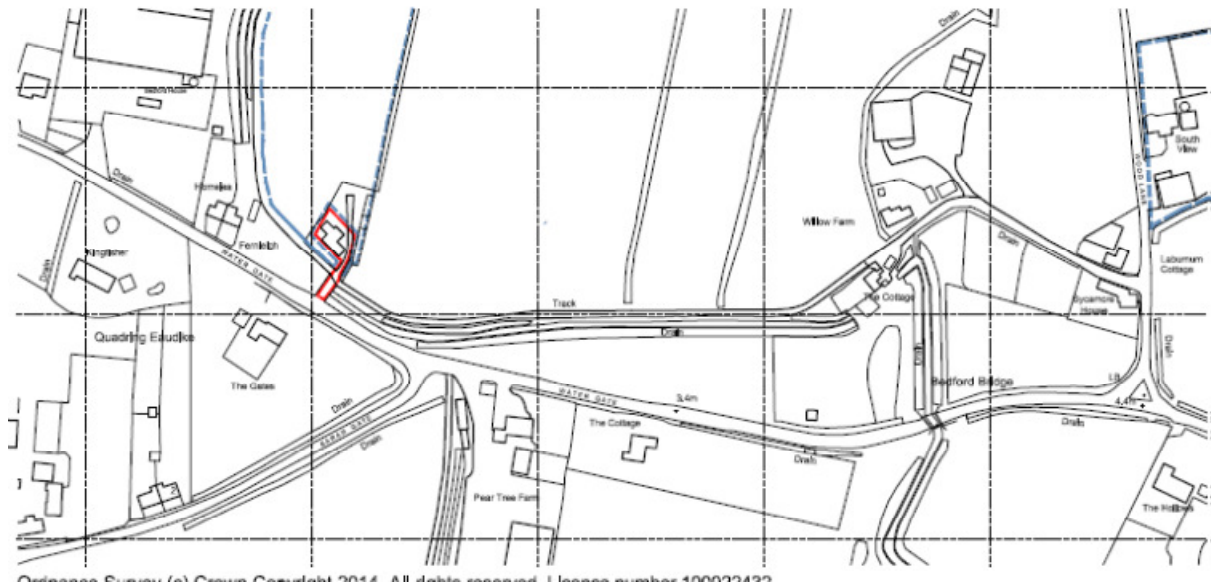
- 9.1 There is not much need for flood risk management measures, as the probability of flooding is very low and there are no major, significant potential consequences. However, floor levels should be kept 150mm above surrounding ground levels, and consideration should be given to the inclusion of some basic flood resilience measures, and a contingency plan for localised flooding (see Section 6.8).

- 9.2 Interruption of water from the roof area, and use of self-draining materials for driveways etc. will give an improved degree of “source control”. Infiltration by means of soakaways will provide diffuse dispersal and a degree of replication of “natural drainage”.

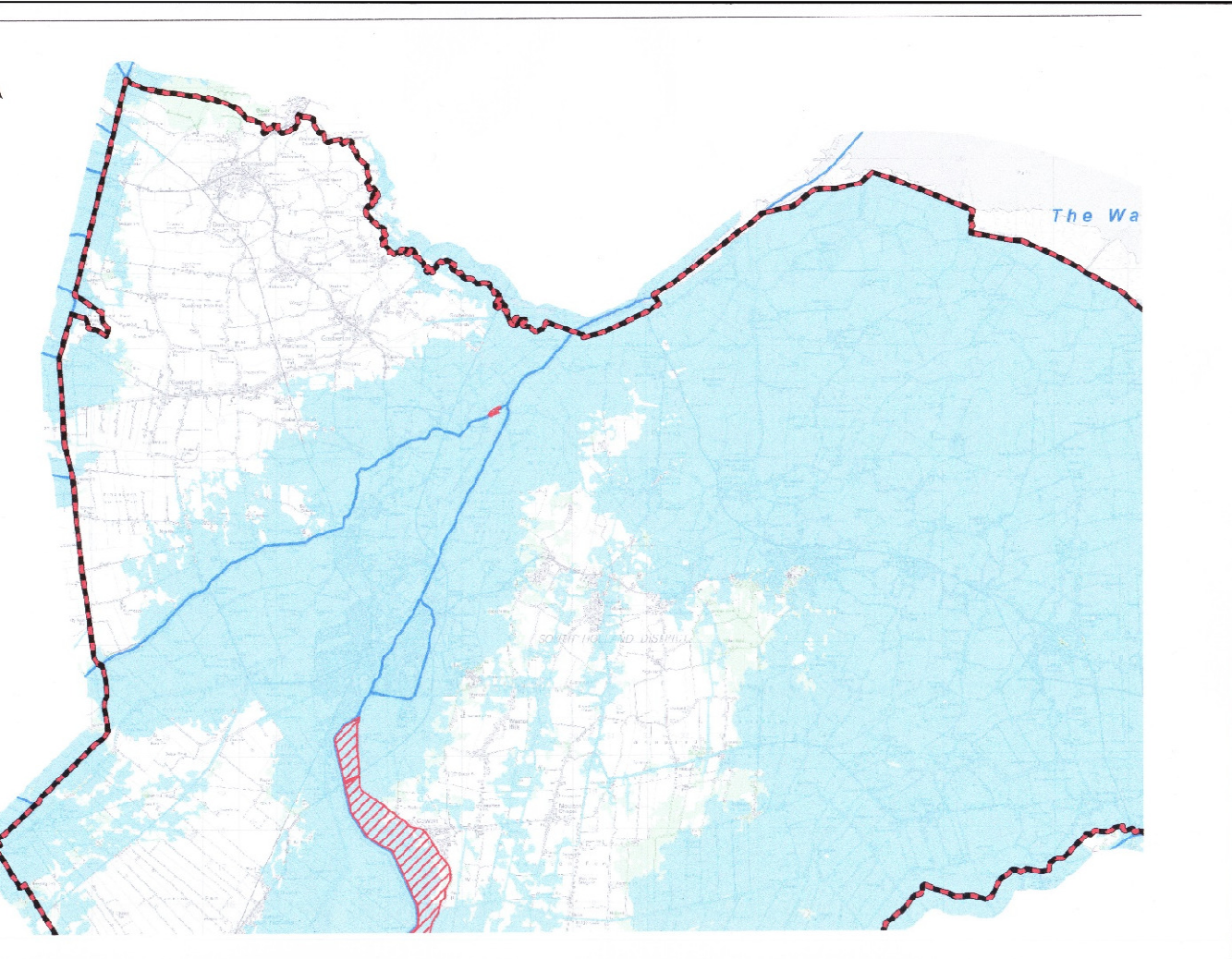
10.0 Conclusions

- 10.1 As a result of this assessment the following conclusions have been reached:-
- The replacement involves a change of use from “less vulnerable” to “more vulnerable”
 - The site is in Flood Zone 1 and “more vulnerable” use is acceptable in this zone
 - Without the existence of flood defences, the site would have a 0.1% annual probability of flooding from fluvial and tidal sources (1 in 1000)
 - The probability of the site being flooded from the arterial drainage system is around 1% (i.e. 1 in 100). If this occurred flooding would be shallow but could be prolonged
 - There are no other significant sources of flooding
 - Residual risks of flooding are very low, because of the location and level of the site
 - Climate change impacts will affect flows in main rivers and the arterial systems but policies indicate that the authorities will act to maintain standards at current levels
 - There should be no adverse, off-site impacts as a result of this replacement
 - Floor levels should be kept 150mm above surrounding ground levels
 - Consideration should be given to the inclusion of some basic flood resilience measures, and to the preparation of a contingency plan for local flooding.
 - Sustainable drainage systems can be constructed to serve the replacement, involving source control, interception and infiltration.
- 10.2 Overall the re-development will provide a sustainable development, to replace one which is becoming unsustainable. This assessment has shown that it is in a location which is appropriate and which has an acceptable level of flood risk. The replacement will improve environmental and visual amenity without adverse impact on adjacent land. The construction of a 2 storey property will give added protection against extreme flooding events, in that it will provide a ‘safe haven’ for residents upstairs.

1 – Location Plan

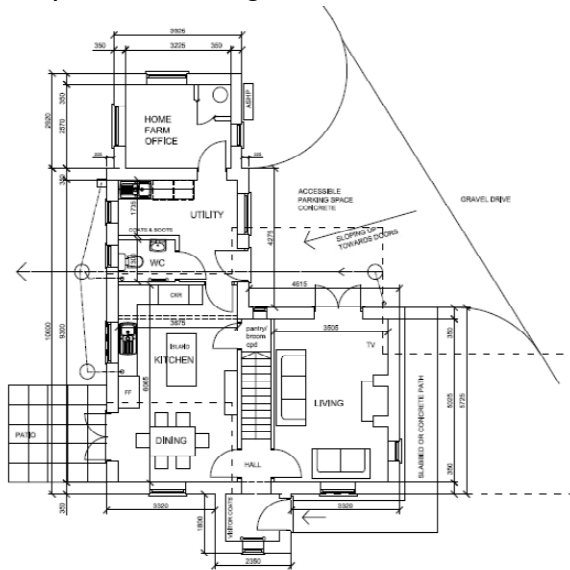


2 – Flood Zones

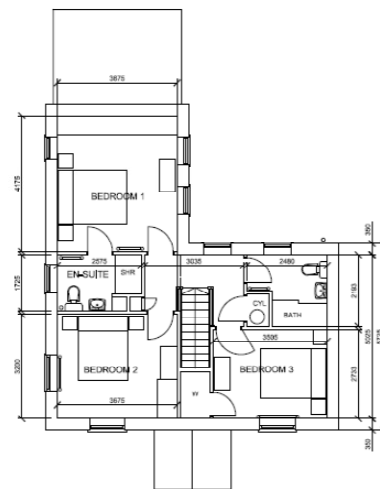


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4- Proposed Building



GROUND FLOOR PLAN



FIRST FLOOR PLAN



SOUTH WEST ELEVATION



SOUTH EAST ELEVATION



NORTH EAST ELEVATION



NORTH WEST ELEVATION

5 – Breech Locations

