Ingram, Northumberland

Flood Risk Assessment

August 2015

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CONTROL SHEET

CLIENT: **Northumberland Estates**

PROJECT TITLE: **Holiday Lodge Park, Ingram, Northumberland**

REPORT TITLE: **Flood Risk Assessment**

PROJECT REFERENCE: **D/I/D/110045/01**

Issue and Approval Schedule:

ISSUE 3 **FINAL**	Name	Signature	Date
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Approved by	S. Dickie	SD	25/8/15

Revision Record:

Issue	Date	Status	Description	By	Chk	App
2	01/07/15	Final	Amendments following client comments	RT	SD	SD
3	24/08/15	Final	Amendments following client comments	RT	DR	SD
4						
5						
6						
7						
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Notes:

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Contents

1. INTRODUCTION

Fairhurst were appointed by Northumberland Estates to undertake a Flood Risk Assessment (FRA) for the proposed holiday lodge park, Ingram, Northumberland. The proposed development can be seen in Appendix A.

The aim of this FRA report is to evaluate the current proposals with regard to flood risk and drainage, and identify potential flood risk to and from the development site. Fairhurst have carried out the following:

i. Assessment of the development potential of the site with regards to flood risk in line with the National Planning Policy Framework (NPPF) and Flood Risk and Coastal Change Planning Practice Guidance (PPG).
ii. An assessment of the surface water runoff.
iii. An assessment of the foul water flows.
iv. Surface Water Drainage Design.

The proposals are for the construction of 9 No. holiday lodge properties and car parking on an existing greenfield site on the eastern periphery of Ingram, Northumberland.

2. PLANNING POLICY

2.1 National planning policy

One of the key aims of the National Planning Policy Framework (NPPF) and Planning Policy Guidance (PPG) is to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

A risk-based approach should be adopted at all levels of planning. Applying the source pathway-receptor model to planning for development in areas of flood risk requires:

- a strategic approach which avoids adding to the causes or "sources" of flood risk, by such means as avoiding inappropriate development in flood risk areas and minimising run-off from new development onto adjacent and other downstream property, and into the river systems;

- managing flood "pathways" to reduce the likelihood of flooding by ensuring that the design and location of the development maximises the use of SuDS, and takes account of its susceptibility to flooding, the performance and processes of river/coastal systems and appropriate flood defence infrastructure, and of the likely routes and storage of floodwater, and its influence on flood risk downstream; and

- reducing the adverse consequences of flooding on the "receptors" (i.e. people, property, infrastructure, habitats and statutory sites) by avoiding inappropriate development in areas at risk of flooding.

Flood risk assessment should be carried out to the appropriate degree at all levels of the planning process, to assess the risks of all forms of flooding to and from development taking climate change into account. A sequential risk-based approach should be applied to determining the suitability of land for development in flood risk areas.

In areas at risk of river or sea flooding, preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources.

Flood risk has been categorised as High, Medium and Low based on the probability of inundation. Extracts from Tables 1, 2 and 3 of the Flood Risk and Coastal Change PPG are provided below, which highlights the likely response to planning applications within each Flood Zone.

Residential development is categorised as "more vulnerable" and therefore should only take place within Flood Zones 1 or 2.

Table 1 - Extract from the Flood Risk and Coastal Change Planning Practice Guidance

Zone 1 Low Probability **Definition** This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%). **Appropriate uses** All uses of land are appropriate in this zone. **Flood risk assessment requirements** For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention. **Policy aims** In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.
Zone 2 Medium Probability **Definition** This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year. **Appropriate uses** Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are *only* appropriate in this zone if the Exception Test is passed. **Flood risk assessment requirements** All development proposals in this zone should be accompanied by a flood risk assessment. **Policy aims** In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.
Zone 3a High Probability **Definition** This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. **Appropriate uses** The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood. **Flood risk assessment requirements** All development proposals in this zone should be accompanied by a flood risk assessment.

Zone 3a (cont.)

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b The Functional Floodplain

Definition
Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses
Only the water-compatible uses and the essential infrastructure listed in Table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and
- relocate existing development to land with a lower probability of flooding.

Where required an exception test must be passed in order for developments of that nature to be justified within the Flood Zone. For the Exception Test to be passed the following must be demonstrated:

a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared.

b) the development should be on developable, previously-developed land or, if it is not there are no reasonable alternative sites on developable previously-developed land; and

c) a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Table 2 - Flood risk vulnerability classification from Flood Risk and Coastal Change Planning Practice Guidance

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines

Highly vulnerable

- Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”).

More vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops, financial, professional and other services,
- restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in “more vulnerable”, and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (**excluding sleeping accommodation).**
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a **specific warning and evacuation plan.**

Table 3 - Flood risk vulnerability and flood zones 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Extract from the Flood Risk and Coastal Change Planning Practice Guidance

Key: ✓ Development is appropriate.

× Development should not be permitted.

3. DEVELOPMENT SITE

3.1 Existing Site Conditions – General Background

The development site is located to the east of Ingram in Northumberland with an approximate National Grid Reference of NU 020 163. The site is bounded predominantly by greenfield land to the east and south, Ingram to the west of the development site, with access to the east of the visitors car park. The River Breamish and associated fluvial terraces are located to the north of the development. The site, with a total area of approximately 0.35 ha is currently undeveloped greenfield land which is currently vacant, having previously been used by the Northumberland National Park Authority for the storage of materials.

Levels within the site boundary fall from 118.0 mAOD in the west to 115.6 mAOD in the north east corner.

3.2 Existing Watercourses

The nearest major watercourse is the River Breamish, which is approximately 20m north west of the site at its closest point. The River Breamish is typical of a mature river with meandering morphology and erosion of surrounding sands and soils. Channel width and shape is subject to constant change.

3.3 Proposed Development

The current proposals are for the construction of 9 No. 'Shepherd Hut Style' holiday lodge units of varying configurations with associated access road, landscaping and car parking, as shown in the architect drawing 'Site Layout as Proposed' included in Appendix A. The current proposed layout is indicative only at this stage due to the levels within the site. The development proposals are considered to be 'More Vulnerable' as outlined in the Flood Risk and Coastal Change Planning Practice Guidance.

3.4 Historic Features

Historic mapping for the area has been examined from 1866 to 1979 in order to identify changes in land use on the site and throughout the catchment which may be relevant to flood risk.

As the site is greenfield, it has not previously been subject to development and thus there have been no significant changes throughout the period of historic mapping examined.

Fluvial channel change is evident within the mapping, outlining the northern half of the development site to be within the historical river channel dated 1866. The River Breamish channel has migrated north between 1866 to its present location. Historic fluvial terraces are evident within the surrounding area, outlined by levels across the site topographic survey.

4 SOURCES OF FLOOD RISK INFORMATION

4.1 Environment Agency

The Environment Agency (EA) Flood Map for Planning (Rivers and Sea) indicates the site to cover areas of Flood Zone 1 and 2 (Figure 1). The EA online map for Surface Water flooding, reproduced in Figure 2, indicates that the site is marginally at risk from surface water flooding, associated with drainage to the River Breamish. Figure 3 indicates that the the development is within an area which the EA issues flood alerts to, but does not issue flood warnings within this area. EA Flood Alerts are given in order for preparatory actions to be taken to mitigate against the risk of flooding.

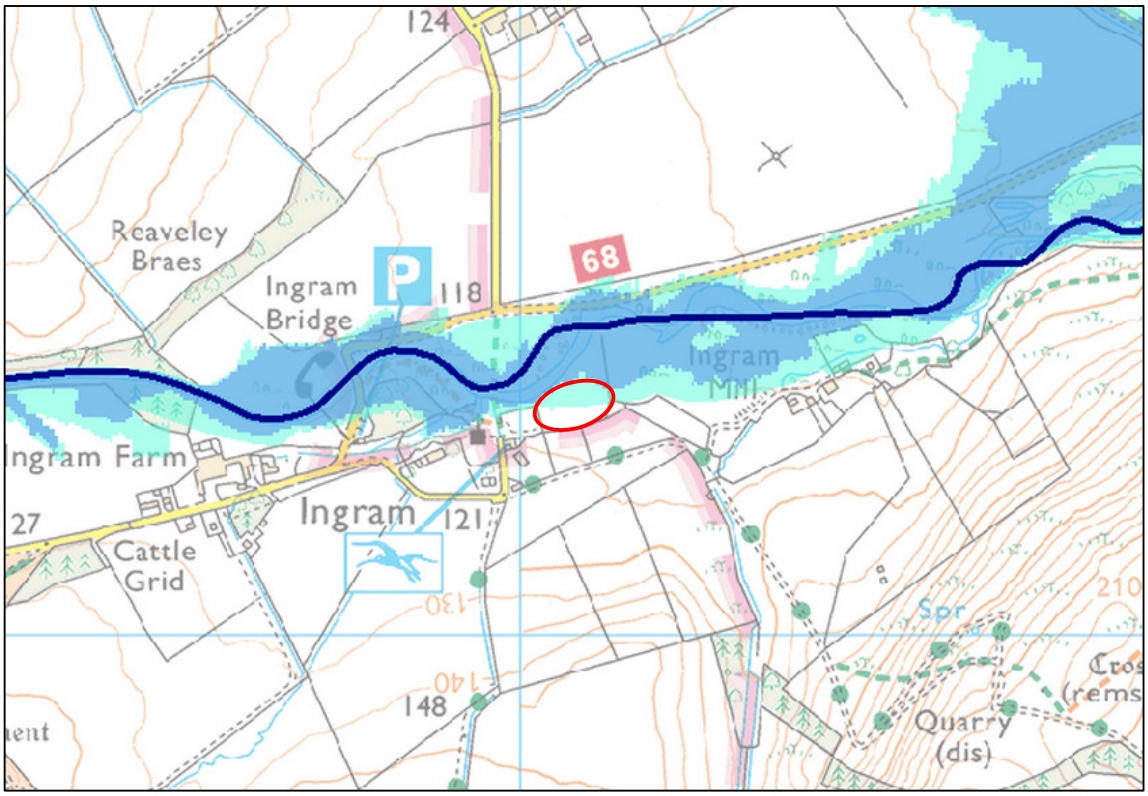

Figure 1: Extract from EA Flood Map for Planning (Rivers and Sea)

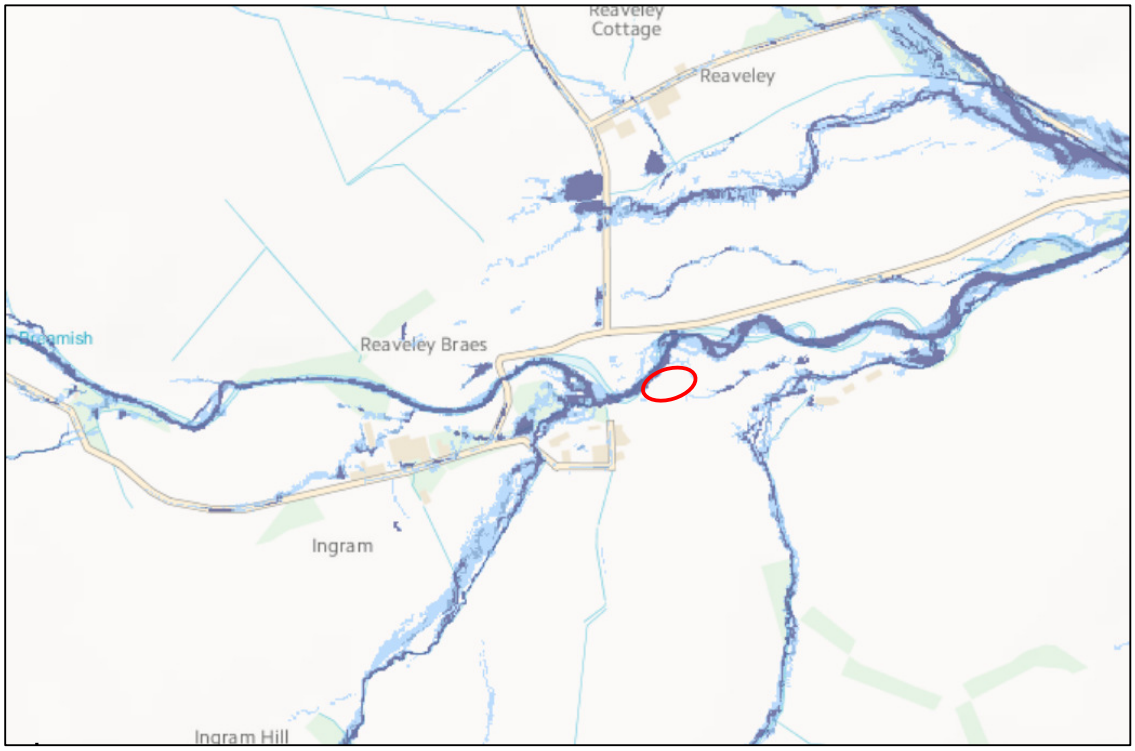

Figure 2: Extract from EA Surface Water Flood Map

High
Medium
Low
Low
Location of development

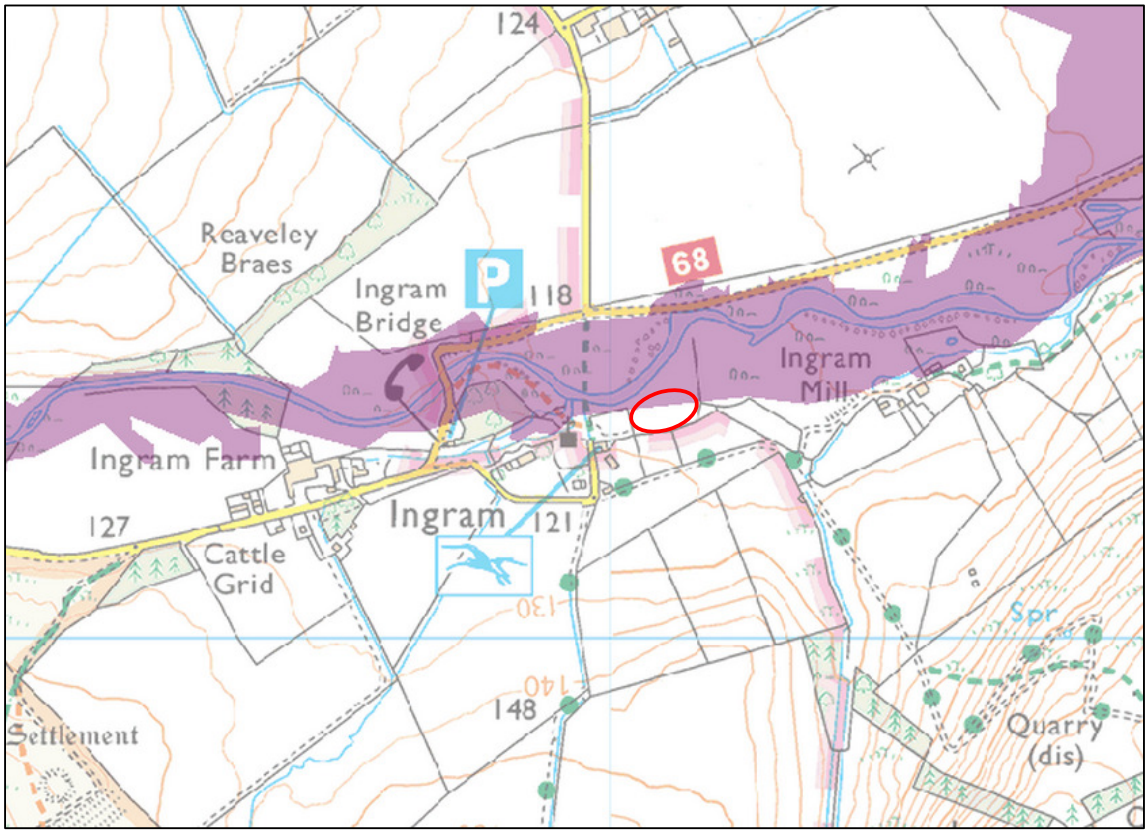

Figure 3: Extract from EA Flood Warning Map

Areas where EA issue Flood Warnings
Areas where EA issue Flood Alerts

4.2 Strategic Flood Risk Assessment

The Northumberland County Council Level 1 Strategic Flood Risk Assessment (SFRA) was published in September 2010. The SFRA has been examined and found not to include specific information relative to the development site and it also confirms the site to be predominantly within Flood Zone 2 (as shown in Figure 4).

The SFRA also appears to show a small area within or adjacent to Flood Zone 3b: functional floodplain, however the resolution and scale of the mapping does not show the site in sufficient detail, therefore this classification is indicative.

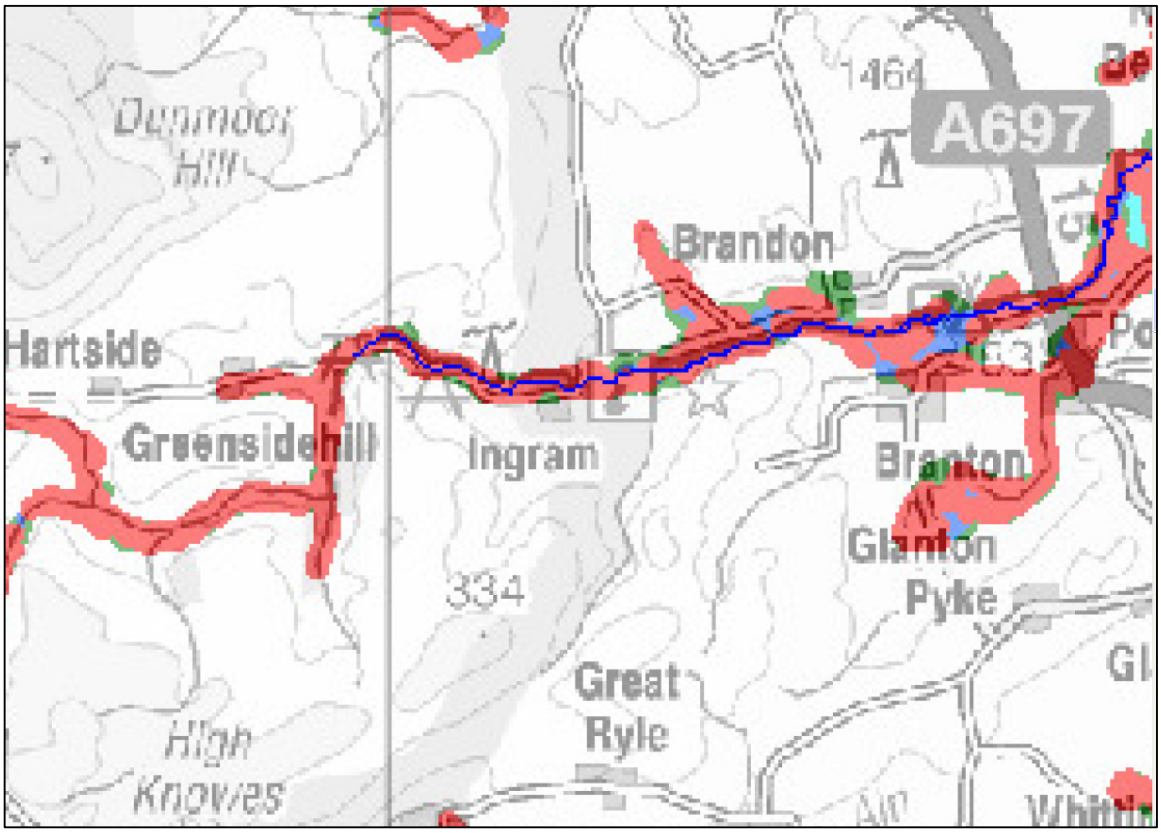

Figure 4: Extract from the Northumberland SFRA – Flood Zone Maps

= River Centrelines
= Flood Zone 2
= Flood Zone 3a
= Flood Zone 3b
= Flood Zone 3 + CC

From the information available within the SFRA and reproduced in Figure 5, the site is identified as being at less or intermediate risk of surface water flooding, however it is difficult not produced at a resolution which allows suitable analysis of site specific flood risk.

Figure 5: Extract from the Northumberland SFRA - Areas Susceptiсble to Surface Water Flooding

= River Centrelines
= Less
= Intermediate
= More

4.3 Water Company

Northumbrian Water (NW), the sewerage operator in the region, is required by OFWAT to maintain a register of flooding incidents due to hydraulic capacity problems on the sewerage network. The DG5 register is a record of locations where customers have reported flooding from the sewerage network due to hydraulic capacity problems. Properties are placed on the register following investigations to determine the cause and risk of flooding. Properties are then placed on the appropriate register depending on the risk - not the number of occurrences of flooding.

NW have been contacted and confirm that there are no sewer flooding incidents in the vicinity of the site recorded on their DG5 register (See Appendix B).

4.4 Local Authority

The Local Authority for Ingram is Northumberland County Council (NCC). NCC is the Lead Local Flood Authority (LLFA) for Northumberland, the Flood and Water Management Act (2010) outlines the following responsibilities of the LLFA.

9 Local flood risk management strategies: England

1. A lead local flood authority for an area in England must develop, maintain, apply and monitor a strategy for local flood risk management in its area (a "local flood risk management strategy").
2. In subsection (1) "local flood risk" means flood risk from—
    a) surface runoff,
    b) groundwater, and
    c) ordinary watercourses.
3. In subsection (2)(c) the reference to an ordinary watercourse includes a reference to a lake, pond or other area of water which flows into an ordinary watercourse.
4. The strategy must specify—
    a) the risk management authorities in the authority's area,
    b) the flood and coastal erosion risk management functions that may be exercised by those authorities in relation to the area,
    c) the objectives for managing local flood risk (including any objectives included in the authority's flood risk management plan prepared in accordance with the Flood Risk Regulations 2009),
    d) the measures proposed to achieve those objectives,
    e) how and when the measures are expected to be implemented,
    f) the costs and benefits of those measures, and how they are to be paid for,
    g) the assessment of local flood risk for the purpose of the strategy,
    h) how and when the strategy is to be reviewed, and
    i) how the strategy contributes to the achievement of wider environmental objectives.

5. The strategy must be consistent with the national flood and coastal erosion risk management strategy for England under section 7.
6. A lead local flood authority must consult the following about its local flood risk management strategy—
    a) risk management authorities that may be affected by the strategy (including risk management authorities in Wales), and
    b) the public.
7. A lead local flood authority must publish a summary of its local flood risk management strategy (including guidance about the availability of relevant information).
8. A lead local flood authority may issue guidance about the application of the local flood risk management strategy in its area. Flood and Water Management Act 2010 (c. 29) Part 1 — Flood and Coastal Erosion Risk Management 8
9. A lead local flood authority must have regard to any guidance issued by the Secretary of State about—
    a) the local flood risk management strategy, and
    b) guidance under subsection (8).

5. POTENTIAL SOURCES OF FLOOD RISK

5.1 Fluvial

Extreme fluvial flood events have the potential to cause rapid inundation of properties whilst posing a threat to the welfare of occupants and potentially preventing emergency access to properties and essential infrastructure.

The EA Flood Maps indicate the site to be at medium risk of fluvial flooding from the River Breamish, however there are also areas which are at lower risk of flooding. Fluvial flooding presents a serious issue due to the nature of the proposed development and the 'temporary' nature of the structures proposed for use on site. Fluvial flooding can be mitigated against with the requirement for an adequate flood safety and evacuation plan.

The River Breamish is a shallow watercourse with low hydraulic gradient therefore water is likely to flow out of channel during periods of extreme rainfall. Depending on antecedent conditions, such as high precipitation, high groundwater table and saturated ground, this may present a high risk of inundation to parts of the development site.

5.2 Infrastructure Failure

The failure of conveyance infrastructure such as culverts or bridges could increase the risk of flooding at the site. From the information available at this stage it is apparent that there are no bridges or culverts within the vicinity of the development site which is likely to present a flood risk to the site.

During the 2008 flooding incident the northern abutment of the Ingram bridge, upstream of the site, was damaged due to heavy flows through the River Breamish channel. It is unclear as to whether the failure of this infrastructure had an increase on the flood potential due to inundation levels throughout the local area. This bridge has since been repaired and reinforced for future flood conditions.

5.3 Overland Flow

Land to the east and west of the site is at grade with the levels and gradients within the site boundary and consists of undeveloped greenfield land to the east and the car park and visitor centre to the west. Given this, overland flows from adjacent sites are likely to flow towards the River Breamish and thus the risk of flooding from these areas is considered to be low.

The land directly adjacent to the south of the development site begins to increase in gradient, meaning that overland flows from the south will flow through the site towards the River Breamish. Although the levels within the site are between 115m and 118m AOD, the East Hill summit, located south east from the site, is 227mAOD which will influence in overland flow of surface water into the development site.

The land to the north of the River Breamish, with elevated road and steep hillside, encourages overland flow of surface waters into the River Breamish catchment, however this overland flow increases fluvial flood risk to the southern bank of the River Breamish, highlighted by the EA categorisation of Flood Zone 3b: Functional Floodplain (Figure 1) which is located adjacent to the north of the site.

5.4 Ground Water Flooding

Information obtained from the BGS online geology viewer, the soilscapes website and the SFRA geology mapping, indicates the site is underlain by alluvium comprising of silt, sand and gravel with limited impermeable clay, in turn underlain by bedrock of igneous rock of the Cheviot Volcanic Formation. Superficial soils are freely draining, slightly acid, loamy soils, which drain to local groundwater and rivers. Information obtained from the EA online maps and SFRA of Groundwater indicates the site to be above a highly vulnerable minor aquifer.

5.5 Sewer Flooding

As outlined in Section 4.3 there are no incidents of Sewer flooding within the development location or within 500m of the development site. Correspondence from NW is included in Appendix B.

6. SURFACE WATER DRAINAGE

The development is within Flood Zone 1 and 2, therefore in accordance with the NPPF, the Flood Risk Assessment focuses on the management of surface water to ensure flood risk is not increased elsewhere. The surface water strategy for the site will be developed in accordance with The Building Regulations Part H.

6.1 Existing Surface Water Runoff

The site covers a total area of approximately 0.6ha and is entirely undeveloped greenfield land.

The EA/DERFA R&D Technical Report W5-074 'Preliminary Rainfall Runoff Management for Developments' states that for developments which are less than 50 ha in size the Institute of Hydrology Report 124 (IH124) 'Flood Estimation for Small Catchments' should be used to calculate the peak greenfield runoff rates. This advice is replicated in The SUDS Manual (CIRIA C697).

The IH124 method uses the following equation to calculate greenfield runoff:

$$Q_{BAR, rural} = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$$

Where:

$Q_{BAR, rural}$ = Mean Annual Flood (m^3/s)
AREA = Catchment Area (km^2)
SAAR = Standard Average Annual Rainfall (mm)
SOIL = Soil Index (from Wallingford Procedure Winter Rainfall Acceptance (WRAP) maps)

Technical Report W5-074 states that "Where developments are smaller than 50 ha the analysis for determining the peak Greenfield discharge rate should use 50 ha in the formula and linearly interpolate the flow rate value based on the ratio of the development to 50 ha."

The Greenfield runoff rate has been calculated on a 'per hectare' basis for a range of return periods. Table 4 summarises the results and the full calculations can be seen in Appendix C.

Table 4 - Greenfield runoff rates

Event	Greenfield Runoff Rate (l/s/ha)
1 in 1 year	10.04
Q_{BAR}	11.54
1 in 30 year	22.50
1 in 100 year	30.35

6.2 Proposed Surface Water Drainage

The Building Regulations Part H sets out a hierarchy for the choice of discharge point for a rainwater system. In order of priority, the possibilities are given as:

- an adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable;
- a watercourse; or where that is not reasonably practicable;
- a sewer.

Fairhurst consider that the presence and characteristics of the hydrogeology beneath the site (Section 5.4) is not likely to preclude the use of infiltration drainage. A ground investigation has not been undertaken for the development of the site, however the SFRA includes a 'Sustainable Drainage Systems Applicability' map, which indicates that attenuation systems are advised for this location due to the presence of freely permeable superficial ground and highly vulnerable aquifer.

To ensure no increase in flood risk from the development, surface water discharge will be limited and attenuated to the equivalent existing greenfield runoff rates. These have been calculated in accordance with the EA/DERFA R&D Technical Report W5-074 'Preliminary Rainfall Runoff Management for Developments'; calculations can be seen in Appendix C.

It is anticipated that impermeable area will be limited to the car parking and potentially the access paths within the site, however these can be made permeable to surface waters. The footprint of the proposed 'Shepherd Hut' style lodges will have limited direct ground contact, and water is able to freely drain beneath the dwellings. Given the information regarding the proposals, it is estimated that the development will create a total impermeable area of less than 0.01ha.

On the basis that the development will not result in the creation of significant impermeable surfaces, proposed surface water drainage will remain as greenfield conditions. Runoff from the roofs of properties and vehicles will be able to run off and freely drain into the soil and towards the River Breamish.

7 FOUL WATER DRAINAGE

Foul flows have been calculated to be 0.9l/s, using the suggested design flow of 4000litres/dwelling/day in accordance with Sewers for Adoption 7th Edition. It is understood that the current proposals are for each lodge to have toilet facilities within; therefore there is a requirement for foul water on an individual basis.

It is proposed within the architect's layout, that a Package Treatment Plant will be installed to the north of the site, as this will best suit existing ground levels. A Package Treatment Plant achieves full treatment of foul flows and treated effluent can be discharged to the nearest watercourse, which will require a discharge licence. As such, consideration of the capacity of the River Breamish should be made with respect to an increase in flow resulting from discharge of the treatment tank.

Given the low flows expected from the development a septic tank may be more efficient, and has the requirement for less maintenance, which can again be located close to the car park when access is required for emptying and does not present an increase in flows within the River Breamish.

Design for foul water drainage should be acknowledged at detailed design stage, including treatment and disposal requirements. Furthermore, due to the levels within the site there may be requirement for pumping of foul waters from each dwelling to either of the treatment options.

8 DEVELOPMENT POTENTIAL

The development is within Flood Zone 1 and 2, therefore a Sequential Test to identify areas of lower risk is not required. This is in line with the information set out in the Flood Risk and Coastal Change Planning Practice Guidance.

As the proposed development can be classified as; sites used for holiday or short-let, caravans and camping, it can be classified as “More Vulnerable” according to Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance (PPG). As outlined in Table 3 from the PPG, development is suitable within the northern area of the site (Flood Zone 2) subject to the preparation of a site specific warning and evacuation plan.

Management of flood risk to people and property can be achieved by outlining a Flood Warning and Evacuation Plan, which is to be displayed in every dwelling or public place, making occupiers aware of the risk of flooding and the necessary procedures which should be taken during a flooding event. The Flood Warning and Evacuation Plan is required for holiday or short-let caravans and camping, or sites with transient occupants, as outlined in the Flooding and Coastal Change Planning Practice Guidance.

Impermeable surfaces are unlikely to be significantly increased by the proposed development; therefore infiltration of surface water runoff is likely to be appropriate.

A Package Treatment Plant and Septic Tank have been presented as being suitable and efficient for the proposed development, however are both subject to consideration regarding pipelines and levels within the site.

9 CONCLUSIONS

The Flood Risk Assessment for the proposed holiday lodge development at Ingram, Northumberland has been prepared in accordance with the NPPF and the Flood Risk and Coastal Change PPG.

There are historic flooding incidents recorded within the development site at varying levels of severity. These records predominantly relate to fluvial sources, which have affected the site, as outlined within the Northumberland County Council SFRA, Cheviot Flood Impact Study.

The development site is within the Environment Agency's indicative flood envelopes, classified predominantly as Flood Zone 1 and 2. Based on the compatibility of developments within each Flood Zone, set out within the Planning Practice Guidance, the development within the south of the site is suitable for all types of development.

Increased runoff from the introduction of limited impermeable surfaces will be attenuated on site to the equivalent greenfield runoff rate to ensure no increase in flood risk. The site is likely to be suitable for the use of infiltration drainage however the River Breamish to the north may provide more adequate discharge option. Alternatively, a new piped or open channel connection to the nearest surface water or combined sewer should be developed, subject to consultation and confirmation from Northumbrian Water.

The possible effects of climate change have been considered by acknowledging the requirement to make an allowance for increased rainfall in the calculation of the surface water discharge rates over the lifespan of the development in line with NPPF. Storage requirements within the site have been calculate for a 1 in 100 year flood with a 30% increase due to climate change.

Appendix A

Originator	Drawing Title
David and Jane Darcy architects (26-05/15)	Site Layout as Proposed

RIVER BREAMISH

new package treatment unit

SITE BOUNDARY

SITE BOUNDARY

SITE BOUNDARY

Post & Wire 1-in

Post & Wire 1-in

9No. car spaces

Shingle

Bushes

Timber Posts

NORTH

0 5 10 15 20 25metres

NOTES

7No. shepherds huts 2.6x6.1metres
2No. shepherds huts 2.6x3.1metres

9No. car spaces – parking area to be compacted and blinded sub-base.

Footpaths to be gravel laid in grid reinforcement system.

New package treatment plant to be enclosed with post and wire fence.

115.96 Existing ground levels

Existing trees

Proposed trees

Shepherds Huts
Ingram, Alnwick, Northumberland

SITE PLAN

Drawing no: DJD/586/12 Rev:
Scale: 1:200@A1 Date:08:08:15

David and Jane Darcy
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Appendix B

Correspondence

Rachael Tweddle

From: Laura Cape [Laura.Cape@nwl.co.uk]
Sent: 29 May 2015 15:26
To: Rachael Tweddle
Subject: RE: 109769/110045/108137 - DG5 Records
Attachments: gp29052015_151940.pdf

Hi Rachael

I have attached a plan for Rothbury, however I am unable to find any reported sewer flooding incidents for Ingram or Kirkwhelpington.

Regards

Laura Cape
New Development

Tel: 0191 4196646
Email: laura.cape@nwl.co.uk

From: Rachael Tweddle [mailto:rachael.tweddle@fairhurst.co.uk]
Sent: 29 May 2015 14:53
To: Laura Cape
Subject: 109769/110045/108137 - DG5 Records

Hi Laura,

As discussed on the phone I have these further sites that we require the DG5 record plans for, as usual the site boundaries have been attached.

1 – Rothbury
Carterside Road, Rothbury NE65 7TR - National Grid Ref: NU 05494 01105.

2 – Ingram
NE66 4LU - National Grid Ref: NU 02090 16359.

3 – Kirkwhelpington
Meadowlands, Kirkwhelpington NE19 2RW - National Grid Ref: NY 999 844. Site boundary included below, excuse the google earth image but we don't have any drawings for this site yet.

Kind regards,

Rachael

Rachael Tweddle
Graduate Engineer

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CECA NE Project of the Decade Award Winners 2013
RTPI NE Award Winners 2013 - Urban Design
RICS NE Award Winners 2012 - Renaissance

Consider the environment. Please don't print this e-mail unless you really need to.

Appendix C
Existing Greenfield Runoff Rates

The EA/DERFA R&D Technical Report W5-074 'Preliminary Rainfall Runoff Management for Developments' states that for developments which are less than 200 ha in size the Institute of Hydrology Report 124 (IH124) 'Flood Estimation for Small Catchments' should be used to calculate the peak greenfield runoff rates.

The areas being considered are all less than 50 ha; Technical Report W5-074 provides the following advice for this scenario.

> *"Where developments are smaller than 50 ha the analysis for determining the peak greenfield discharge rate should use 50 ha in the formula and linearly interpolate the flow rate value based on the ratio of the development to 50 ha."*

This advice is replicated in The SUDS Manual (CIRIA C697).

As described above, the IH124 method uses the following equation to calculate greenfield runoff:

$$Q_{BAR,\ rural} = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$$

Where:
$Q_{BAR,\ rural}$ = Mean Annual Flood (m^3/s)
AREA = Catchment Area (km^2)
SAAR = Standard Average Annual Rainfall (mm)
SOIL = Soil Index (from Wallingford Procedure maps)

For the area of Rothbury, the SAAR is taken to be 783 mm and the SOIL value is 0.10. Regional Growth Factors have been obtained from Technical Report W5-074, which have been used to determine peak flows for a range of return periods.

For 50 ha $Q_{BAR,\ rural} = 0.00108 * 0.50^{0.89} * 783^{1.17} * 0.10^{2.17}$
$= 0.577\ m^3/s$
$= 577\ l/s$

For 1 ha $Q_{BAR,\ rural} = 577/50 = 11.54\ l/s/ha$

Event	Growth Factor	Greenfield Runoff Rate (l/s/ha)
1 in 1 year	0.87	10.04
Mean Annual Flood	-	11.54
1 in 30 year	1.95	22.50
1 in 100 year	2.63	30.35

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