Technical Appendix 9.2: Flood Risk & Drainage Assessment;

McCloy Consulting

Flood Risk & Drainage Assessment

Unshinagh Wind Farm

M01616-23_DG03 | February 2022

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1 INTRODUCTION

1.1 Terms of Reference

This Flood Risk and Drainage Assessment has been commissioned by RES, to support a planning application for a proposed wind farm development known as Unshinagh near Carnlough, Co. Antrim.

The purpose of this assessment is to address Revised Planning Policy Statement 15 (PPS15). The assessment will therefore determine potential sources of flooding at the site and their associated risk to life and property; and shall discuss the site suitability for development and outline proposed design and mitigation measures where appropriate.

1.2 Statement of Authority

This report and assessment have been prepared and reviewed by qualified professional civil engineers, specialising in the fields of hydrology, drainage and flood risk as required by DfI Rivers. The key staff members involved in this project are as follows:

- Iain Muir MSc CEnv MIEnvSc – Project Consultant specialising in environmental assessment and applied hydrology, and particular experience in fluvial flood hydrology and modelling.
- Kyle Somerville BEng (Hons) CEng MIEI – Associate and Senior Engineer specialising in the fields of flood risk assessment; flood modelling, drainage and surface water management design.

1.3 Approach to the Assessment

Consideration has been given to the sources and extent of fluvial and tidal flooding at the site, as well as flooding of the site from pluvial sources, infrastructure failure, overland flow, and ponding of localised rainfall within the site. The assessment is intended to be proportionate to the scale and nature of the development and the perceived risk to it.

For the purposes of this study the following have been considered:

- Available information on historical flooding in the area.
- Site level information based on a high resolution digital terrain model;
- Detailed assessment of potential flooding from rivers, including fluvial flood modelling;
- Assessment of potential flooding to the site from overland sources;
- Assessment of potential flood risk to adjacent lands caused by development at the site; and
- Determination of the availability of safe discharge of surface water from the site.

Further guidance is also provided in the CIRIA Research Project 624 "Development and Flood Risk: Guidance for the Construction Industry" and Revised Planning Policy Statement 15 (PPS 15) – Planning and Flood Risk.

1.4 Application Site

The application site within which the Development lies within a landholding (lands under applicant control) is located on elevated land west of Carnlough.

For purposes of this assessment the "Site" shall refer to lands within the application (red line) boundary. The Site has an area of approximately 207 Ha.

Site context and location are shown on the drawings submitted in support of the application.

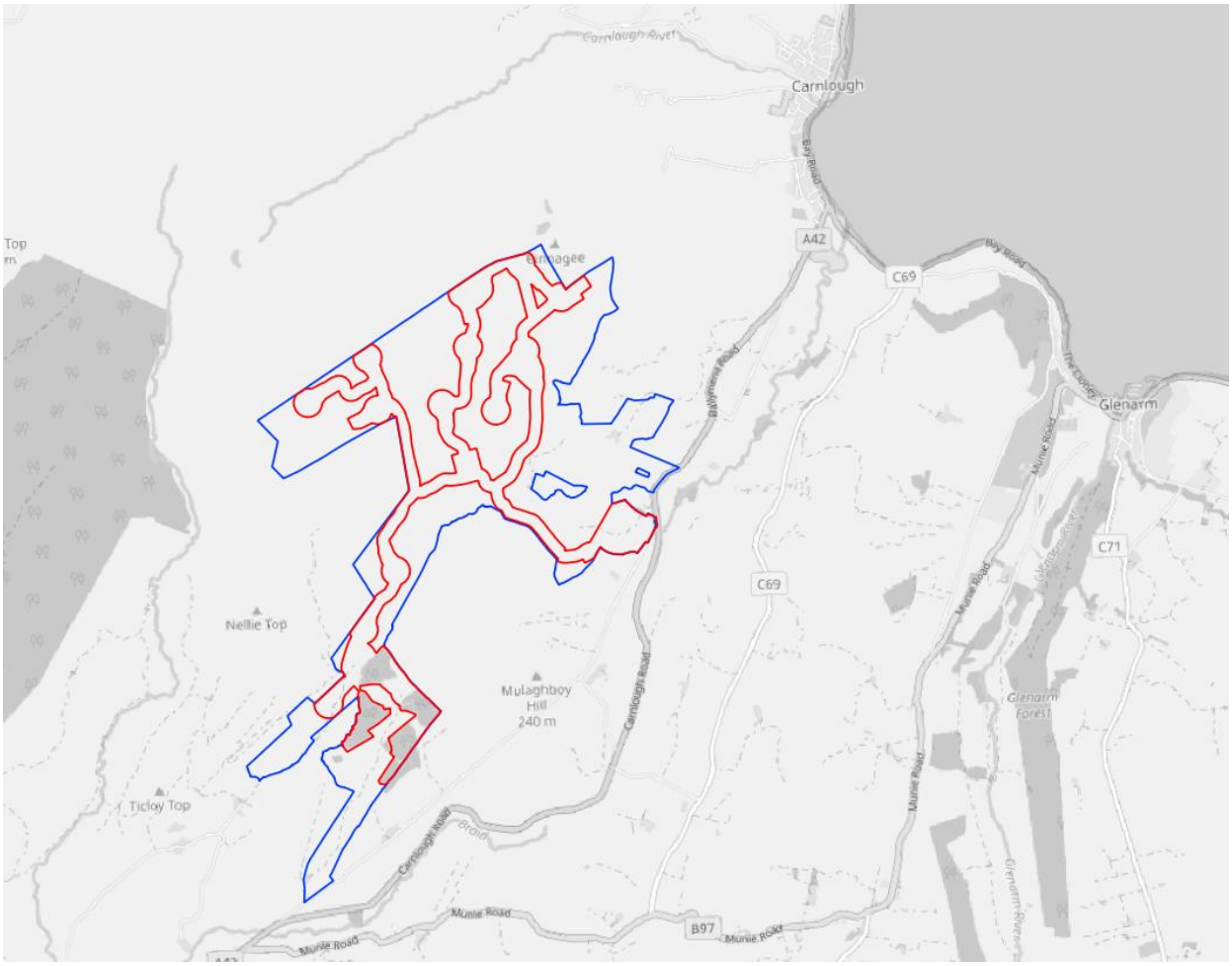


Figure 1-1 Site Location

1.4.1 Existing Land Use

The site is undeveloped land used for agricultural grazing. The site is accessible via several unbound agricultural tracks.

1.4.2 Proposed Development

The proposed development involves the construction of 14 no. wind turbines with associated permanent unbound gravel track for access and egress, associated site infrastructure including a control building / substation and battery energy storage, and permanent drainage features.

The proposed development footprint within the site is shown on the following figure.

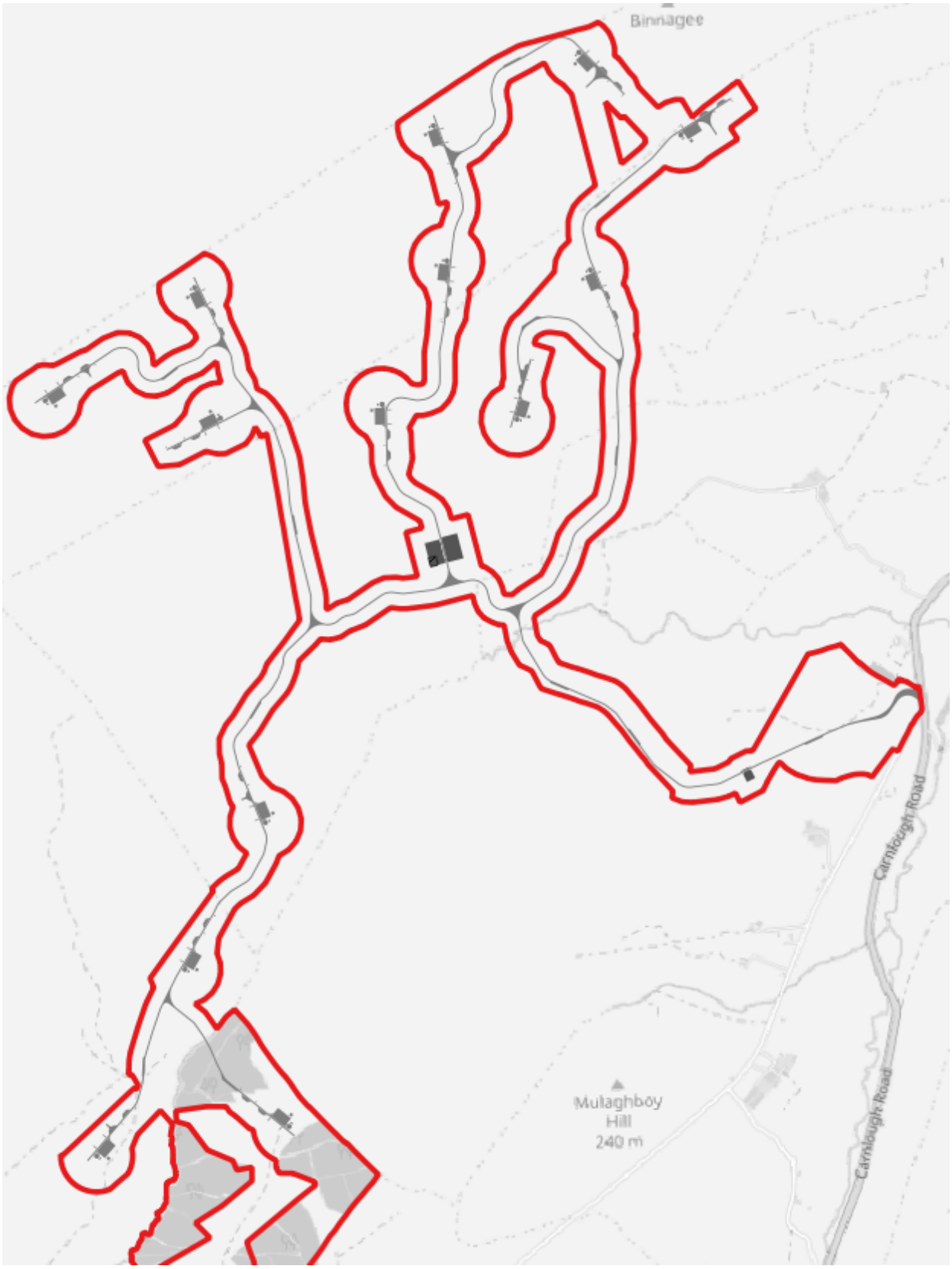


Figure 1-2 Proposed Site Layout

1.5 Site Characteristics

Site characteristics are more fully described within the Geology and Water Environment chapter within the Environmental Statement that this assessment is intended to support. Those aspects pertinent to flood risk and drainage are highlighted in the following sections.

1.5.1 Topography

Topography derived from the OSNI NI 10m DTM is shown on the following figure.

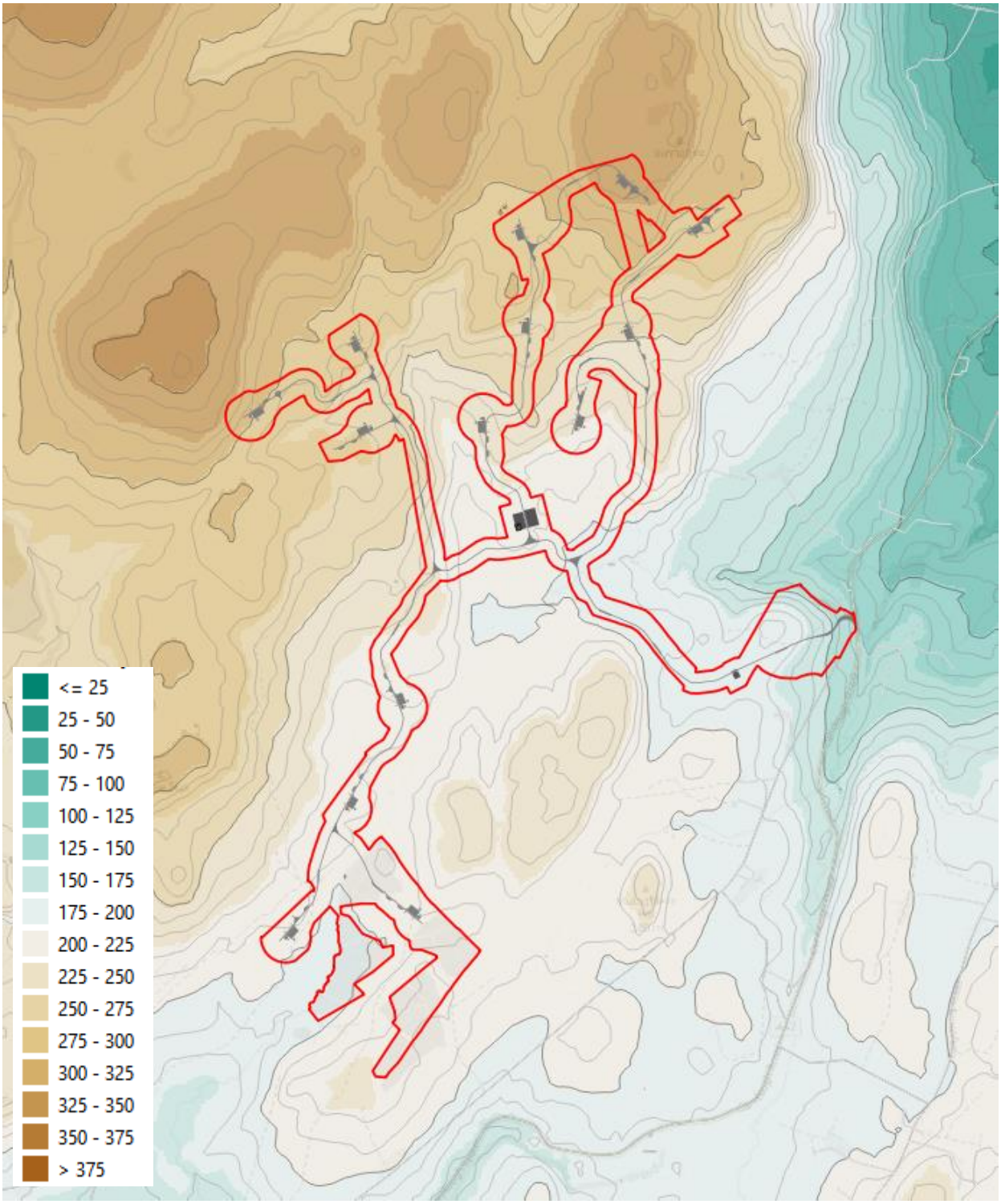


Figure 1-3 Site location and Topography

1.5.2 Hydrology and Watercourses

There are no watercourses designated under the Drainage Order on the site. Undesignated / minor drainage has been mapped to inform the Environmental Statement.

The hydrology in the areas where development is proposed falls across two primary drainage basins. The majority of the site drains east and north to the Glencloy River. The south of the site drains south and west to the Aghacully catchment of the Braid River.

Watercourses, peat / land drainage and field boundary drainage, have been mapped as part of the wider hydrological assessment. Main water features on and adjacent to the site are shown on Figure 1-4. A detailed hydrology map is included at Appendix A (which is a duplicate of EIAR Figure 9.1).

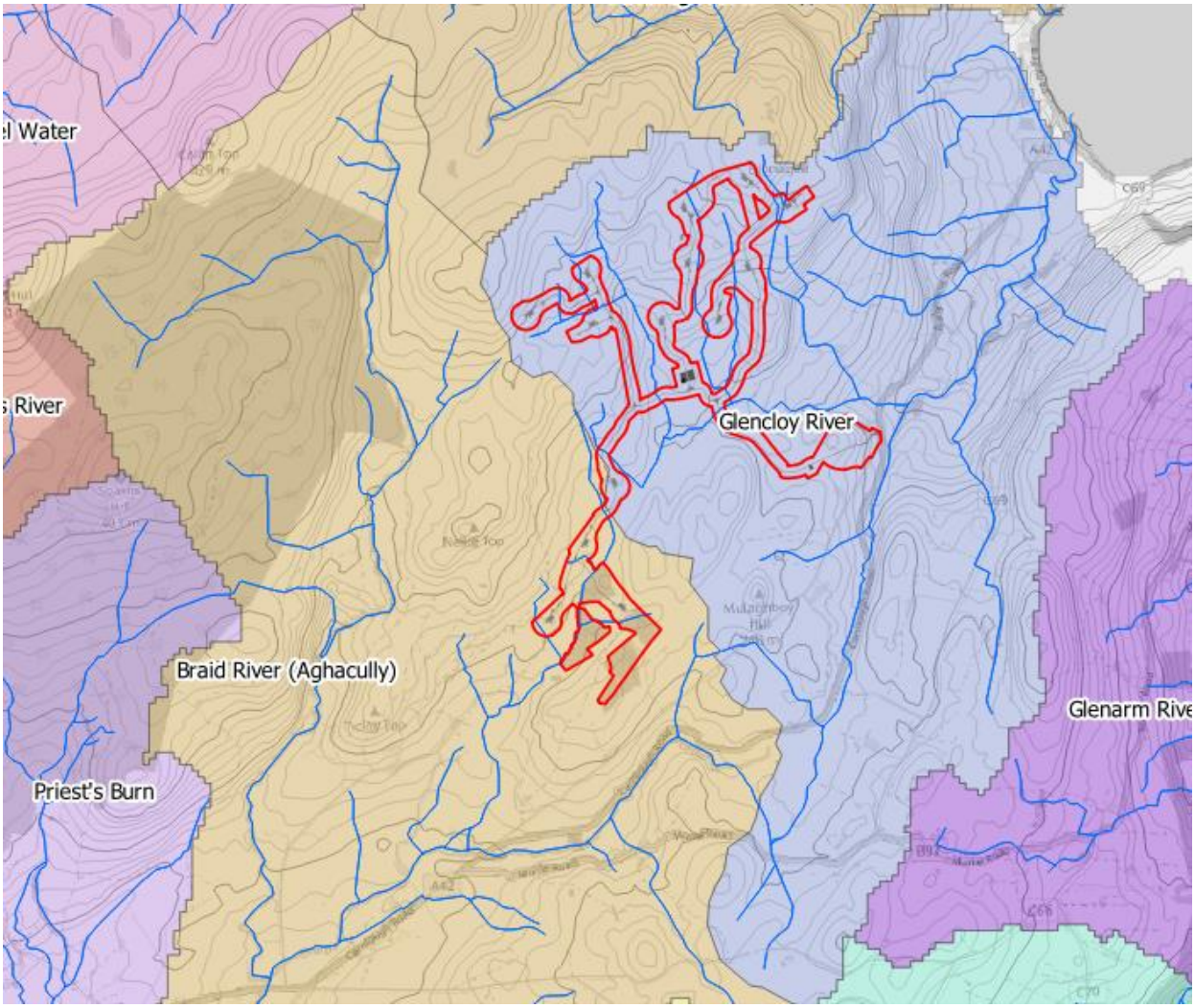


Figure 1-4 Site Hydrology

1.5.3 Geology

A review of GSNI geology data[1] has been undertaken to inform this assessment. Underlying superficial site geology based on GSNI 10k mapping is shown on the following figure. A refined description of ground cover is contained in the Environmental Statement.

[1] Department for the Economy. GSNI GeoIndex. Available from: https://mapapps2.bgs.ac.uk/GSNI_Geoindex/home.html. [Accessed: 28/1/2020].

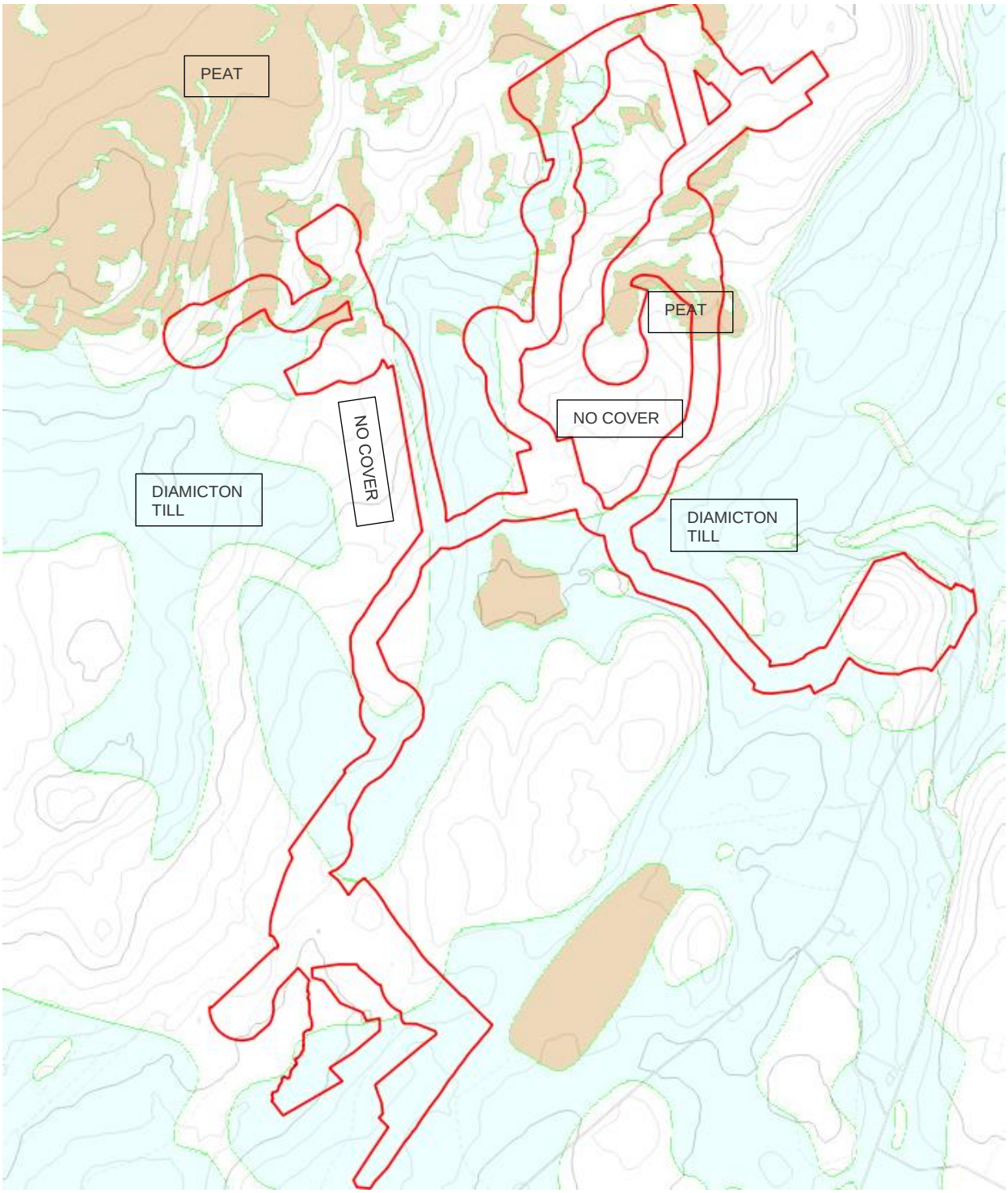


Figure 1-5 GSNI 1:10K Superficial Cover

2 BACKGROUND INFORMATION REVIEW

As part of the data collection phase, several sources of information were investigated to develop an understanding of the potential site flood risk. The following review highlights the findings of the anecdotal evidence collection exercise.

2.1 Internet/Media/Background Search

Preliminary consultation with online media sources indicates that there are no recorded flood incidents which have affected the site.

2.2 Northern Ireland Water

2.2.1 Out of Sewer Flooding

Northern Ireland Water (NI Water) has indicated that it is generally unable to provide data relating to out of sewer flooding.

2.2.2 Asset Information

NI Water asset information shows no drainage infrastructure that would be of material concern to this assessment within the vicinity of the development.

2.3 DfI Rivers

2.3.1 Flood Maps NI

The extent of development was reviewed with reference to Flood Maps (NI). Information obtained from flood maps is summarised as follows:

- There is no record of historic flooding within or in proximity of the proposed development.
- DfI Rivers indicative fluvial flood maps – present day indicates that parts of the site are affected by the indicatively modelled1% AEP fluvial flood extents.
- DfI Rivers indicative surface water flood maps – present day indicates that parts of the site are affected by the indicatively modelled 0.5% AEP surface water flood extent. Flooding coincides with the routes of watercourse.
- The DfI Reservoir inundation maps confirms that the site is unaffected by the inundation zone of any controlled reservoir.

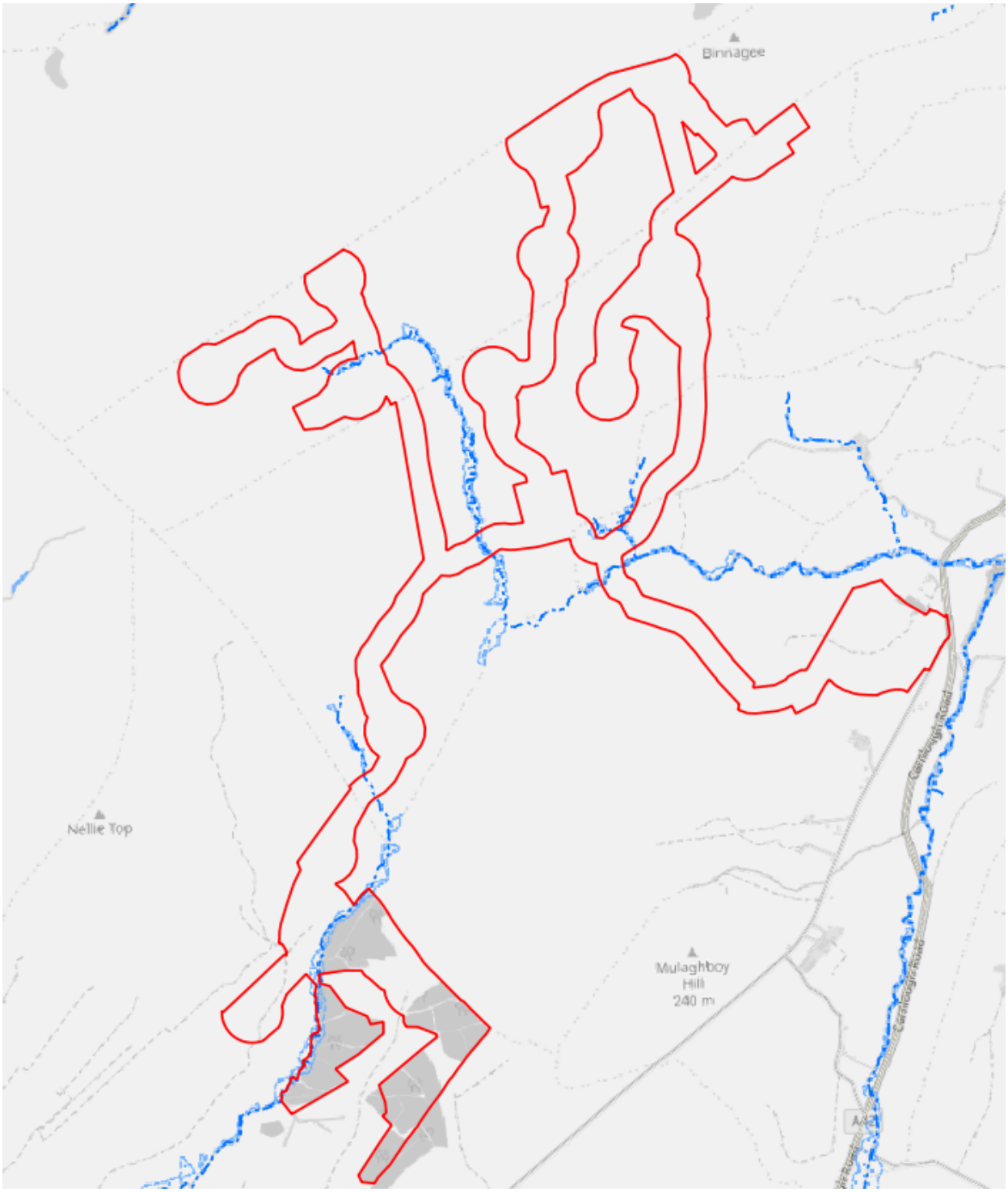


Figure 2-1 Extract from Flood Maps NI – Indicative 1% AEP Fluvial Flood Extent

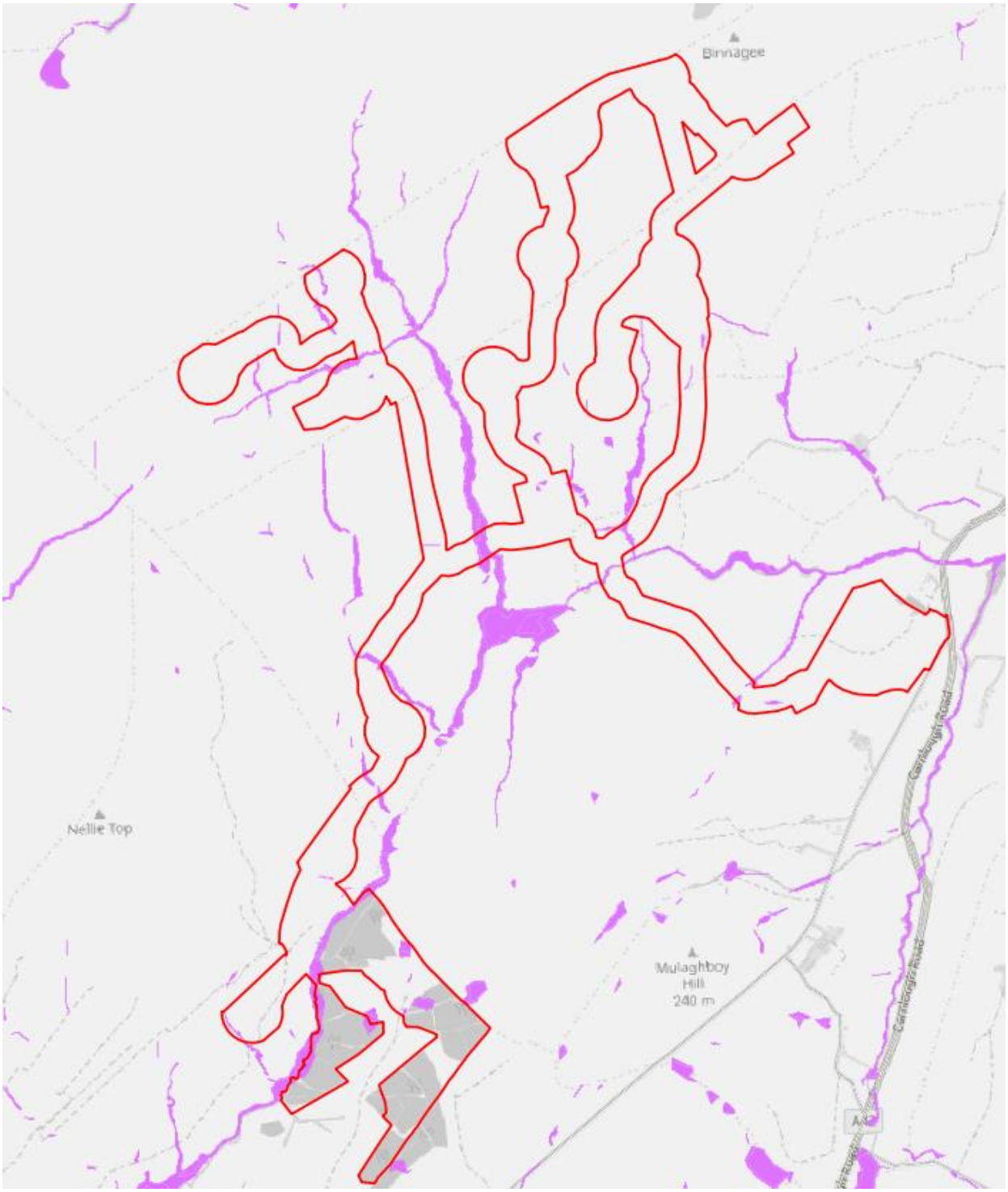


Figure 2-2 Extract from Flood Maps NI – Indicative 0.5% AEP Surface Water Flood Extent

3 FLOOD RISK ASSESSMENT

3.1 Initial Assessment

The following flood mechanism and policy screening is undertaken based on the initial information obtained and in the absence of any pre-application DfI Rivers Planning Advisory consultation response.

Table 3-1 Potential Flood Mechanism and Policy Screening

Policy	Flood Mechanism	Initial Assessment	Policy Applies?	Assess further?
FLD 1 - Development in Fluvial & Coastal Flood Plains	Fluvial Flooding	The site is affected by fluvial flooding shown on FMNI. Locations where development is proposed coincide with proposed watercourse crossing at access tracks.	Yes	Yes
	Coastal Flooding	The site is unaffected by coastal flooding shown on FMNI.	No	
	Flood Defence / Failure	The site does not lie in a defended area.	No	
FLD 2 - Protection of Flood Defence & Drainage Infrastructure	Development near drainage or flood defence assets	The proposed development is located adjacent to and crosses several watercourses and minor drains.	Yes	Yes
FLD 3 – Development and Pluvial Flood Risk Outside Flood Plains	Surface water flooding	Predicted surface water flooding shown on FMNI coincides with watercourses an is more appropriately assessed as fluvial.	No	Yes
	Surface water discharge	The development would potentially modify surface water run-off characteristics onsite/offsite. The scale and nature of the proposal triggers the need for a drainage assessment; development is required to demonstrate that safe discharge of surface water is feasible.	Yes	
	Culvert Blockage	No existing culverted watercourses have potential to affect the site in areas that would be of concern in relation to flood damage to the proposal.	No	
	Urban Drainage / Local Drainage Failure	No record of local drainage failures.	No	
	Groundwater	Not for consideration due to underlying geology and soil types.	No	
FLD 4 – Artificial Modification of Watercourses	Development affecting watercourses	The development shall involve several crossings of undesignated watercourses and field drains to permit access.	Yes	Yes
FLD 5 - Development in Proximity to Reservoirs	Reservoir Flooding	The site is not located within a reservoir inundation zone.	No	No

3.2 Fluvial Flooding

3.2.1 Background – Indicative Floodplains

Review of Flood Maps (NI) indicates that the undesignated watercourses including the upper reaches of Glencloy River and Ticloy Water have been indicatively modelled within and proximal to the Application Site. The flooding affects areas where access tracks are proposed to cross the watercourses and floodplains. No development is planned in affected areas other than watercourse crossings where tracks are required for access.

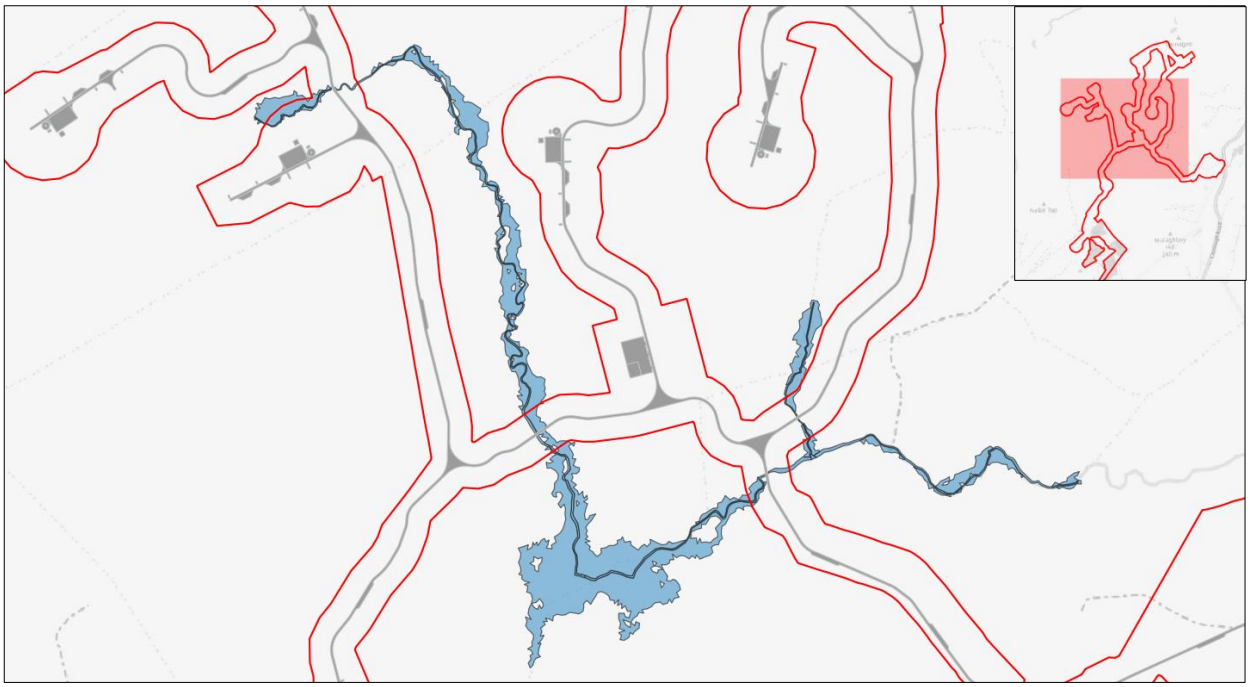
A more robust site-specific river model, suitable to the scale and nature of the proposed development, has been prepared using high resolution DTM to allow design and evaluation of crossing options given spate upland rivers can characteristically spread over a broad valley floor from a small base channel. Flood mapping produced is intended to supersede the indicative model predictions within the application site.

3.2.2 Existing 1% AEP Flood Extent

Site-specific hydraulic modelling of the undesignated watercourses undertaken (See Appendix D**Error! Reference source not found.** for methodology and detail) indicates) 1% AEP flooding broadly consistent with that shown on Flood Maps NI.

Due to expected climate change impacts, the application of the precautionary approach requires any assessment of flood risk to incorporate the necessary allowances for increased rainfall, storminess and sea level rise (where appropriate) specified in current UK research and guidance. As per DfI guidance[2], an estimation of the effect of climate change has been derived through modelling an increase of current design flows by 20%. In this instance (given primary driver is sizing of bridge and culvert openings), flooding for Present Day hydrology has not been assessed and the effect of climate change is included in the flood levels and flood mapping shown on the preceding figure and all subsequent figures.

The 1% AEP flood extents applicable to policy FLD 1 is shown in **Error! Reference source not found.** and Figure 3-2 below.



[2] DfI. (2019). Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland. Available from: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/technical-flood-risk-guidance-in-allowances-for-climate-change-6feb19.PDF. [Accessed: 23/11/2021].

Figure 3-1 1% AEP Flood Extent (Northern Section)– Existing Scenario

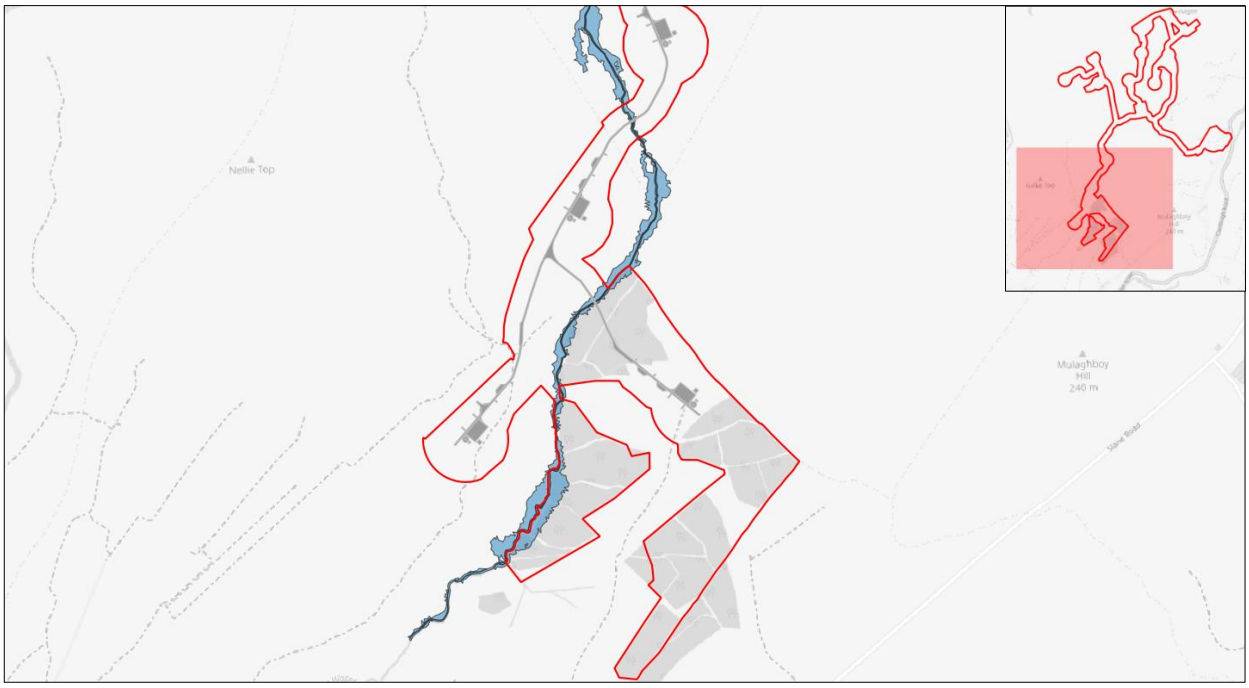


Figure 3-2 1% AEP Flood Extent (Southern Section)– Existing Scenario

Detailed flood extents mapping is provided in Appendix G. Mitigation of risk to the development adjacent to or crossing the floodplain is stated in Section 4.2.

3.2.3 Effect of the Development

The proposed access tracks must cross the undesignated watercourses to permit access throughout the site area. The crossing locations have been sited to minimise the number of crossings over watercourses, and to avoid complex meandering reaches which would cause a complex extended culvert or need for a diversion / realignment of the watercourse.

There are twenty culverts of which six are significant crossings on larger watercourses where fluvial flood mapping is shown on Flood Maps NI. Minor watercourse crossings are not significant in planning terms and cannot have a significant effect on flood risk, and their design is deferred post-planning consent subject to normal requirements for DfI Rivers authorisation.

Due to the larger scale of the 6 watercourse significant crossings, the effect of the proposed development (track geometry and proposed culvert openings) has been assessed by incorporating the track alignment as raised embankments within the model geometry and testing river culvert dimensions until a satisfactory outcome was resolved that complies with normal culvert design and flood protection standards.

Due to the nature of the spate streams and broad flat-bottomed valleys, where flooding can be shallow but over a wide area, in a number of instances solutions include main openings to the river channel supplemented by flood conveyance culvert in the floodplain.

The proposal has targeted the following standard:

- Main channel culvert / bridge sized to accommodate the in-channel 1% AEP + Climate Change flow with min. 0.3m freeboard between inlet top water level to culvert soffit, per CIRIA C689 Culvert Design and Evaluation Guide. The culvert span is informed primarily by environmental protection standards which seek to maintain the stream banks and bed intact.
- While causing no change to upstream water levels is not viable without bridging the whole floodplain, then the proposal has sought to cause an upstream effect not greater than approximately +0.3m, the effect of which is contained entirely within lands under control of the applicant.

The outcome of the analysis and design is scheduled in the following table. Pre-/Post-development flood extent maps at each watercourse crossing is included at Appendix G.

WX	Upstream 1% AEP Flood Level		Effect (m)	Proposed Solution
	Pre-Development	Post Development		
03	194.09	194.36	0.27	Bottomless culvert with span 3.0m, height 1.1m and soffit not less than 195 m OD. Two no. flood conveyance culverts of 0.9 m diameter.
03.1	195.71	196.07	0.36	Bottomless culvert with span 3.0m, height 1.3m and soffit not less than 196.3 m OD. Two no. flood conveyance culverts of 0.75 m diameter.
09	202.76	203.11	0.35	Bottomless culvert with span 3.0m, height 1.8m and soffit not less than 203.4 m OD.
14	209.89	210.09	0.2	Bottomless culvert with span 2.5m, height 1.2m and soffit not less than 210.4 m OD. Two no. flood conveyance culverts of 0.9 m diameter.
18	200.41	200.75	0.34	Bottomless culvert with 2.8m span, height 1.1m and soffit not less than 201 m OD.
19	260.67	260.87	0.2	Box culvert with 1.4 span, height 0.9m and invert level of 260.32 m OD. Two no. flood conveyance culverts of 0.75 m diameter.

Modelling confirms no significant effect on flooding elsewhere, with any localised effect contained immediately proximal to the proposed infrastructure and within lands under control of the applicant. No further mitigation (in the form of floodplain reprofiling) is necessary to mitigate any effect elsewhere.

3.2.4 Risk to the Development

All development other than unavoidable watercourse crossings is sited outside of floodplains and away from watercourses.

All development adjacent to floodplains and proposed track crest levels and any other proposed infrastructure adjacent to watercourse crossings shall be sited at a level greater than the adjacent 1% AEP Climate Change flood level (per mapping shown at Appendix G, ideally including 0.6m freeboard, and as such will have an appropriate standard of flood protection .

3.3 Surface Water

3.3.1 Effect of the Development

The proposed development shall lead to an increase in the impermeable area of the site. Therefore, the risk of flooding from surface water run-off from the site shall be greater relative to the existing scenario without appropriate mitigation.

An estimate of the unmitigated post-development run-off for the footprint of the proposed development has been made as part of this assessment. A comparison of existing and proposed run-off rates in litres per second (lps) are provided in Table 3-2.

Table 3-2 Comparison of surface water run-off rates (Peak [1hr] Runoff rates)

Return Period	Existing Site (l/s)	Proposed Site (l/s)	Increase (l/s)
1 in 2 year	132	259	*128*
1 in 30 year	229	739	*510*
1 in 100 year	272	1003	*730*

3.3.1.1 Potential for Overland Flooding

The site setting is rural, and the proposal is unlikely to cause any significant direct risk of surface water flooding to any receptor downgradient.

Routing of overland flooding from the site has been determined based on a "rolling ball" hydrological analysis, the outcome of which (showing key overland flow routes) is shown on Figure 3-3. That analysis tends to confirm that all runoff from the site will be intercepted by the watercourse network prior to causing any effect of adjacent land.

Mitigation of surface water flood risk to adjacent lands shall be by provision of an adequate drainage system, see Section 4.2.3.

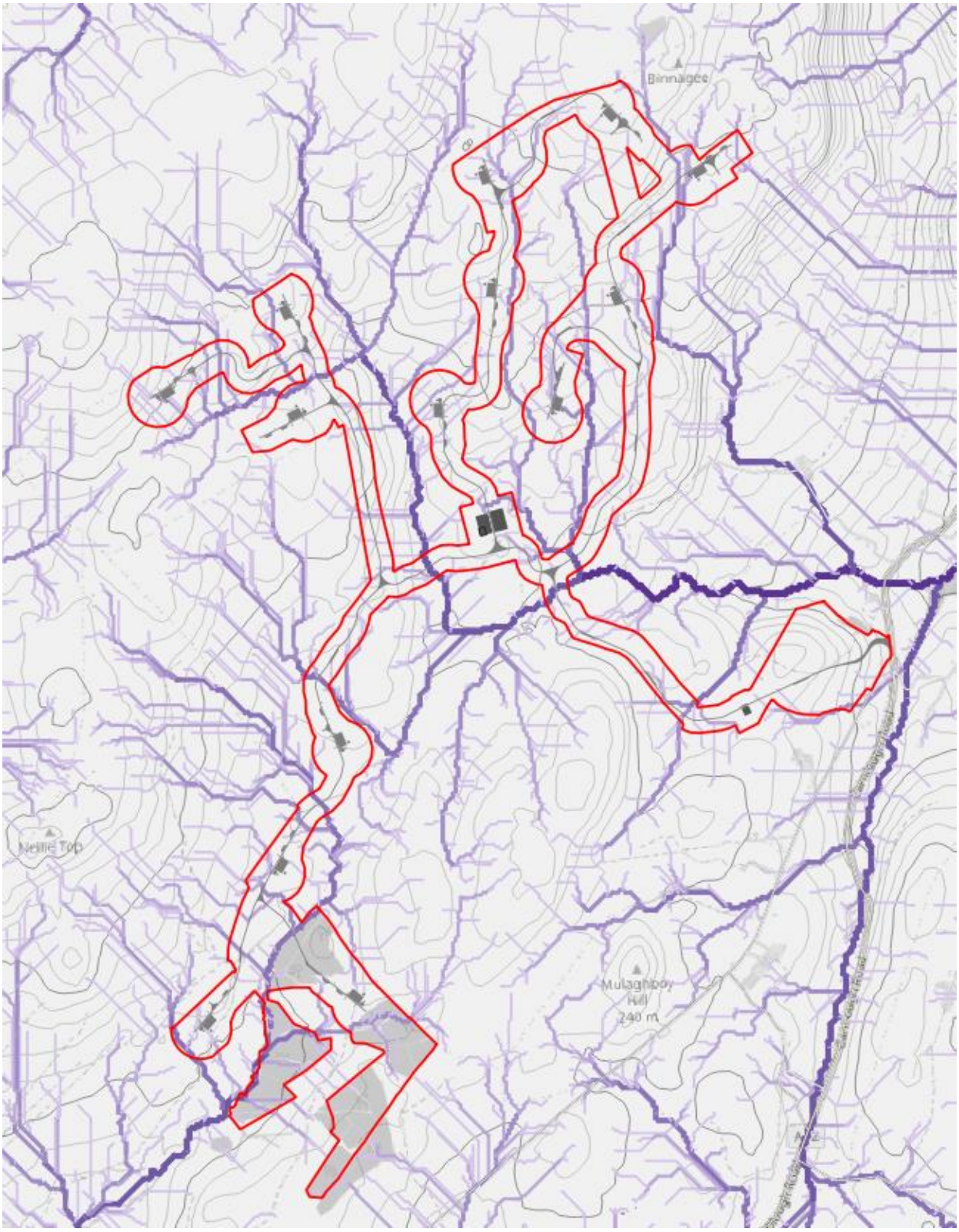


Figure 3-3 Indicative Overland Flow Path

3.3.1.2 Effect on Downstream Watercourses

All runoff from the site · other than at the site entrance, will drain to downstream watercourses within the site or within lands under control of the applicant, with direct discharge to undesignated watercourses within the application boundary. Drainage at the site entrance shall drain either to the Glencloy River east

of the site or an unnamed tributary shortly north of the site entrance, via short (<200m) offsite outfall extensions.

The effect of the development has been assessed as causing an increased rate and volume of run-off. To mitigate this effect, it is proposed to use a rural SuDS approach to encourage dispersal of runoff over the site and discourage point discharges to watercourses; and to limit run-off from direct discharges to watercourses to a greenfield equivalent pre-development run-off rate.

Point discharges to watercourses will be attenuated to the DfI Rivers greenfield rate up to the 1% AEP + Climate Change. DfI Rivers consent for point discharges has been granted for the proposed development (Rivers ref. IN1-21-19677) and is included in Appendix C.

Requirements for the attenuation and discharge of surface water based on the proposals at the site are discussed in Section 4.2.

4 SUMMARY OF FINDINGS AND RECOMMENDATIONS

4.1 Summary of Findings

Parts of the Application Site are affected by the 1% AEP fluvial flood extents which are associated with out of bank flooding from undesignated watercourses within the site boundary i.e., the upper reaches of Glencloy River and Ticloy Water.

An assessment of fluvial flooding undertaken. No development is sited within the fluvial floodplain other than a track and watercourse crossing required to permit access to the north and east of the site. The proposed development has been assessed and determined to cause no adverse effect outside lands under control of the applicant. No other significant flood risk has been identified.

The proposed development causes an increase in peak rate and volume of runoff from the site. Mitigation of surface water flood risk to the development, by providing an adequate drainage system, is discussed below.

4.2 Design Measures

This section details measures which have been incorporated into the proposal submitted in support of the planning application, and to be further developed in any detailed design or variation post-determination of the planning application.

4.2.1 Track Levels

Finished track levels adjacent to watercourse crossings where fluvial flooding has been assessed in detail shall be sited at a minimum level of the adjacent 1% AEP Climate Change flood level + 0.6m freeboard, to comply with DfI Rivers standard recommendations. Adjacent flood levels are shown on maps at Appendix G.

All other infrastructure is sited sufficiently remotely from watercourses that no minimum design levels apply.

4.2.2 Watercourse Crossings

The development shall involve the installation of piped crossings for twenty water features locations across the site to permit access, comprising of 6 no. significant watercourses and 14 no. minor watercourses. Watercourses vary from headwater channels to substantial upland streams with bed widths >2m.

The nature of the crossing proposed (i.e. closed culvert or clear span) is dictated by other overriding environmental factors (fisheries and habitats requirements) and the need to avoid in-stream works where applicable.

A detailed schedule of culvert crossings and the watercourses affected is included at Appendix **H**.

4.2.2.1 Minor Crossings

Piped crossings of the 14 no. minor watercourses shall be designed as to mitigate potential for flooding of infrastructure. Culverts shall be designed to have free inlet conditions for an appropriate flood design standard, nominally 1% AEP / 1-in 100 years with climate change allowance or as may otherwise be required by DfI Rivers in consultation.

Any crossings required shall be designed to accommodate track crossings whilst limiting the length of the channel affected.

Hydraulic design of crossings shall be undertaken as per the guidance and requirements provided in CIRIA C689 "Culvert Design and Operation Guide" (or other standard as may be required by DfI Rivers in post-consent consultation), with primary parameters likely to include:

- Width of the crossing will be greater than the width of the active drainage channel.
- Alignment of the crossing will suit the alignment of the drainage channel i.e. preserve the existing direction of flow.

- The slope of the crossing will not exceed the slope of the bed of the existing channel.

Proposed culverts shall be subject to future approval from DfI Rivers through a Schedule 6 application, under the Drainage Order (NI) 1973. The locations affected are not located in any floodplain and are of a conventional nature and there is no significant potential for the culverts in themselves to cause a new flood risk requiring consideration as part of this flood risk assessment. As such detailed design and consent for those crossings is not material to determination of an associated planning application and can satisfactorily be deferred post-consent of the application.

4.2.2.2 Significant Watercourses

The crossings over significant watercourses are sited on floodplains and as such their effects are of material consideration in terms of this flood risk assessment, and so have been considered and assessed in further detail.

The proposed structures, which comply with and exceed the minimum standards stated in Section 4.2.2.1 for minor watercourse crossings, is shown on drawings included in Appendix B. There is sufficient information in this FRA to allow the conclusion that the proposed culverts are satisfactory from a flood risk point of view and that the planning application can be determined without DfI Rivers Schedule 6 applications in place. Authorisation has been sought from DfI Rivers in parallel with the planning application that this assessment is intended to support.

The culverts shall be formed from precast portal frame sections or similar. The section heights shall be dictated by the structural and foundation / formation design including consideration of stream scour, which can be deferred post-consent. Whether an opening is a closed culvert or a bottom culvert is dictated by a fisheries assessment and the need to preserve the river substrate.

Conveyance culverts will be sited at ground level on the upstream side, with nominal falls to emerge at or above ground level on the downstream side.

4.2.3 Drainage Design

Drainage is to meet or exceed the hydraulic standards stated as follows:

• The drainage network / site layout ensures containment and control of the 100-year (1% AEP) return period storm within the site to ensure no offsite effect elsewhere. • The drainage network allows for a **20%** allowance for climate change for the flood protection standard.	To suit DfI Rivers flood protection standards.

Due to the nature of the development, a formalised conventional drainage system is not considered feasible or practical at the site. The design principles in summary are as follows:

- Runoff from the access track shall be collected via open swales. Run-off shall be attenuated with the use of check dams to reduce the peak rate of run-off and to encourage infiltration of surface water.
- Settlement/attenuation basins will be provided where drainage from significant areas of hardstanding discharge directly to streams and watercourses.
- If feasible at detailed design, run-off should be encouraged to discharge overland, rather than accumulate concentrated peak flows to discharge to watercourses.

The drainage networks should also allow for a 20% allowance for climate change at all the above listed return periods. SuDS features shall be designed in accordance with best practice guidance in The SuDS Manual (Document ref: C753; CIRIA).

4.2.3.1 Discharge Rate and Location

To demonstrate that the safe discharge of surface water from the proposed wind farm site is feasible, a concept drainage design has been prepared and is included in Appendix B. The proposal involves surface

water from the proposed development discharging directly to the existing on-site watercourses and field drains, at the 38 no. locations indicated on the drainage design.

Direct discharges to watercourses are subject to discharge consent under Schedule 6 of the Drainage (Northern Ireland) Order 1973. DfI Rivers consent has been granted for the proposed development (Rivers ref. IN1-21-19677) and is included in Appendix C.

Surface water run-off shall be limited as closely as feasible to the greenfield run-off rate of 10l/s/ha for the developed site area.

4.2.3.2 Attenuation Requirement

The indicative drainage design shown intends surface water from the site to discharge into 38 no. attenuation basins at locations adjacent watercourses and field drains. Flows controls shall be installed at the pond outflow points to ensure that flows are discharging to watercourses as per Table 4-1.

The storage calculation has not included the storage provided within the drainage conveyance system i.e. by checkdams in swales, and loss of water by overland dispersal. The attenuation sizes required are therefore considered highly conservative. Attenuation calculations demonstrate that the following is required:

Table 4-1 Attenuation Requirements

Catchment	Comment	Drainage area (m^2)	Attenuation storage required (m^3)	Allowable run-off rate (l/s)
1	Discharge overland	5319	130	5.3
2	Discharge to Drain / Watercourse	2969	72	3
3	Discharge to Drain / Watercourse	5844	142	5.8
4	Discharge to Drain / Watercourse	4545	111	4.5
5	Discharge to Drain / Watercourse	630	15	0.6
6	Discharge overland	7052	172	7.1
7	Discharge to Drain / Watercourse	6448	157	6.4
8	Discharge to Drain / Watercourse	5515	134	5.5
9	Discharge to Drain / Watercourse	541	13	0.5
10	Discharge to Drain / Watercourse	563	14	0.6
12	Discharge to Drain / Watercourse	1780	43	1.8
13	Discharge overland	1672	41	1.7
14	Discharge to Drain / Watercourse	272	7	0.3
15	Discharge to Drain / Watercourse	5119	125	5.1
16	Discharge to Drain / Watercourse	5900	144	5.9
17	Discharge to Drain / Watercourse	6935	169	6.9
18	Discharge to Drain / Watercourse	5627	137	5.6
19	Discharge to Drain / Watercourse	2002	49	2
20	Discharge to Drain / Watercourse	13755	335	13.8
21	Discharge to Drain / Watercourse	1154	28	1.2
22	Discharge to Drain / Watercourse	3343	81	3.3
23	Discharge to Drain / Watercourse	1167	28	1.2
24	Discharge to Drain / Watercourse	873	21	0.9
25	Discharge to Drain / Watercourse	829	20	0.8
26	Discharge to Drain / Watercourse	583	14	0.6
27	Discharge to Drain / Watercourse	2601	63	2.6
28	Discharge to Watercourse via offsite outfall	4281	104	4.3
29	Discharge to Drain / Watercourse	5795	141	5.8
30	Discharge overland	1284	31	1.3
31	Discharge to Drain / Watercourse	5361	131	5.4
32	Discharge to Drain / Watercourse	1770	43	1.8
33	Discharge to Drain / Watercourse	4451	108	4.5
34	Discharge to Drain / Watercourse	484	12	0.5
35	Discharge to Drain / Watercourse	482	12	0.5
36	Discharge to Drain / Watercourse	1041	25	1
37	Discharge to Drain / Watercourse	5455	133	5.5
38	Discharge to Drain / Watercourse	4511	110	4.5
TOTAL		**127953 sq m**	**3115 cu.m**	**128 lps (equivalent to 10 lp/Ha)**

The attenuation volume stated is based on preliminary information; drainage catchments are subject to change dependent on the finalised layout of any drainage layout and finished ground levels. Volumes stated are dependent on the type and efficiency of the flow control method used. Ultimately the final design (to be completed and agreed post-consent) must comply with the limiting discharge rate (per hectare) applied to the drained development area.

The location of attenuation basins / configuration can be viewed in drawings included in Appendix B.

4.2.3.3 Exceedance

In the event of an unprecedented flood, any attenuation pond is expected to overtop and drain overland. This overland flow is expected to be collected by existing downstream watercourses and field drains, which will contribute to the overall catchment at a location downstream of the site.

It has been demonstrated that flows from the site up to the flood protection design standard (1 in 100 year/1% AEP) can be safely contained within the system without flooding. Runoff in the event of other exceedance (i.e. blockage or other failure) will tend to follow flow routes tending towards the south/south west of the site as per the present day scenario (refer to Figure 3-3.)

Mitigation of such exceedance shall be by robust maintenance of the drainage network described subsequently.

4.2.4 Protection of Watercourses

The proposal includes measures that prevent development within 10m of minor watercourses and 50m of hydrologically significant water features, which ensure that the requirements of policy FLD2 are met. The nature of the proposal causes no built development of a type that would impede riparian maintenance of watercourses, and as such meets the normal requirements stated in policy FLD2 in relation to watercourse maintenance.

4.3 Maintenance Requirements

4.3.1 Drainage System Maintenance

The developer/site operator is to ensure that the maintenance of the drainage system is included within the overall management plan for the site. Detailed drainage layouts for the site shall ensure that key features requiring maintenance (e.g. flow control devices) are in accessible locations.

Maintenance plans for SuDS are to include (where applicable):

- Cyclical (min. annual, or after significant storm event) check of any flow control device for damage, debris, or blockage.
- Seasonal maintenance of any surface water feature e.g. swales/ponds – nominally to include management of vegetation, clearing of obstructions, etc.

4.3.2 Drainage Feature Maintenance

The operator is reminded of their statutory obligations set out in the Drainage (Northern Ireland) Order 1973 in relation to their role as a riparian landowner to the watercourses and field drains located on site.

4.4 Flood Risk & Planning Policy Summary

The following table summarises the findings, mitigation, and policy context of those flood mechanisms and policies deemed to be required to be investigated further by the initial assessment.

Table 4-2 PPS15 Policy Summary

Policy	Assessment / Mitigation
FLD 1 - Development in Fluvial & Coastal Flood Plains	No development in floodplains is proposed other than where proposed access tracks cross watercourses. Development adjacent to floodplains is resilient to flooding including freeboard to climate change flood levels. Proposed watercourse crossings have been assessed to have no effect elsewhere and no additional mitigation is required.
FLD 2 - Protection of Flood Defence & Drainage Infrastructure	The proposals shall not impede riparian maintenance of watercourses. The proposal therefore complies with FLD2.
FLD 3 – Development and Pluvial Flood Risk Outside Flood Plains	Site drainage shall ensure that the site is adequately drained and flood resilient. Drainage design shall adopt suitable hydraulic standards in relation to standards of flood protection to the site and downstream watercourses. Surface water can be safely disposed of to existing field drains and watercourses. The proposal will comply with FLD3.
FLD 4 – Artificial Modification of Watercourses	The proposed development shall involve the construction of crossings to existing watercourses and field drains. The crossings shall be constructed to facilitate access only and are a permissible exception to policy FLD4. Crossing designs ensure flood risk outside the site / outside lands under control of the applicant is unaffected.
FLD 5 - Development in Proximity to Reservoirs	Does not apply (see **Error! Reference source not found.**)