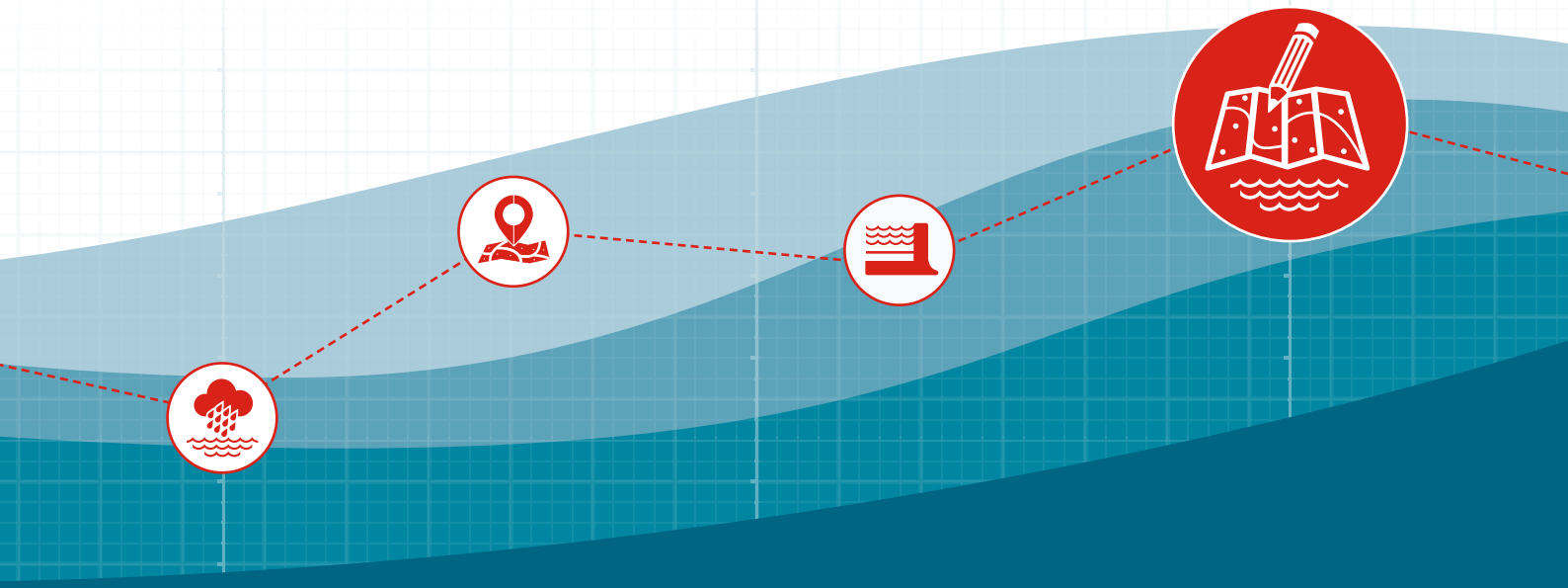
OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

Abhantrach
06
River Basin



Plean um Bainistiú Priacal Tuile

Flood Risk Management Plan

Loch nEathach An Bhanna

Neagh Bann

2018

Plean um Bainistiú Priacal Tuile
Flood Risk Management Plan

Amhantrach (06) Loch nEathach An Bhanna
River Basin (06) Neagh Bann

Limistéir um Measúnú Breise a chuimsítear sa phlean seo:
Areas for Further Assessment included in this Plan:

Áth na gCasán	*Annagassan*
Baile Átha Fhirdhia	*Ardee*
Na Creagacha Dubha (Theas)	*Blackrock South*
Cairlinn & An Grianfort	*Carlingford & Greenore*
Carraig Mhachaire Rois	*Carrickmacross*
Dún Dealgan	*Dundalk*
Inis Caoin	*Inishkeen*
Tearmann Feichín	*Termonfeckin*
Muineachán	*Monaghan*

Ullmhaithe ag Oifig na nOibreacha Poiblí 2018
Prepared by the Office of Public Works 2018

De réir In accordance with
Rialacháin na gComhphobal Eorpach (Measúnú agus Bainistiú Priacal Tuile) 2010 agus 2015
European Communities (Assessment and Management of Flood Risks) Regulations 2010 and 2015

Séanadh Dlíthiúil

Tugadh na Pleananna um Bainistiú Priacal Tuile chun cinn mar bhonn eolais le céimeanna indéanta agus molta chun priacal tuile in Éirinn a fhreagairt agus le gníomhaíochtaí eile pleanála a bhaineann leis an rialtas. Ní ceart iad a úsáid ná brath orthu chun críche ar bith eile ná um próiseas cinnteoireachta ar bith eile.

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The Flood Risk Management Plans have been developed for the purpose of informing feasible and proposed measures to address flood risk in Ireland and other government related planning activities. They should not be used or relied upon for any other purpose or decision-making process.

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- RPS Consulting Engineers
- WFD Local Authorities Water and Communities Office LAWCO
- Cavan County Council
- Donegal County Council
- Leitrim County Council
- Louth County Council
- Monaghan County Council
- Department for Infrastructure (Rivers & Flooding) (formerly Rivers Agency of Northern Ireland)
- The Environmental Protection Agency
- Met Éireann
- All members of the National CFRAM Steering and Stakeholder Groups

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ACHOIMRE FHEIDHMEACH

RÉAMHRÁ

Is é seo an Plean um Bainistiú Priacal Tuile (an 'Plean') d'Abhantrach Loch nEathach An Bhanna. Tá cur síos ar an Abhantrach i Rannán 2 den Phlean.

Is cuspóir don Phlean straitéis, ar a n-áirítear sraith céimeanna molta, um bainistiú costéifeachtach inbhuanaithe fadtéarnmach an phriacail tuile ins an Abhantrach a leagan amach, ar a n-áirítear limistéir inar cinneadh go bhfuil an priacal tuile dóchúil suntasach.

Tá an Plean seo, don tréimhse 2018-2021, ar cheann de 29 bPlean atá dá bhfoilsiú; leagann gach ceann acu amach an réimse indéanta de chéimeanna um bainistiú priacal tuile atá molta dá nAbhantracha ar leith. Céim shuntasach chun tosaigh is ea ullmhú na bPleananna seo maidir le feidhmiú pholasaí an Rialtais um bainistiú priacal tuile, mar atá leagtha amach i dTuarascáil an Ghrúpa um Athbhreithniú ar Pholasaí Tuile (OPW, 2004[1]), agus freagraíonn sé oibleagáidí na hÉireann faoi Threoir 'Tuilte' an AE 2007 (EU, 2007[2]).

Cuimsíonn an Plean céimeanna indéanta a tugadh chun cinn trí réimse clár agus tionscnamh polasaí ar a n-áirítear:

- Céimeanna neamhstruchtúrtha um chosc agus ullmhacht priacal tuile atá infheidhme ar bhonn náisiúnta, dírithe ar thionchair thuilte a laghdú, a tugadh agus atá á dtabhairt chun cinn chun polasaí Rialtais um bainistiú priacal tuile a fheidhmiú (OPW, 2004).

- Céimeanna struchtúrtha um chosaint tuile atá molta do phobail atá ar phriacal suntasach tuile, dírithe ar dhóchúlacht agus/nó céim thuilte a laghdú, a léiríodh tríd an Chlár Náisiúnta um Measúnú agus Bainistiú Priacal Tuile Abhantraí (MBPTA).

Scrúdaigh an Clár MBPTA an priacal tuile, agus céimeanna féideartha um an priacal a fhreagairt, in 300 pobal ar fud na tíre atá ar phriacal dóchúil suntasach tuile. Léiríodh na pobail seo ins an Réamh-Mheasúnú um Priacal Tuile (RPT); measúnú náisiúnta scagtha a bhí anseo. I dTábla ES-1 thíos tugtar liosta na bpobal atá léirithe tríd an phróiseas RPT mar phobail atá faoi phriacal dóchúil suntasach tuile in Abhantrach Loch nEathach An Bhanna chomh maith leis na foinsí tuile a cinneadh a bheith suntasach maidir le gach pobal. Tugadh chun cinn agus foilsíodh sraith mapaí tuile le haghaidh gach pobal díobh, ag léiriú na limisteir atá ar phriacal tuile.

Tógann an Plean ar an chlár náisiúnta oibreacha cosanta tuile a críochnaíodh roimhe seo, orthu san atá faoi dhearadh agus faoi thógáil um an dtaca seo nó atá leagtha amach trí thionscadail nó pleananna eile, agus ar chothabháil leanúnach ar scéimeanna dhraenála agus faoiseamh tuile.

Rinneadh Measúnú Straitéiseach Comhshaoil, agus Measúnú Cuí faoin Treoir um Ghnáthóga mar ba chuí, mar chuid den ullmhú, agus tá siad folisithe i dteannta leis an Phlean.

1 Tuarascáil an Ghrúpa um Athbhreithniú ar Pholasaí Tuile, OPW, 2004 (www.floodinfo.ie)

2 Treoir faoi mheasúnú agus bainistiú priacal tuile, 2007/60/EC

Táble ES-1 Pobail atá ar Phriacal Dóchúil Suntasach Tuile taobh istigh d'Abhantrach an Loch nEathach An Bhanna

CONTAE	AINM an PHOBAIL	FOINSÍ PRIACAL TUILE
Lú	Áth na gCasán	Abhann & Cósta
Lú	Baile Átha Fhirdhia	Abhann
Lú	Cairlinn & An Grianfort	Abhann & Cósta
Muineachaín	Carraig Mhachaire Rois	Abhann
Lú	Dún Dealgan & Na Creagacha Dubha (Theas)	Abhann & Cósta
Muineachaín	Inis Caoin	Abhann
Muineachaín	Muineachán	Abhann
Lú	Tearmann Feichín	Abhann & Cósta

CUSPÓIRÍ AN PHLEAN

Is é cuspóir foriomlán an Phlean ná tionchair tuilte a bhainistiú agus a laghdú, agus aird ar shochair agus éifeachtaí eile, ar fud réimse leathan earnála, ar a n-áirítear sláinte daoine, an comhshaol, an oidhreacht chultúrtha agus gníomhaíocht eacnamaíoch, trí scéimeanna inmharthana cosanta tuile agus céimeanna eile, bunaithe ar thuiscint chruinn ar phriacal tuile mar atá léirithe in ullmhú mapaí tuile.

Maidir le gach ceann ar leith de na hearnála seo tugadh chun cinn sraith cuspóirí a bhí comhsheasmhach ar bhonn náisiúnta. Tugtar liosta de na cuspóirí ar leith seo agus an tábhacht a bhaineann le gach ceann díobh i Rannán 1.4 den Phlean.

RAON AN PHLEAN

Leagtar amach raon an Phlean thíos:

- ***Raon Spásúil***: Leagann an Plean amach céimeanna inmharthana, scéimeanna cosanta tuile go hiondúil, atá molta chun priacal tuile a bhainistiú agus a laghdú ins na pobail sin a léiriodh tríd an RPT a bheith faoi phriacal dóchúil suntasach tuile. Leagtar amach freisin réimse polasaí agus céimeanna neamhstruchtúrtha, atá in áit nó faoi fhorbairt, a thacaíonn le laghdú agus bainistiú priacal tuile ar fud na hAbhantraí.
- ***Foinsí Priacal Tuile***: Freagraíonn na céimeanna cosanta tuile atá leagtha amach sa Phlean priacal tuile ó na foinsí tuile mar a léiríodh i dTábla ES-1 i bpobal amháin nó níos mó, mar cinneadh tríd an RPT go raibh na foinsí seo dóchúil suntasach ins na pobail seo. Féadfaidh an réimse polasaí agus céimeanna neamhstruchtúrtha tacú le laghdú agus le bainistiú priacal tuile ó fhoinsí uile priacal tuile.
- ***Leibhéal Sonraí***: Leagtar amach sa Phlean na céimeanna atá léirithe mar na céimeanna is cuí ag an phointe seo measúnaithe. Is dearadh imlíneach iad na céimeanna cosanta tuile a leagtar amach sa Phlean; níl siad réidh um thógáil ag an am seo. Beidh gá le dearadh breise mionsonraithe, ar a n-áirítear athbhreithniú ar chostais agus tairbhí, measúnú comhshaoil agus comhairliúchán roimh a bhfeidhmiú.

COMHAIRLIÚCHÁN AGUS PLÉ LE POBAL AGUS LE PÁIRTITHE LEASMHARA

Rinneadh comhairliúchán poiblí ar scála leathan le linn do na mapaí tuile agus na Pleananna a bheith dá n-ullmhú. Cuireadh suíomhanna gréasáin don Chlár MBPTA agus do na Tionscadail ar fáil chun eolas faoin phróiseas iomlán agus faoi na tionscadail bhainteacha a

sholáthar agus chun torthaí na dtionscadal a fhoilsiú (tá an t-eolas a bhí ar fáil ar na suíomhanna gréasáin sin ar fáil anois ag www.floodinfo.ie).

Thionól an OPW breis agus 200 Lá Comhairliúcháin Phoiblí maidir leis na mapaí tuile ins na pobail bhainteacha; bhí deis ag daoine tuilte staitiúla agus cruinneas na mapaí a phlé leis na hinnealtóirí ón OPW agus a gcuid comhairleoirí. Tharla comhairliúchán reachtúil phoiblí faoi na mapaí tuile go déanach sa bhliain 2015. In ullmhú na mapaí críochnaithe tugadh aird ar na tráchtais, tuairimí agus agóidí ó na Laethanta Comhairliúcháin Phoiblí agus ón chomhairliúchán foirmiúil chun eolas áitiúil ar thuilte agus tuairimí an phobail a chuimsiú ins na mapaí.

Tionóladh dhá bhabhta de Laethanta breise Comhairliúcháin Phoiblí ins na pobail maidir leis na roghanna dóchúla agus ansin maidir leis na Dréacht-Phleananna um bainistiú an phriacail tuile. Tionóladh comhairliúchán reachtúil phoiblí eile maidir leis na Dréacht-Phleananna. Breathnaíodh an réimse leathan tuairimí agus aighneachtaí a tháning trí na comhairliúcháin seo agus tugadh san áireamh iad de réir mar ba chuí nuair a bhí na Pleananna dá gcríochnú.

Tiomsaíodh Grúpaí Náisiúnta agus Réigiúnacha Páirtithe Leasmhara chun deis a thabhairt do pháirtithe leasmhara páirt a ghlacadh in ullmhú na mapaí tuile agus na bPleananna. Bhí cruinnithe comhordaithe leis na húdaráis atá freagrach as an Creat-Treoir Uisce a fheidhmiú agus, maidir le habhantracha a roinntear i bpáirt le Tuaisceart Éireann, leis na húdaráis chuí ansin.

Tá cur síos ar na gníomhaíochtaí maidir le comhairliúchán leis an bpobal agus le páirtithe leasmhara i Rannán 4 den Phlean.

MEASÚNÚ TEICNIÚIL

In ullmhú an Phlean bhí anailís agus measúnú forleathan teicniúil chun an priacal tuile a léiríodh tríd an PBT a chinneadh agus ansin chun céimeanna roghnaithe inmharthana um fhreagairt an phriacail a léiriú. Ar an measúnú teicniúil seo bhí:

- ***Suirbhé ón Aer:*** Suirbhé ón aer ar thopagrafaíocht na dtuilemhánna, chun anailís a dhéanamh ar chonas a scaipeann uiscí tuile trasna na dtuilemhánna.
- ***Suirbhé Topagrafaíoch:*** Suirbhé de thalamh ar leagan amach na n-aibhneacha agus na sruthán a ritheann trí na limistéir agus ansin anuas chun na farraige, ar a n-áirítear suirbhéanna ar chruth ghrinill abhann, na bruacha agus na struchtúir atá in aice leis na cainéil nó os a gcionn nó iontu.
- ***Anailís Hidreolaíoch:*** Anailís chun sruthanna tuile isteach agus trí na haibhneacha agus na sruthán a chinneadh, chomh maith leis na géirleibhéil farraige is cúis le tuilte. Bhí tuairiscí ar leibhéil agus srutha stairiúla abhann mar bhonn eolais leis seo, maraon le meastachán ar thionchair dhóchúla athrú aeráide ar shrutha tuile agus géirleibhéil farraige.
- ***Samhaltú Hiodrálach:*** Tugadh chun cinn samhaltuithe ríomhaire de na haibhneacha, srutháin agus tuilemhánna chun leibhéil tuile um shrutha tugtha tuile a mheas agus a fhiosrú conas a rithfeadh agus a leathnódh tuilte ar fud na dtuilemhánna, ag tabhairt aird ar chosanta tuile atá ann cheana. Bhí na samhaltuithe mar bhonn eolais um éifeacht céimeanna dóchúla chun an priacal tuile a bhainistiú agus a laghdú.
- ***Mapáil Tuile:*** Maidir leis na limistéir shamhaltaithe, ullmhaíodh mapaí tuile chun réimse, doimhneacht agus luas srutha na n-uiscí tuile a thaispeáint, chomh maith le réimse mapaí guaise (chun baol agus tionchair dhóchúla tuilte a thaispeáint) agus mapaí Creasa Tuile mar bhonn eolais ar phleanáil agus forbairt inbhuanaithe. Don chás reatha agus don chás amach anseo, ullmhaíodh mapaí ócáidí tuile le réimse dóchúlachtaí

tarlaithe (ó ócáidí le seans 1 as 2 in aon bhliain ar leith, chuig ócáidí le seans 1 as 1000 in aon bhliain ar leith), ag tabhairt aird ar thionchair dhóchúla ón athrú aeráide.

- ***Measúnú Priacail:*** Measúnú ar thionchair dhóchúla tuilte ins na pobail, ag tabhairt san áireamh an díobháil a fhéadfadh tuilte a dhéanamh maidir le tithe cónaithe, sócmhainní pobail agus sochaí, gnóthais, talmhaíocht, bonneagar, an comhshaol agus an oidhreacht chultúrtha áitiúil. Rinneadh measúnú priacail eacnamaíoch (díobháil) chun impleachtaí eacnamaíocha tuilte ins na pobail a chinneadh.
- ***Measúnú agus Breithmheas ar Chéimeanna Dóchúla um Bainistiú Priacal Tuile:*** Rinneadh réimse leathan céimeanna dóchúla um bainistiú priacal tuile ins na pobail a bhí ar phriacal suntasach tuile a fhorbairt, a mheasúnú agus a bhreithmheas chun céim dóchuil roghnaithe a léiriú um a mholadh sa Phlean. Bhí roinnt ceimeanna i gceist anseo:
    - ***Scagadh:*** Measúnú ar mhodhanna dóchúla um bainistiú priacal tuile chun iad san a fhéadfadh bheith éifeachtach agus inmharthana a léiriú.
    - ***Céimeanna Dóchúla Inmharthana a Fhorbairt:*** Cumadh modhanna dóchúla éifeachtacha i gcéimeanna dóchúla; rinneadh iad san a fhorbairt chuig dearadh imlíneach agus ríomhadh an costas dóchúil ar an chéim sin a fheidhmiú agus a chothabháil.
    - ***Breithmheas faoi 'Anailís Ilchritéir' (AI):*** Rinneadh measúnú agus breithmheas ar na céimeanna indéanta trí AI chun a n-éifeacht um bainistiú priacal tuile agus na sochair agis tionchair dhóchúla faoi réimse aidhmeanna ar leith a chinneadh.
    - ***Breithmheas Eacnamaíoch:*** Rinneadh anailís eacnamaíoch costais tairbhe ar na céimeanna indéanta chun inmharthanacht aon chéimeanna molta a chinntiú.
    - ***Plé le Pobail agus le Páirtithe Leasmhara:*** Chuathas i gcomhairle leis na pobail áitiúla, ionadaithe tofa agus páirtithe leasmhara eile san áireamh, chun tuairimí ar aon chéim mholta a ghlacadh ar bord.
    - ***Céimeanna Rognaithe a Léiriú:*** Ceim roghnaithe do na pobail a chinneadh, ag tabhairt aird ar shochair agus ar thionchair eacnamaíocha, comhshaoil agus foriomlána, tuairimí an phobail áitiúil agus páirtithe leasmhara agus costais tuartha na céime.

Maidir le cuid de na pobail, chinn an anailís mionsonraithe teicniúil go bhfuil leibhéal íseal priacal tuile don phobal ó aibhneacha agus/nó an fharraige. Ins na cásanna sin, níorbh fhiú céimeanna um bainistiú priacal tuile (i.e. scéimeanna áitiúla um fhaoiseamh tuile) a fhorbairt dírithe ar na pobail sin ar leith a chosaint. Le haghaidh pobail eile, fuarthas amach nach mbeadh sé indéanta scéimeanna um chosaint tuile a chur chun cnn. Ach féadfaidh polasaithe agus céimeanna neamhstruchtúrtha atá infheidhme ins na limistéir uile an priacal reatha agus dóchúil a bhainistiú agus a laghdú ins na pobail seo.

Tá cur síos ar na measúnaithe teicniúla i Rannáin 5 agus 7 den Phlean.

MEASÚNAITHE COMHSHAOIL

Rinneadh Measúnú Straitéiseach Comhshaoil (MSC) agus, nuair ba ghá, Measúnú Cuí (MC) ar Phleanleibhéal faoin Treoir um Ghnáthóga, chun sochair agus tionchair dhóchúla na bPleananna ar an chomhshaoil a chinneadh, agus chun céimeanna maolaithe agus monatóireachta a léiriú um thionchair dá leithéid a sheachaint nó a íoslaghdú.

Ba chóir a thabhairt faoi deara nach ionann faomhadh an Phlean agus cead a thabhairt um oibreacha fisiciúla ar bith a thógáil. Ní foláir Measúnú Tionchair Chomhshaoil agus Measúnú Cuí ar leibhéal tionscadail a dhéanamh, de réir na reachtaíochta bainteach mar is cuí, mar chuid de chur chun cinn céimeanna molta lena mbaineann oibreacha fisiciúla.

Tá cur síos ar na ceisteanna agus measúnaithe comhshaoil a ndearnadh i Rannán 6 den Phlean.

CÉIMEANNA MOLTA

Tá achoimre ar na céimeanna atá molta sa Phlean, agus na scéimeanna agus oibreacha um bainistiú priacal tuile atá curthe chun cinn nó á moladh trí thionscadail nó pleananna eile, leagtha amach anseo thíos.

Is ar dhearadh imlíneach, nach bhfuil réidh ag an bpointe seo um thógáil, atá na hoibreacha fisiciúla um fhaoiseamh tuile nó 'Scéimeanna' a tugadh chun cinn tríd an Chlár MBPTA. Roimh a bhfeidhmiú, is gá dearadh breise mionsonraithe trí mheasúnú ar leibhéal tionscadail le haghaidh oibreacha dóchúla dá leithéid, ar a n-áirítear suirbhéanna áitiúla, comhairliúchán breise poiblí agus le páirtithe leasmhara agus measúnú comhshaoil.

CÉIMEANNA ATÁ MOLTA SA PHLEAN

Céimeanna is Infheidhmithe do gach Limistéar

Bainistiú Pleanála agus Forbartha Inbhuanaithe: Tá feidhmiú cóir na dTreoirlínte ar an Chóras Pleanála agus Bainistiú Priacal Tuile (RTPRA/OPW, 2009) ag na húdaráis phleanála fíor-riachtanach chun forbairt mhí-oiriúnach i limistéir atá ar phriacal tuile a sheachaint, agus mar sin méadú nach gá ar phriacal tuile a sheachaint amach anseo. Soláthróidh an mhapáil tuile a tháinig tríd an Chlár MBPTA bonn fianaise níos mó um chinntí inbhuanaithe pleanála.

Córais Inbhuanaithe um Dhraenáil Uirbeach (CIDU): De réir na dTreoirlínte ar an Chóras Pleanála agus Bainistiú Priacal Tuile (RTPRA/OPW, 2009), ba cheart do na húdaráis phleanála féachaint chuig cruadhromchlú agus cruaphábháil a laghdú agus teicnící inbhuanaithe draenála a fheidhmiú chun tionchar dóchúil forbartha ar phriacal tuile le sruth anuas a laghdú.

Pleanáil um Oiriúnú: Tar éis don Rialtas an Creat Náisiúnta um Oiriúnú d'Athrú Aeráide a fhaomhadh, is gá do phríomhearnálacha agus do na hÚdaráis Áitiúla pleananna earnála agus áitiúla um oiriúnú a thabhairt chun cinn. Mar sin is gá don OPW plean athchóirithe earnála a ullmhú, a chlúdaíonn an earnáil um bainistiú priacal tuile. Caithfidh earnálacha eile a léirítear sa Chreat agus Údaráis Áitiúla aird a thabhairt ar phriacal tuile nuair atá a gcuid pleananna earnála agus áitiúla um oiriúnú á n-ullmhú acu.

Bainistiú Talamhúsáide agus Bainistiú Nádúrtha Priacal Tuile: Oibreoidh an OPW leis an Ghníomhaireacht um Chaomhnú Comhshaoil, leis na hÚdaráis Áitiúla agus le gníomhaireachtaí eile le linn measúnaithe ar leibhéal tionscadail ar oibreacha fisiciúla agus níos leithne ar leibhéal abhantraí, chun céimeanna ar bith mar chéimeanna nádúrtha um choinneáil uisce a léiriú, a thairbheoidh aidhmeanna faoin Treoir um Chreat Uisce, bainistiú priacal tuile agus bithéagsúlacht.

Scéimeanna um Dhraenáil Artaireach: Tá dualgas reachtúil ar an OPW faoin Acht um Dhraenáil Artaireach 1945, agus Leasú 1995 an Achta sin, cothabháil a dhéanamh ar na Scéimeanna um Dhraenáil Artaireach agus um Fhaoiseamh Tuile a thóg an OPW faoi na hAchtanna sin.

Ceantair Dhraenála: Is ar na hÚdaráis Áitiúla cuí a luíonn an dualgas reachtúil cothabhála maidir leis an 4,600 km de chainéil abhann a thairbhíonn ó na Scéimeanna Ceantair Dhraenála.

Cothabháil Cainéal nach cuid de Scéim iad: Taobh amuigh de na Scéimeanna um Dhraenáil Artaireach agus na Scéimeanna Ceantair Dhraenála, is ar úinéirí talún a bhfuil

cúrsaí uisce ar a gcuid tailte a luíonn cúram a gcothabhála. Tá treoir faoi chearta agus dualgais úinéirí talún, maidir le cothabháil cúrsaí uisce ar a gcuid tailte nó ina gcóngar, ar fáil ag www.flooding.ie.

Réamhaisnéis agus Foláireamh Tuile: Ar 5 Eanáir 2016 chinn an Rialtas ar Sheirbhís Náisiúnta um Réamhaisnéis agus Foláireamh Tuile a bhunú. Pléifidh an seirbhís le réamhaisnéis tuile ó thuilte abhann agus cósta; nuair a bheidh sé ag feidhmiú ina iomlán eiseofar réamhaisnéisí agus foláirimh ginearálta ar scálaí náisiúnta agus abhantraí araon. Tá clár cúig bliana aontaithe chun an seirbhís seo a bhunú.

Pleanáil um Fhreagairt Éigeandála: Tá doiciméad *Bainistiú Straitéiseach Éigeandála (BSE): Struchtúir agus Creat Náisiúnta* á dhréachtadh faoi láthair ag Tascfhórsa Rialtais um Pheanáil Éigeandala. Beidh Caibidil ann maidir le Téarnamh, a chuimseoidh conas a phléifear le cistiú um éigeandálacha, agus um chostais téarnaimh ach go háirithe, amach anseo.

Díonacht Aonair agus Phobail a Chothú: Tá taighde ar bun ag an Roinn Tithíochta, Pleanála agus Rialtais Áitiúil (RTPRA) maidir le conas is féidir Díonacht Phobail a chur chun cinn mar chuid den athbhreithniú foriomlán ar an Chreat um Bhainistiú Móréigeandála.

Cosaint Mhaoine Aonair: Tá dhá scéim phíolótach um Chosaint Mhaoine Aonair (CMA) ar bun faoi láthair agus beidh a dtorthaí seo mar bhonn eolais don Rialtas maidir le tacú indéanta ar bith a fhéadfaí a sholáthar do mhaojne atá ar phriacal.

Bailiú Sonraí maidir le Tuilte: Tá bailiú sonraí ar thuilte agus, nuair is cuí, a bhfoilsiú, ar siúl ar bhonn leanúnach; is céim í seo a chuideoidh um ullmhú agus um fhreagairt ar thuiliú.

Athlonnú Deonach Tí Cónaithe: Ins na cúinsí is géire, féadfaidh an priacal tuile do theach cónaithe a bheith chomh mór sin go gceapfadh úinéir an tí nach bhfuil sé inbhuanaithe fanacht ann agus go gcinnfeadh sé ar athlonnú. Ar 11 Aibreán 2017 d'aontaigh an Rialtas na socruithe riaracháin do Scéim aonuaire um Athlonnú Deonach d'Úinéirí Tí Cónaithe, maidir leis na príomhthithe cónaithe sin a bhí faoi thuile le linn na tréimhse ó 4 Nollaig 2015 go 13 Eanáir 2016.

Céimeanna ar Leibhéal Abhantraí / Fo-Abhantraí

Ní bhfuarthas aon chéimeanna indéanta ar leibhéal abhantraí / fo-abhantraí don Abhantrach seo.

Céimeanna ar Leibhéal Pobail

Do na pobail seo a leanas, moltar sa Phlean go dtabharfar scéim um fhaoiseamh tuile chun cinn chuig forbairt agus measúnú ar leibhéal tionscadail, ar a n-áirítear measúnú comhshaoil mar is gá agus tuilleadh comhairliúcháin phoiblí, um mionchoigeartú agus ullmhú um a phleanáil agus a thaispeáint agus, más agus nuair is cuí, um fheidhmiú:

- Baile Átha Fhirdhia
- Na Creagacha Dubha (Theas)
- Cairlinn & An Grianfort
- Dún Dealgan
- Inis Caoin
- Muineachán

Do na pobail seo a leanas rinneadh scrúdú ar chéimeanna struchtúrtha dóchúla indéanta um fhaoiseamh tuile dar léiríodh scéim um fhaoiseamh tuile atá inmharthana ar bhonn teicniúil.

Ach beidh gá le measúnú níos mionsonraithe ar chostais agus ar thairbhí a chríochnú um a chinneadh an bhfuil an Scéim atá molta indéanta:

- Áth na gCasán
- Tearmann Feichín

Scéimeanna agus Oibreacha um Fhaoiseamh Tuile atá Tugtha Chun Cinn nó Molta trí Thionscadail nó trí Phleananna Eile

Tá oibreacha faoi thógáil cheana féin maidir le Claífort Bhaile na Lorgan.

Tá Staidéár um Measúnú Priacal Tuile críochnaithe maidir le Dún Léire.

Tá an Staidéar ar Chreimeadh Cósta Lú críochnaithe.

FEIDHMIÚ, MONATÓIREACHT AGUS ATHBHREITHNIÚ AN PHLEAN

Is gá infheistíocht chaipitiúil suntasach chun na céimeanna uile, mar atá leagtha amach sa Phlean seo agus ins na Pleananna uile, a fheidhmiú. Mar sin is gá tosaíocht a thabhairt don infheistíocht is gá chun an sraith náisiúnta de chéimeanna molta a fheidhmiú.

I dteannta le foilsiú an Phlean seo agus na bPleananna eile, fógraíodh an chéad sraith d'oibreacha cosanta tuile dar tugadh tosaíocht dóibh atá leagtha amach sa Phlean seo agus san 28 bPlean eile. Oibreoidh an OPW agus na hÚdaráis Áitiúla go dlúth lena chéile chun feidhmiú éifeachtach na dtionscadail tosaigh seo a thabhairt chun críche agus ina dhiaidh sin ar na tionscadail eile.

Léirítear sa Phlean an dream/na dreamanna atá freagrach as feidhmiú na gcéimeanna molta um bainistiú priacal tuile ar bhonn tosaíochta mar atá leagtha amach thuas.

Is é an tAire Stáit le cúram speisialta um Oifig na nOibreacha Poiblí agus Faoiseamh Tuile atá ina Chathaoirleach ar an An Ghrúpa Idir-Rannach um Chomhordú Pholasaí Tuile. Is é an Grúpa seo a chomhordaíonn agus a dhéanann monatóireacht ar dhul chun cinn maidir le feidhmiú na moltaí atá leagtha amach in Athbhreithniú Pholasaí Tuile an Rialtais 2004, ar a n-áirítear na céimeanna atá leagtha amach ins na Pleananna.

Is don tréimhse 2018-2021 na Pleananna seo. Athbhreithneoidh an OPW agus páirtithe leasmhara eile iad, maidir leis an dul chun cinn atá déanta, agus déanfar iad a uasdhátú in 2021.

EXECUTIVE SUMMARY

INTRODUCTION

This is the Flood Risk Management Plan (the 'Plan') for the Neagh Bann River Basin. A description of the River Basin is provided in Section 2 of the Plan.

The purpose of the Plan is to set out the strategy, including a set of proposed measures, for the cost-effective and sustainable, long-term management of flood risk in the River Basin, including the areas where the flood risk has been determined as being potentially significant.

This Plan, which is for the period of 2018-2021, is one of 29 Plans being published; each setting out the feasible range of flood risk management measures proposed for their respective River Basins. The preparation of these Plans represents a significant milestone in the implementation of Government policy on flood risk management, as set out in the Report of the Flood Policy Review Group (OPW, 2004[3]), and addresses Ireland's obligations under the 2007 EU 'Floods' Directive (EU, 2007[4]).

The Plan includes feasible measures developed through a range of programmes and policy initiatives including:

- Non-structural flood risk prevention and preparedness measures that are applicable nationally, aimed at reducing the impacts of flooding, that have been and are being developed to implement Government policy on flood risk management (OPW, 2004).

- Structural flood protection measures proposed for communities at significant flood risk, aimed at reducing the likelihood and/or degree of flooding, identified through the National Catchment Flood Risk Assessment and Management (CFRAM) Programme.

The CFRAM Programme has examined the flood risk, and possible measures to address the risk, in 300 communities throughout the country at potentially significant flood risk. These communities were identified through the Preliminary Flood Risk Assessment (PFRA - See Section 3 of the Plan), which was a national screening assessment of flood risk. The communities identified through the PFRA process as being at potentially significant flood risk in the Neagh Bann River Basin are listed in Table ES-1 below, along with the sources of flood risk that were deemed to be significant for each community. A set of flood maps, indicating the areas prone to flooding, has been developed and published for each of the communities.

The Plan builds on and supplements the national programme of flood protection works completed previously, that are under design and construction at this time or that have been set out through other projects or plans, and the ongoing maintenance of existing drainage and flood relief schemes.

A Strategic Environmental Assessment, and an Appropriate Assessment under the Habitats Directive where appropriate, have been undertaken as part of the preparation of, and have been published with, the Plan.

[3] Report of the Flood Policy Review Group, OPW, 2004 (www.floodinfo.ie)

[4] Directive on the assessment and management of flood risks, 2007/60/EC

Table ES-1 Communities at Potentially Significant Flood Risk within the Neagh Bann River Basin

COUNTY	COMMUNITY NAME	SOURCE(S) OF FLOOD RISK
Louth	Annagassan	Fluvial & Coastal
Louth	Ardee	Fluvial
Louth	Carlingford & Greenore	Fluvial & Coastal
Monaghan	Carrickmacross	Fluvial
Louth	Dundalk & Blackrock South	Fluvial & Coastal
Monaghan	Inniskeen	Fluvial
Monaghan	Monaghan	Fluvial
Louth	Termonfeckin	Fluvial & Coastal

OBJECTIVES OF THE PLAN

The overall objective of the Plan is to manage and reduce the potential consequences of flooding, recognising other benefits and effects across a broad range of sectors including human health, the environment, cultural heritage and economic activity, through viable flood protection schemes and other measures informed by a sound understanding of the flood risk established through the preparation of flood maps.

A nationally consistent set of specific objectives relating to each of these sectors was developed for the preparation of the Plans. These specific objectives and the importance given to each are listed in Section 1.4 of the Plan.

SCOPE OF THE PLAN

The scope of the Plan is set out below:

- ***Spatial Scope***: The Plan sets out viable measures, typically flood protection schemes, proposed to manage and reduce flood risk in the communities that were identified through the PRFA as being at potentially significant flood risk. The Plan also sets out a range of non-structural policies and measures, which are in place or under development, that contribute to the reduction and management of flood risk throughout the River Basin.
- ***Sources of Flood Risk***: The flood protection measures that are set out in the Plan address flood risk from the sources of flooding as identified in Table ES-1 in one or more communities, as these sources were determined through the PFRA to be potentially significant in these communities. The range of non-structural policies and measures set out in the Plan can contribute to the reduction and management of flood risk from all sources of flood risk.
- ***Level of Detail***: The Plan sets out the measures that have been identified as the most appropriate at this stage of assessment. The flood protection measures set out in the Plan are to an outline design, and are not at this point ready for construction. Further detailed design, including a review of costs and benefits, environmental assessment, and consultation will be required for such works before implementation.

PUBLIC AND STAKEHOLDER CONSULTATION AND ENGAGEMENT

Extensive public consultation has been undertaken throughout the preparation of the flood maps and the Plans. Websites for the CFRAM Programme and Projects were also maintained

throughout the process to provide information on the overall process and the relevant projects and to provide access to project outputs (the information that was available from these websites is now available through www.floodinfo.ie).

Over 200 Public Consultation Days were held by the OPW in or near the relevant communities in relation to the flood maps, where residents and the engineers of the OPW and its consultants could discuss past floods and the accuracy of the maps. A statutory public consultation on the draft maps was also undertaken late in 2015. The preparation of the final maps have taken the comments, observations and objections from the Public Consultation Days and formal consultation on board to reflect the local knowledge of flooding and people's views of the maps.

Two rounds of further Public Consultation Days were held in or near the communities in relation to potential options and then the Draft Plans for managing the flood risk. A further statutory public consultation was held in relation to the Draft Plans. The extensive comments and submissions made through these consultations have all been considered and taken into account as appropriate in finalising the Plans.

National and Regional Stakeholder Groups were formed to provide an opportunity for input by stakeholders to participate in the preparation of the flood maps and the Plans. Coordination and engagement meetings were held with the authorities responsible for implementing the Water Framework Directive and, for river basins that are shared with Northern Ireland, with the relevant authorities in the North.

The public and stakeholder consultation and engagement activities are described in Section 4 of the Plan.

TECHNICAL ASSESSMENT

The preparation of the Plan has involved extensive technical analysis and assessment to determine the flood risk in the communities identified through the PFRA, and then to identify preferred, viable measures to address the risk. This technical assessment has included:

- ***Aerial Survey:*** Airborne survey of the physical topography of the floodplains to facilitate an analysis of how flood waters spread across the floodplains.
- ***Topographical Survey:*** Ground-based survey of the geometry of the rivers and streams running through the communities, between the communities and then down to the sea, including surveys of the shape of the river bed and banks and of structures in, over or alongside the channels.
- ***Hydrological Analysis:*** An analysis to determine flood flows into and through the rivers and streams, and extreme sea levels that can cause flooding. This analysis has been informed by records of past river levels and flows and an estimation of the potential impacts of climate change on flood flows and extreme sea levels.
- ***Hydraulic Modelling:*** The development of computer models of the rivers, streams and floodplains to determine the flood levels for given flood flows and how floods would flow and spread over the floodplains, taking into account existing flood defences. The models informed the assessment of the effectiveness of possible measures to manage and reduce the flood risk.
- ***Flood Mapping:*** The preparation of flood maps to indicate the extent, depth, flow velocity (speed) of flood-waters and a range of risk maps (showing the potential dangers and impacts of flooding) for the modelled areas, along with Flood Zone maps to inform sustainable planning and development. Maps of flood events with a range of likelihoods of occurrence (from events with a 1 in 2 chance of occurring in any year, to those with a

1 in a 1000 chance in any year) have been developed for the current scenario and for future scenarios taking into account the potential impacts of climate change.

- ***Risk Assessment:*** An assessment of the potential impacts of flooding in the communities, taking account of the homes, community and society assets, businesses, agriculture, infrastructure, the environment and the local cultural heritage that could be damaged by flooding. An economic risk (damage) assessment was undertaken to determine the economic implications of floods in the communities.
- ***Assessment and Appraisal of Possible Flood Risk Management Measures:*** The development, assessment and appraisal of a wide range of possible measures to manage flood risk in the communities at significant flood risk to identify a potentially preferred measure to be proposed in the Plan. This involved a number of steps:
  - ***Screening:*** The assessment of possible methods to manage flood risk to identify those that might be effective and potentially viable.
  - ***Development of Potentially Viable Measures:*** Potentially effective methods were formed into possible measures, which were then developed to outline design, and the likely cost of implementing and maintaining the measure calculated.
  - ***Appraisal by 'Multi-Criteria Analysis' (MCA):*** The possible measures were assessed and appraised through a MCA to determine their effectiveness in reducing flood risk and their potential benefits and impacts across the range of specific objectives.
  - ***Economic Appraisal:*** The possible measures were also subject to an economic cost-benefit analysis to ensure the viability of any proposed measures.
  - ***Public and Stakeholder Engagement:*** The local communities, including elected representatives and other stakeholders, were consulted with to take on board views and opinions on any proposed measure for the community it would protect.
  - ***Identification of Preferred Measures:*** Determination of a preferred measure for the communities, taking account of the economic, environmental and overall benefits and impacts, the observations of the local community and stakeholders and the foreseen costs of the measure.

For some communities, the detailed technical analysis has determined that there is currently a low level of flood risk to the community from rivers and/or the sea. In such cases, the development of flood risk management measures aimed specifically at protecting such communities (i.e. local flood relief schemes) was not merited. For some other communities, it was found that it would not be feasible to progress flood protection schemes However, the non-structural policies and measures applicable across all areas can reduce and manage the existing and potential future risk in these communities.

The technical assessments are described in Sections 5 and 7 of the Plan.

ENVIRONMENTAL ASSESSMENTS

The Plans have been subject to Strategic Environmental Assessment (SEA), and, where necessary, Plan-level Appropriate Assessment (AA) under the Habitats Directive, to determine the potential benefits and impacts of the Plans on the environment, and to identify mitigation and monitoring measures necessary to avoid or minimise such impacts.

It should be noted that approval of the Plan does not confer consent to the construction of any physical works. Environmental Impact Assessment and Project-level Appropriate Assessment must be undertaken in accordance with the relevant legislation where relevant as part of the progression of proposed measures that involve physical works.

The environmental issues and assessments undertaken are described in Section 6 of the Plan.

PROPOSED MEASURES

A summary of the measures proposed in the Plan and the flood relief schemes and works that have been progressed or proposed through other projects or plans are set out below.

The proposed physical flood relief works or 'Schemes' set out in the Plans that have been developed through the CFRAM Programme are to an outline design, and are not at this point ready for construction. Further detailed design through a project-level of assessment will be required for such potential works before implementation, including local surveys, further public and stakeholder consultation and environmental assessment.

MEASURES PROPOSED IN THE PLAN

Measures Applicable for all Areas

Sustainable Planning and Development Management: The proper application of the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009) by the planning authorities is essential to avoid inappropriate development in flood prone areas, and hence avoid unnecessary increases in flood risk into the future. The flood mapping produced through the CFRAM Programme will provide an even greater evidential basis for sustainable planning decisions.

Sustainable Urban Drainage Systems (SUDS): In accordance with the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009), planning authorities should seek to reduce the extent of hard surfacing and paving and require the use of sustainable drainage techniques to reduce the potential impact of development on flood risk downstream.

Adaptation Planning: Following approval by Government of the National Climate Change Adaptation Framework key sectors and Local Authorities are required to develop sectoral and local adaptation plans. This will require a revised sectoral plan to be prepared by the OPW, covering the flood risk management sector. Other sectors identified in the Framework and Local Authorities will also be required to take account of flood risk when preparing their own sectoral and local adaptation plans.

Land Use Management and Natural Flood Risk Management: The OPW will work with the Environment Protection Agency, Local Authorities and other agencies during the project-level assessments of physical works and more broadly at a catchment-level to identify any measures, such as natural water retention measures, that can have benefits for Water Framework Directive, flood risk management and biodiversity objectives.

Arterial Drainage Schemes: The OPW has a statutory duty under the Arterial Drainage Act, 1945, and the Amendment of the Act, 1995, to maintain the Arterial Drainage and Flood Relief Schemes constructed by it under those Acts.

Drainage Districts: The statutory duty of maintenance for 4,600 km of river channel benefitting from Drainage District Schemes rests with the relevant Local Authorities.

Maintenance of Channels not part of a Scheme: Outside of the Arterial Drainage and Drainage District Schemes, landowners who have watercourses on their lands have a responsibility for their maintenance. Guidance to clarify the rights and responsibilities of landowners in relation to the maintenance of watercourses on or near their lands is available at www.flooding.ie.

Flood Forecasting and Warning: A Government decision was taken on 5 January 2016 to establish a National Flood Forecasting and Warning Service. The service will deal with flood forecasting from fluvial (river) and coastal sources and when fully operational will involve the issuing of flood forecasts and general alerts at both national and catchment scales. A 5-year programme has been agreed to oversee the establishment of this new service.

Emergency Response Planning: A Government Task Force on Emergency Planning is currently drafting a *Strategic Emergency Management (SEM): National Structures and Framework* document. This is to include a Chapter on Recovery to include how funding for emergencies, particularly recovery costs, may be handled in the future.

Promotion of Individual and Community Resilience: The Department of Housing, Planning & Local Government (DHPLG) is researching how Community Resilience may be advanced as part of the overall review of the Framework of Major Emergency Management.

Individual Property Protection: The outcomes of two Individual Property Protection (IPP) pilots currently underway will inform the Government on any feasible support it could provide to at risk properties.

Flood-Related Data Collection: The ongoing collection and, where appropriate, publication of flood-related data is a measure that will help to continually improve preparation for, and response to, flooding.

Voluntary Home Relocation: In extreme circumstances, the flood risk to a home may be such that the homeowner may consider that continuing to live in the property is not sustainable and would choose to relocate. On 11 April 2017, the Government agreed the administrative arrangements for a once-off Homeowners Voluntary Relocation Scheme for those primary residential properties that flooded during 4 December 2015 to 13 January 2016.

Catchment / Sub-Catchment-Level Measures

No catchment / sub-catchment-level measures were found to be feasible for this River Basin.

Community-Level Measures

For the following communities, it is proposed in the Plan that a flood relief scheme is progressed to project-level development and assessment, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation:

- Ardee
- Blackrock South
- Carlingford & Greenore
- Dundalk
- Inniskeen
- Monaghan

Potentially viable structural flood relief measures have been investigated for the following communities for which a technically viable flood relief scheme has been identified. However, a more detailed assessment of the costs and benefits will need to be completed to determine if the proposed Scheme is feasible:

- Annagassan
- Termonfeckin

Flood Relief Schemes and Works Progressed or Proposed through Other Projects or Plans

There are works already in construction for the Bellurgan Embankment.

A Flood Risk Assessment Study has been completed for Dunleer.

The Louth Coastal Erosion Study has been completed.

IMPLEMENTATION, MONITORING AND REVIEW OF THE PLAN

Implementing all of the measures, set out in this and all Plans, requires a significant capital investment. It has therefore been necessary to prioritise the investment required to implement the national set of proposed measures.

A prioritised initial tranche of flood protection works set out within this and the 28 other Plans to be advanced to the more detailed project level of assessment has been announced in conjunction with the publication of this and the other Plans. The OPW and Local Authorities will work closely to bring about the effective implementation of these initial projects and then subsequent projects.

The Plan identifies the body/bodies responsible for implementing the proposed flood risk management measures in a prioritised manner as above.

The Minister of State with special responsibility for the Office of Public Works and Flood Relief chairs the Interdepartmental Flood Policy Co-ordination Group. This Group co-ordinates and monitors progress in the implementation of the recommendations set out in the Government's 2004 Flood Policy Review, including the measures set out in the Plans.

These Plans are for the period 2018 - 2021. They will be reviewed in terms of progress made and be updated by the OPW and other stakeholders in 2021.

CONTENTS

1 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

This is the Flood Risk Management Plan (the 'Plan') for the Neagh Bann (UoM06) River Basin.

The purpose of the Plan is to set out the strategy, including a set of measures, for the cost-effective and sustainable, long-term management of flood risk in the Neagh Bann River Basin, including the areas where the flood risk has been determined as being potentially significant. The Plan includes feasible measures developed through a range of programmes or policy initiatives including:

- Non-structural flood risk prevention and preparedness measures that are applicable nationally, aimed at reducing the impacts of flooding, to implement the recommendations of the Report of the Flood Policy Review Group, 2004[1].
- Structural flood protection measures for communities at significant flood risk, aimed at reducing the likelihood and/or degree of flooding, identified through the National Catchment Flood Risk Assessment and Management (CFRAM) Programme.

The Plan builds on and supplements the programme of flood protection works completed previously, that are under design and construction at this time or that have been set out through other projects or plans, and the ongoing maintenance of existing drainage and flood relief schemes.

The Objectives and scope of the Plan are set out in Sections 1.4 and 1.5 respectively.

This Plan is one of 29 Plans being published; each setting out the feasible range of flood risk management measures for their respective River Basins. The preparation of these Plans is a central part of the implementation of Government policy on flood risk management (OPW, 2004), and meets Ireland's obligations under the 2007 EU 'Floods' Directive (EU, 2007[2]). A Strategic Environmental Assessment, and an Appropriate Assessment under the Habitats Directive, have been undertaken as part of the preparation of the Plan.

The Government's National Development Plan 2018-2027 has provided the capital envelope for a prioritised programme of investment for the advancement and implementation of ongoing flood relief projects and the flood protection measures set out within this and the 28 other Plans.

1.2 FLOODING AND FLOOD RISK

Flooding is a natural event that can happen at any time in a wide variety of locations.

Flood ***hazard*** is the potential threat posed by flooding to people, property, the environment and our cultural heritage. Flooding only presents a ***risk*** however when people, property, businesses, farms, infrastructure, the environment or our cultural heritage can be potentially impacted or damaged by floods.

Flood risk is the combination of the probability of flood events of different magnitudes and the degree of the potential impact or damage arising from a flood.

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1 Report of the Flood Policy Review Group, OPW, 2004 (www.floodinfo.ie)

2 Directive on the assessment and management of flood risks, 2007/60/EC

1.2.1 Types and Causes of Flooding

Flooding can occur from a range of sources, individually or in combination, including:

- Coastal flooding (from the sea or estuaries)
- Fluvial flooding (from rivers or streams)
- Pluvial flooding (from intense rainfall events and overland flow)
- Groundwater flooding (typically from turloughs in Ireland)
- Other sources, such as from water-bearing infrastructure

A description of each of these sources of flooding is provided in Appendix A.

1.2.2 Impacts of Flooding

Flooding can cause damage, loss or harm in a number of ways, including:

- Impacts of people and society, including physical injury, illness, stress and even loss of life.
- Damage to property, such as homes and businesses.
- Damage to, and loss of service from, Infrastructure (such as water supply or roads).
- Impacts on the environment, such as damage or pollution of habitats.
- Damage to our cultural heritage, such as monuments and historic buildings.

A description of each of these potential impacts of flooding is provided in Appendix A.

1.2.3 Potential Impacts of Future Change

Climate change is likely to have a considerable impact on flood risk in Ireland, such as through rising mean sea levels, increased wave action and the potential increases in winter rainfall and intense rainfall events. Land use change, for example through new housing and other developments, can also increase potential future flood risk.

1.3 BACKGROUND

1.3.1 Flood Policy and Legislative Background

Flood risk to urban areas in Ireland has been addressed, since the 1995 Amendment to the Arterial Drainage Act (1945), through the use of structural or engineered solutions (flood relief schemes). In line with internationally changing perspectives, the Government adopted a new policy in 2004 that shifted the emphasis in addressing flood risk towards:

- A catchment-based context for managing risk and the identification of solutions to manage existing and potential risks.
- More pro-active flood hazard and risk assessment and management, with a view to avoiding or minimising future increases in risk, e.g., from development on floodplains.
- Increased use of non-structural and flood impact mitigation measures.

Notwithstanding this shift, engineered solutions to manage existing and potential future risks will continue to form a key component of the overall national flood risk management programme and strategy.

Specific recommendations arising from the policy review included:

– the preparation of flood maps, and,

– the preparation of flood risk management plans.

A further influence on the management of flood risk in Ireland is the EU ‘Floods’ Directive [2007/60/EC]. The aim of this Directive is to reduce the adverse consequences of flooding on human health, the environment, cultural heritage and economic activity. The 'Floods' Directive was transposed into Irish law by Statutory Instrument SI No. 122 of 2010[3] and amended by SI No. 495 of 2015[4].

Under the 'Floods' Directive, Ireland, along with all other Member States, are required to undertake a Preliminary Flood Risk Assessment (PFRA) to identify areas of potentially significant flood risk (referred to in Ireland as Areas for Further Assessment, or 'AFAs'), and then for these areas to prepare flood maps in relation to the sources of flood risk deemed to be significant. Ireland is then required to prepare Plans for each River Basin, focussed on managing and reducing the risk within the AFAs. The PFRA, flood maps and the Plans need to be reviewed on a 6-yearly cycle.

1.3.2 Competent and Responsible Authorities for the 'Floods' Directive

The Office of Public Works (OPW) was designated following the Government approval of the Report of the Flood Policy Review Group (OPW, 2004) as the lead agency for flood risk management in Ireland. As lead agency, the OPW was designated as the Competent Authority under SI No. 122 of 2010 for the implementation of the Directive.

The following authorities may be designated by the OPW under SI Nos. 122 of 2010 and 495 of 2015 as being responsible for the implementation of key requirements of the EU 'Floods' Directive (Preliminary Flood Risk Assessment, preparation of flood maps, and identification of flood risk management measures) with respect to infrastructure for which they have responsibility:

– All local authorities

– Electricity Supply Board (ESB)

– Waterways Ireland

– Irish Water

1.3.3 The 'CFRAM' Programme

The purpose of the CFRAM Programme is to assess the existing fluvial and coastal flood risk, and the potential increase in risk due to climate change, ongoing development and other pressures that may arise in the future, and develop a Plan setting out a sustainable, long-term strategy to manage this risk. The OPW in conjunction with the CFRAM Study Consultants (the 'Consultants', being RPS for the Neagh Bann River Basin), are undertaking the National Catchment-based Flood Risk Assessment and Management (CFRAM) Programme.
The objectives of the CFRAM Programme are to:

– Identify and map the existing and potential future fluvial and coastal flood hazard and flood risk in the Areas for Further Assessment (AFAs).

– Identify viable structural and non-structural options and measures for the effective and sustainable management of flood risk in the AFAs.

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3 SI No. 122 of 2010 (http://www.irishstatutebook.ie/eli/2010/si/122/made/en/pdf)

4 SI No. 495 of 2015 (http://www.irishstatutebook.ie/eli/2015/si/495/made/en/pdf)

- Prepare a set of Plans, and associated Strategic Environmental and Habitats Directive (Appropriate) Assessments, that sets out the proposed strategies, measures and actions that should be pursued by the relevant bodies, including the OPW, local authorities and other Stakeholders, to achieve the most cost-effective and sustainable management of existing and potential future flood risk, taking account of environmental plans, objectives and legislative requirements and other statutory plans and requirements.

The CFRAM Programme has been implemented for seven large areas called River Basin Districts (RBDs) that cover the whole country. Each RBD is then divided into a number of River Basins (Units of Management, or 'UoMs'), where one Plan has been prepared for each River Basin. A map of the RBDs and the UoMs is provided in Figure 1.1.

The CFRAM Programme is focused on a number of areas where the risk has been determined through the PFRA to be potentially significant, which are referred to as Areas for Further Assessment, or 'AFAs', and on the sources of flooding within these areas that were determined to be the cause of significant risk.

Further details on the CFRAM Programme can be found on the OPW website: www.floodinfo.ie.

1.3.4 Pilot CFRAM Projects

Following the adoption of the new policy by Government in 2004, the OPW commenced a series of pilot CFRAM Projects to test and develop the approach before rolling-out the Programme nationally. None of the pilot CFRAM projects were located within the Neagh Bann River Basin.

1.3.5 Other Relevant Flood Risk Management Projects

The National CFRAM Programme is delivering on the requirements of the Government Policy and the EU 'Floods' Directive for most of the AFAs. In some areas however, other parallel or preceding projects have delivered on these requirements. In relation to this Plan, these projects are:

- Dunleer Flood Study
- Louth Coastal Erosion Study

The process undertaken in preparing the flood maps and/or determining suitable flood risk management options under these projects would be generally similar to those undertaken for the CFRAM Programme, and are set out in the project reports available from the relevant project website.

This Plan includes the measures undertaken or proposed through the above Projects, including an update on their current status.

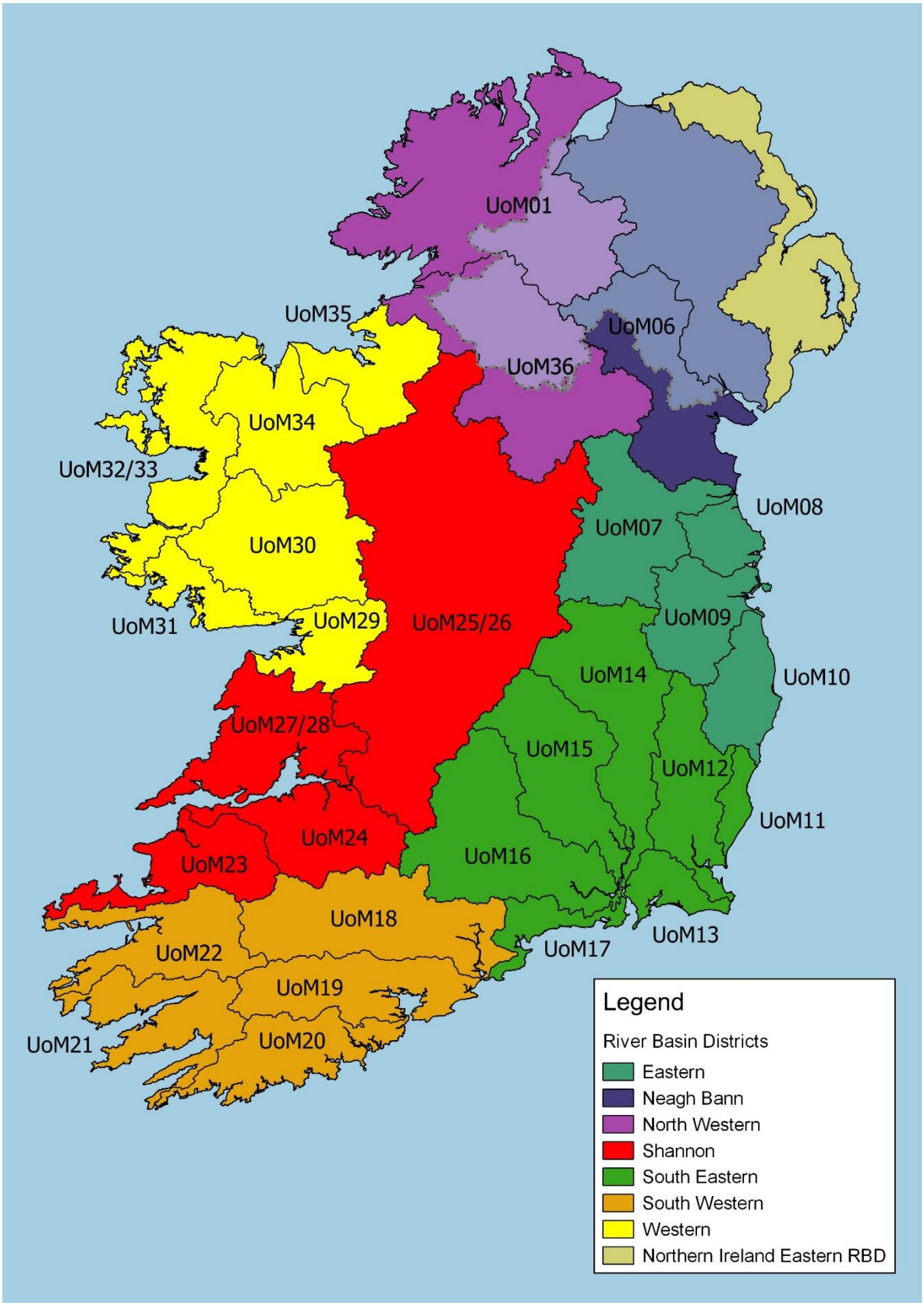

Figure 1.1: River Basin Districts (RBDs) and River Basins (UoMs) in Ireland

1.3.6 Other Relevant Policies and Plans

The 2004 Report of the Flood Policy Review Group and SI Nos. 122 and 495 of 2010 and 2015 respectively are the policy and legislation that directly relate to the preparation of this Plan. However, a wide range of legislation, policies and plans are relevant to, or may be impacted by, this Plan. The relevant legislation, policies and plans (as of June 2017) are listed in Table 1.1.

Table 1.1 Legislation, Policies and Plans Relevant to the Plan

Legislation / Policy / Plan	Description
Legislation	
Arterial Drainage Act, 1945, and Amendment Act, 1995	Acts empowering the Commissioners of Public Works to implement Arterial Drainage Schemes (1945) and Flood Relief Schemes (1995), which must then be maintained.
Commissioners of Public Works (Functions and Powers) Act, 1996	Act to make further provision in relation to the functions and powers of the Commissioners of Public Works including in relation to flooding. The Minor Works Programme (to fund local authorities to implement local flood relief schemes) is an administrative scheme operated by the OPW under its general powers and functions to make schemes to address flood risk.
Coast Protection Act, 1963	Act to provide for the making and execution of coast protection schemes and to provide for other matters connected with the matters aforesaid.
Local Government (Works) Act, 1949	Enables local authorities to execute works affording relief or protection from flooding
SI Nos. 122 and 495 of 2010 and 2015	Transposing Instruments for the EU 'Floods' Directive - European Communities (Assessment and Management of Flood Risks) Regulations 2010 & 2015
SI Nos. 722 and 350 of 2003 and 2014,	Transposing Instruments for the EU Water Framework Directive: - European Communities (Water Policy) Regulations, 2003 & 2014
SI Nos. 435 and 200 of 2004 and 2011	Transposing Instruments for the EU Strategic Environmental Assessment Directive: - European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2004 & 2011
SI No. 477 of 2011	Transposing Instruments for the EU Birds and Habitats Directives: - European Communities (Birds and Natural Habitats) Regulations 2011
Planning and Development Act, 2000 (No. 30 of 2000) and associated regulations	Principal Planning Act (and amendments) - Planning and Development Regulations 2001 to 2015 Provides for the adoption of Guidelines under Section 28 Sets out planning requirements for certain flood relief works by local authorities
Climate Action and Low Carbon Development Act, 2015	Provides for the making of a National Adaptation Framework to specify the national strategy for the application of adaptation measures in different sectors and by local authorities to reduce the vulnerability of the State to the negative effects of climate change, including potential increases in flood risk.

Policies	
Report of the Flood Policy Review Group, 2004	Report, approved by Government in September 2004, that sets out recommendations for flood risk management policy in Ireland, including roles and responsibilities.
Guidelines on the Planning System and Flood Risk Management, 2009	Guidelines published under Section 28 of the Planning and Development Acts that provide a transparent and robust framework for the consideration of flood risk in planning and development management.
Major Emergency Management Framework, 2006	Sets out common arrangements and structures for front line public sector emergency management in Ireland to facilitate the co-ordination of the individual response efforts of the Principal Response Agencies to major emergencies.
National Adaptation Framework, 2012 & 2018	Set out Government policy for addressing climate change adaptation in Ireland, focusing on key climate sensitive sectors and mandating certain Government Departments, other public sector bodies and Local Authorities to prepare sectoral and local climate change adaptation plans. A new statutory Framework was introduced in January 2018 under the Climate Action and Low Carbon Development Act, 2015.
Plans	
Climate Change Sectoral Adaptation Plan for Flood Risk Management, 2015	Sets out the policy on climate change adaptation of the OPW, the lead agency for flood risk management in Ireland, based on a current understanding of the potential consequences of climate change for flooding and flood risk in Ireland, and the adaptation actions to be implemented by the OPW and other responsible Departments and agencies in the flood risk management sector. A revised statutory Sectoral Adaptation Plan will be prepared under the 2018 National Adaptation Framework.
National Spatial Strategy, 2002 - 2020	A 20-year coherent national planning framework for Ireland that aims to achieve a better balance of social, economic and physical development across Ireland, supported by more effective and integrated planning.
National Landscape Strategy for Ireland (Draft) 2014 – 2024	Strategy for the provision of a framework for the protection of the many cultural, social, economic and environmental values embedded in the landscape.
River Basin Management Plans, 2010	Plans (RBMPs) prepared under the Water Framework Directive (2000/60/EC) that summarise the waterbodies that may not meet the environmental objectives of the WFD and identify which pressures are contributing to the environmental objectives not being achieved. The plans describe the classification results and identified measures that can be introduced in order to safeguard waters and meet the environmental objectives of the WFD. • Neagh Bann International River Basin District - River Basin Management Plan: 2009 – 2015 • SEA for the WFD River Basin Management Plans and Programmes of Measures - Neagh Bann iRBD (2009) The second cycle (2018-2021) represents a new approach to river basin management planning. Ireland is now taking a single river basin district approach with a much improved evidence base to underpin decision making at both national and local level • River Basin Management Plan for Ireland (2018-2021) (Draft) • SEA for the Draft River Basin Management Plans for Ireland (2018-2021)

Regional Planning Guidelines	Planning strategies at the regional level to provide the link between the national and local planning frameworks, which work within the overall approach taken in the NSS, while providing more detail and establishing a development and spatial framework that can be used to strengthen local authority development plans and other planning strategies at county, city and local level. • Regional Planning Guidelines for the Northern and Western 2010-2022, (Regional Planning Guidelines Office, 2010) • Regional Planning Guidelines for the Midland 2010-2022, (Regional Planning Guidelines Office, 2010)
Development Plans	The development plan sets the agenda for the development of the local authority's area over its six year lifespan. Development, whether it be residential, industrial, commercial or amenity, must generally take place in accordance with the development plan. The plan is therefore a blueprint for the economic and social development of the city, town or county for which it has been made. • Cavan County Development Plan 2014-2020 (Cavan County Council, 2014) • Monaghan County Development Plan 2013-2019 (Monaghan County Council, 2013) • Louth County Development Plan 2015-2021 (Louth County Council, 2015) • Meath County Development Plan 2013-2019 (Meath County Council, 2013) • Dundalk and Environs Development Plan 2009 – 2015
Local Areas Plans	Local Area Plans provide more detailed planning policies at a local level for either urban areas or wider urban and rural areas where significant development and change is anticipated. • Ardee Local Area Plan 2010 – 2016 • Dunleer Local Area Plan 2017-2023
Other Spatial / Development Plans for UoM	• Landscape Character Assessment Monaghan (Monaghan County Council, 2008) • Louth County Council Landscape Character Assessment (Louth County Council, 2002) • The Geological Heritage of Cavan (GSI, 2013) • Cavan Local Economic Plan 2016-2021 (Cavan County Council, 2016) • Local Economic and Community Plan Monaghan 2015 -2021 (Monaghan County Council, 2015) • Meath Economic Development Strategy 2014-2022 (Meath County Council, 2014) • County Cavan Groundwater Protection Scheme (GSI, 2008) • Monaghan Groundwater Protection Scheme (GSI, 2002) • County Meath Groundwater Protection Scheme (GSI and Meath County Council, 1996) • Cavan Draft Heritage Plan 2016-2021 (Cavan County Council, 2015) • Draft County Meath Heritage Plan 2016-2021 (Meath County Council, 2015) • Louth Heritage Plan 2015-2020 (Louth County Council, 2014) • Monaghan Heritage Plan 2012-2017 (Monaghan County Council, 2012)

	• Housing Strategy for County Cavan 2008-2014 (Appendix 26) (Cavan County Council, 2007) • Monaghan's Housing Strategy 2013-2019 (Monaghan County Council, 2013) • Local Biodiversity Action Plan Louth (Louth County Council, 2014) • (Draft) County Meath Biodiversity Action Plan 2015-2021 (Meath County Council, 2015) • Carlingford Lough Shellfish Pollution Reduction Programme (DEHLG, 2009) • Dundalk Bay Shellfish Pollution Reduction Programme (DEHLG, 2009) • Eastern-Midlands Regional Waste Management Plan (WMP) 2015-2021 • Connacht - Ulster Region Waste Management Plan 2015 - 2021

1.4 FLOOD RISK MANAGEMENT OBJECTIVES

1.4.1 Overview

The Flood Risk Management Objectives set out the goals the Plan is aiming to achieve. They have a key role in the preparation of the Plan, and the identification of appropriate measures, as the options that are available to manage flood risk within a given area are appraised against these Objectives to determine how well each option contributes towards meeting the defined goals. Establishing such Objectives is also a requirement of the EU 'Floods' Directive [Art. 7(2)].

The Flood Risk Management Objectives are aimed at considering potential benefits and impacts across a broad range of sectors including human health, the environment, cultural heritage and economic activity. The Flood Risk Management Objectives are well aligned with the objectives defined for the Strategic Environmental Assessment (see Section 6.3), as both are aimed at defining sustainable measures providing benefits to a wide range of sectors.

1.4.2 Definition of the Flood Risk Management Objectives

A set of Flood Risk Management Objectives was developed and applied through the Pilot CFRAM Studies, with stakeholder consultation to ensure the Objectives set were appropriate. In commencing the National CFRAM Programme, the Objectives developed for the Pilot Studies were reviewed and refined. The OPW considered it appropriate to publicly consult on the proposed Objectives, and launched a public consultation in October 2014. Seventy one submissions were received which informed amendments then made to define the final Objectives. The final set of Objectives are set out in Table 1.2.

Sets of Objectives, similar to those adopted for the National CFRAM Programme, have also been adopted for other flood relief scheme projects undertaken in parallel to the CFRAM Programme. Details of these are set out in the relevant project reports (Section 1.3.5).

The purpose of the Global Weightings referred to in Table 1.2 is set out in Section 7.3.4.

Table 1.2 Flood Risk Management Objectives and Global Weightings for the National CFRAM Programme

CRITERIA		OBJECTIVE		SUB-OBJECTIVE		GLOBAL WEIGHTING
1	Social	a	Minimise risk to human health and life	i)	Minimise risk to human health and life of residents	27
				ii)	Minimise risk to high vulnerability properties	17
		b	Minimise risk to community	i)	Minimise risk to social infrastructure and amenity	9
				ii)	Minimise risk to local employment	7
2	Economic	a	Minimise economic risk	i)	Minimise economic risk	24
		b	Minimise risk to transport infrastructure	i)	Minimise risk to transport infrastructure	10
		c	Minimise risk to utility infrastructure	i)	Minimise risk to utility infrastructure	14
		d	Minimise risk to agriculture	i)	Minimise risk to agriculture	12
3	Environmental	a	Support the objectives of the WFD	i)	Provide no impediment to the achievement of water body objectives and, if possible, contribute to the achievement of water body objectives.	16
		b	Support the objectives of the Habitats Directive	i)	Avoid detrimental effects to, and where possible enhance, Natura 2000 network, protected species and their key habitats, recognising relevant landscape features and stepping stones.	10
		c	Avoid damage to, and where possible enhance, the flora and fauna of the catchment	i)	Avoid damage to or loss of, and where possible enhance, nature conservation sites and protected species or other known species of conservation concern.	5
		d	Protect, and where possible enhance, fisheries resource within the catchment	i)	Maintain existing, and where possible create new, fisheries habitat including the maintenance or improvement of conditions that allow upstream migration for fish species.	13

CRITERIA		OBJECTIVE		SUB-OBJECTIVE		GLOBAL WEIGHTING
3	Environmental (Continued)	e	Protect, and where possible enhance, landscape character and visual amenity within the river corridor	i)	Protect, and where possible enhance, visual amenity, landscape protection zones and views into / from designated scenic areas within the river corridor.	8
		f	Avoid damage to or loss of features, institutions and collections of cultural heritage importance and their setting	i)	Avoid damage to or loss of features, institutions and collections of architectural value and their setting.	4
				ii)	Avoid damage to or loss of features, institutions and collections of archaeological value and their setting**.**	4
4	Technical	a	Ensure flood risk management options are operationally robust	i)	Ensure flood risk management options are operationally robust	20
		b	Minimise health and safety risks associated with the construction, operation and maintenance of flood risk management options	i)	Minimise health and safety risks associated with the construction, operation and maintenance of flood risk management options	20
		c	Ensure flood risk management options are adaptable to future flood risk, and the potential impacts of climate change	i)	Ensure flood risk management options are adaptable to future flood risk, and the potential impacts of climate change	20

1.5 SCOPE OF THE PLAN

This Plan sets out a sustainable, long-term strategy to manage the flood risk within the Neagh Bann River Basin, focused on the areas of potentially significant flood risk (AFAs), and the sources of flooding giving rise to that risk.

1.5.1 Spatial Scope of the Plan

The Plan is focussed on the areas, the 'AFAs', where the risk was determined through the PFRA as being potentially significant. There are 300 AFAs, which are typically communities (villages, towns and cities) where the flood risk is concentrated, throughout the country. The areas covered by this Plan are set out in Section 3.2 (Table 3.1).

Some flood risk mitigation measures developed for the AFAs will have benefits for other areas, and so areas outside of the AFAs may also benefit from the proposed specific measures set out in the Plan.

While the Plan does not include locally specific flood protection measures to address the flood risk in areas outside of the AFAs, it does set out the range of policies and measures, which are in place or under development, that can contribute to the reduction and management of flood risk throughout the River Basin, including areas outside of the AFAs, such as spatial planning, emergency response planning and maintenance of drainage schemes.

1.5.2 Sources of Flooding Addressed in the Plan

The Plan for the Neagh Bann River Basin addresses fluvial and coastal sources of flooding in one or more communities (AFAs), as these sources were determined through the PFRA to be potentially significant in one or more communities within the area covered by the Neagh Bann River Basin Plan. The sources of flooding addressed for each of the AFAs are indicated in Table 3.1.

Other sources of flood risk within these communities, which were not deemed to have been significant for those communities within the scope of the PFRA, have not been specifically addressed (i.e., through locally specific flood protection measures). The Plan does however set out a range of policies and measures that can be contribute to the reduction and management of flood risk for all sources of flood risk throughout the River Basin, including areas outside of these communities, such as spatial planning, emergency response planning and maintenance of drainage schemes.

1.5.3 Level of Detail of the Plan

The Plan sets out the strategy, actions and measures that are considered to be the most appropriate at this stage of assessment, which has involved detailed modelling and appraisal of possible options for managing and reducing flood risk, including environmental assessment to the degree of detail appropriate for the Plan.

The observations and views submitted as part of the consultation on the Draft Plan (See Section 4.4.6) have been reviewed and taken into account in the preparation of this Plan.

It should be noted that the flood relief works or 'Schemes' set out in the Plans that have been developed through the CFRAM Programme are to an outline design, and are not at this point ready for construction. Further project level assessment through a project-level of assessment will be required for such works before implementation, along with project-level environmental assessment and appraisal (including the consideration of alternatives), further public and stakeholder consultation and engagement and a statutory planning

process such as planning permission or public exhibition and confirmation (Ministerial approval), where relevant. Local information that cannot be captured at the Plan-level of assessment, such as ground investigation results and project-level environmental assessments, may give rise at that stage to some amendment of the proposed works to ensure that they are fully adapted, developed and appropriate within the local context, and that they are compliant with environmental legislation.

The works set out in the Plan may therefore be subject to some amendment prior to implementation.

1.6 STRUCTURE OF THE PLAN

The structure of the Plan is set out below.

Flood Risk Management Plan

Section 1	Provides an introduction and background to the Plan, including the flood risk management Objectives the Plan is aiming to achieve, and sets out the scope of the Plan
Section 2	Provides an overview of the catchment and coastal areas covered by the Plan, including a summary of the flood history and existing flood risk management measures
Section 3	Describes the PFRA undertaken to identify the AFAs that are the focus of this Plan
Section 4	Outlines the public and stakeholder consultation and engagement undertaken throughout the National CFRAM Programme and other relevant projects.
Section 5	Details the existing and potential future flood hazard and risk in areas covered by the Plan
Section 6	Describes the environmental assessments undertaken to ensure that the Plan complies with relevant environmental legislation and inform the process of identifying the suitable strategies that will, where possible, enhance the environment
Section 7	Sets out the measures to manage the flood risk in the area covered by the Plan, and how these were developed and assessed, and provides a summary of the measures proposed in the Plan
Section 8	Outlines how the implementation of the Plan will be monitored and reported, and then reviewed and updated at regular intervals
APPENDIX A	Provides an overview of flooding and flood risk
APPENDIX B	Describes in more detail a physical overview of the River Basin
APPENDIX C	Summarises the process in undertaking the Preliminary Flood Risk Assessment
APPENDIX D	Provides details on certain aspects of the stakeholder and public engagement and consultation
APPENDIX E	Sets out the flood risk in each AFA
APPENDIX F	Provides a summary of the different methods of flood risk management
APPENDIX G	Describes the potential flood risk management works

Strategic Environmental Assessment Statement

Natura Impact Statement

The flood maps that have informed and form part of this Plan are available from the OPW website: www.floodinfo.ie.

2 OVERVIEW OF THE RIVER BASIN

2.1 THE NEAGH BANN RIVER BASIN

The Neagh Bann River Basin District (RBD) is transboundary and is therefore classified as an International River Basin District (IRBD).

The Neagh Bann IRBD covers an area of 8,120 km^2 with approximately 1,779 km^2 of that area in Ireland. It represents one single River Basin or Unit of Management, the Neagh Bann River Basin.

This plan covers only the portion of the Neagh Bann district within Ireland which includes the majority of County Louth, much of County Monaghan and significant areas of Meath and Cavan.

The Neagh Bann River Basin is predominantly rural with the largest urban areas being Dundalk, Monaghan and Ardee. Smaller towns and villages include Castleblayney and Carrickmacross.

Much of the Neagh Bann River Basin is given over to agriculture with some areas of forestry and peatland cover.

2.2 TOPOGRAPHY, GEOLOGY, SOILS AND GROUNDWATER

The topography of the Neagh Bann River Basin reveals a general easterly drainage pattern through the southern portion of the study area towards the Irish Sea, with the northern portion of the study area, draining in a general north easterly direction towards Lough Neagh in Northern Ireland. In the northern portion of the Neagh Bann study area, the landscape is dominated by drumlins that stretch across Monaghan and Louth and into Northern Ireland.

The geology of the area consists mainly of calcareous red-mica greywacke which forms a quarter of the bedrock in the Neagh Bann River Basin, with a large area covering most of County Louth. Formations of calcareous greywacke and banded mudstone run in a north east direction in the southern part of the UoM, spanning across northern County Meath and into Louth before reaching the coast. In the northern part of the UoM, argillaceous limestone and siltstone is present in a large area in northern Monaghan along the Northern Irish border. Most of County Louth has bedrock that is generally unproductive, as well large parts of County Monaghan. Other areas with unproductive aquifers are located in northern Meath, and eastern Cavan.

In terms of soils, acid brown earths and brown podzolics cover most of the Neagh Bann River Basin. Surface water and ground water gleys derived from non-calcareous parent materials are also widely distributed, particularly in the western and northern parts of the UoM, as well as some areas of the south east near the coast.

Further details on the topography, geology, soils and groundwater in the Neagh Bann River Basin is provided in Appendix B.

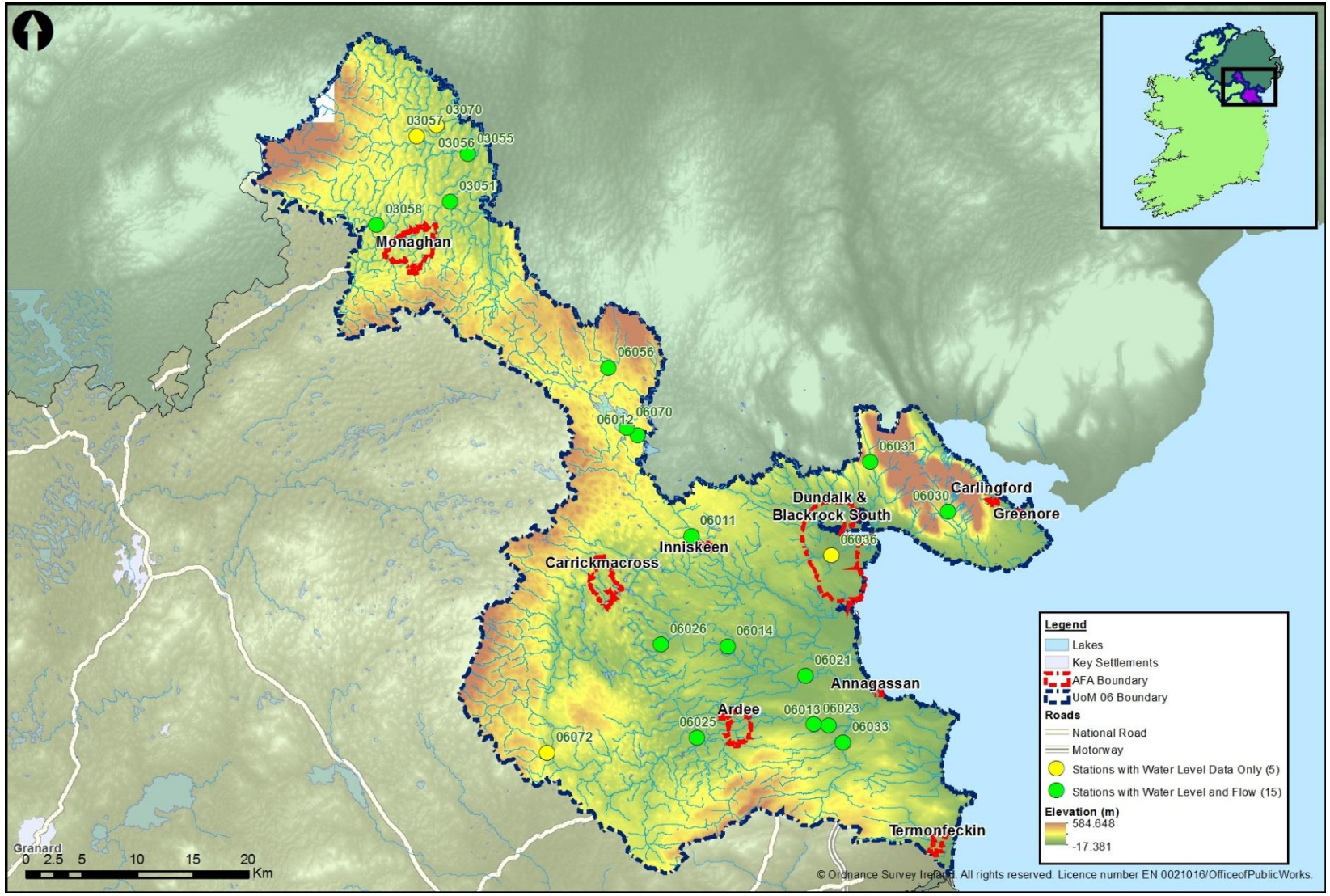

Figure 2.1: Neagh Bann River Basin Location Map

2.3 LAND USE AND LAND MANAGEMENT

The 2011 census data held by the Central Statistics Office (CSO, 2011) show a total population of 147,668 in the Neagh Bann RBD. The Neagh Bann RBD has a low average population density as it is rural in nature. The primary settlements include the towns of Dundalk, Monaghan, Ardee, Carrickmacross, Castleblaney and Ardee.

The land use in the Neagh Bann River Basin is typified by improved pasture but also includes extensive arable farming, particularly in County Louth. To the northern extent of the study area, agriculture is also the predominant land use. There are pockets of peat bogs and coniferous forestry in upland areas surrounding Carlingford Lough and in Slieve Beagh in Co. Monaghan. Land cover is dominated by agricultural pastureland, with urban areas making up a very small proportion of the study area.

While it is unlikely that the general pattern of land use will be substantially changed in the future, increases in population can pose development pressures resulting in changes in land use. The 2011 census shows a dramatic increase in population from the 2006 census (9%). These increases have been centralised around urban areas.

The areas of land zoned for further development, under extant development plans, in the key urban areas within UoM10 are summarised in Table 2.1

Table 2.1 Zoned Lands within Key Urban Areas in the Neagh Bann River Basin

NAME	AREA ZONED (km^2)	DEVELOPMENT PLAN DATE
Monaghan	9.62	26/03/13 – 26/03/19
Carlingford	1.01	26/03/12 – 16/11/15
Dundalk & Blackrock South	44.25	25/11/09 – 25/11/15
Inniskeen	0.05	26/03/13 – 26/03/19
Carrickmacross	3.76	26/03/13 – 26/03/19
Ardee	4.54	11/04/10 – 11/04/16
Annagassan	0.35	16/03/12 – 16/11/15
Termonfeckin	1.48	26/03/12 – 16/11/15

Further details on land use and land use management in the Neagh Bann River Basin is provided in Appendix B.

2.4 HYDROLOGY

The principal Irish rivers in the Neagh Bann River Basin are the Fane, Glyde and Dee rivers (which flow eastwards into the Irish Sea) and the Blackwater River (which flows over the border into Northern Ireland in the northern reaches of the UoM).

Within the Neagh Bann River Basin the OPW has implemented and maintains the Glyde and Dee Arterial Drainage Scheme and the Blackwater Arterial Drainage Scheme which were undertaken by the OPW, under the 1945 Arterial Drainage Act. The OPW continues to have statutory responsibility for inspection and maintenance of the Schemes, which includes much of the main channels and a large number of designated tributaries. The primary focus of arterial drainage schemes is not for flood relief but for the improvement of agricultural land.

Drainage Districts represent areas where the Local Authorities have responsibilities to maintain watercourse channels and therefore contribute to maintaining the existing regime. In relation to the three Drainage Districts located within the Neagh Bann River Basin (Blackwater DD, Fane DD and Wottanstown DD), two are located directly on key watercourses where fluvial and coastal flood risk is being investigated.

Hydrometric data is available at 23 hydrometric gauge stations (including 3 Rivers Agency stations located in Northern Ireland) on watercourses within the study area. Eighteen of these stations have water level and flow data available (three of which are operated by the Department of Agriculture and Rural Development (DARD) Rivers Agency (Northern Ireland).

Meteorological data was available from a number of Met Éireann, NRA and UK Met Office daily, sub-daily and hourly rain gauges within the NWNB CFRAM study area and beyond.

In addition to the observed historical rainfall data available at the aforementioned rain gauge locations, further meteorological information namely observed evaporation, soil moisture deficits and potential evapotranspiration data was used within the hydrological rainfall run-off model.

Further details on the hydrology of the Neagh Bann River Basin is provided in Appendix B.

Full details of the methodology, datasets used and outcomes of the hydrological analysis for the NWNB CFRAM study area can be found at www.floodinfo.ie.

2.5 FLOOD HISTORY

The historical flood events which occurred in the various AFAs in the Neagh Bann River Basin are summarised in Table 2.2.

The majority of the flood history data collection results yielded from searches on the OPW National Flood Hazard Mapping website (http://www.floodinfo.ie/) related to floods which had occurred pre-2005. A desk study was carried out for information on the more recent flood events to supplement the records for each AFA in the Neagh Bann River Basin. During the Study information was brought forward by local authorities, particularly in relation to events which occurred in the intervening period between the flood event analysis and verification of the hydraulic modelling. Information on flood events which occurred during the Study was also collected through the Flood Event Response task. Details of the most recent, and therefore more widely reported events, are summarised below with additional information available in the hydrology report.

Information on these past floods, such as flood flows, levels, depths, extents and mechanisms, has been used as appropriate in the CFRAM Programme to inform the preparation of the flood maps and Plans, where such information has been available at the relevant stage of the Programme and has been considered adequately reliable. Details of the more widely reported events are summarised below.

Table 2.2: Summary of Historical Flood Events for each AFA

Event	Annagassan	Ardee	Carlingford Greenore	Carrickmacross	Dundalk & Blackrock South	Inniskeen	Monaghan	Termonfeckin
Jan-2016				✓	✓	Recurring		
Dec-2015		✓						
Nov-2014					✓			✓
Feb-2014			✓					
Jan-2014			✓		✓			
Oct-2011					✓		✓	
Sep-2010					✓			
Nov-2009		✓					✓	
Aug-2008		✓	✓				✓	
Oct-2005			✓					
Oct-2004	✓				✓			
Oct-2002								✓
Feb-2002	✓		✓		✓			
Nov-2000		✓	✓		✓			✓
Feb-1990							✓	
Oct-1986		✓						
Dec-1981	✓		✓		✓			
Nov-1980				✓				
Dec-1978		✓		✓				
Feb-1977					✓			
Dec-1954					✓			
Nov-1954					✓			

Flood Event of January 2016 – A flood event response report describes how four residential properties flooded at Carrickmacross when a combination of surface water and drainage system flooding led to a build-up of water in the Ascáill Rois housing development. This affected the ground floor of three properties within the development and also the basement level of a property on the main road where depths of up to 3m were reported.

Flooding also occurred in Dundalk in January 2016. As reported by the Irish Independent, a number of homes were affected by flooding caused by high water levels in the River Blackwater. Local and major roads including the M1 motorway were affected causing significant disruption to travel. Subsidence near the railway line also caused the track between Newry and Dundalk to close.

Flood Event of 30th December 2015 – It is understood that flooding occurred in Ardee, John Street and Stoney Lant when a screen was blocked. This resulted in overland flow and flooding of the bottom floor of Riverside Apartment block.

Flood Event of November 2014 - Flood event response reports describe flooding which occurred in Dundalk and Termonfeckin on the 14 and 15th November. A watercourse exceeded its banks at Regan's Terrace in Dundalk resulting in flooding of two residential properties. Within the same catchment three residential properties at Mounthamilton were affected when a watercourse exceeded its banks on Ardee Road. Four large industrial properties were also flooded internally at the nearby Mounthamilton Industrial Estate. Three residential properties along Strand Road and the Riverside Pub were reported flooded in Termonfeckin when the river exceeded bank level.

Flood Event of February 2014 - Flood event reports describe coastal flooding along a 160m (approx.) stretch of coast line to the east of the Greenore industrial estate. The cause of this flooding was identified as a combination of high tide and failure / erosion of the defences leading to tidal inundation of the immediate area. Two properties, 20m of public highway and an industrial facility were affected.

Flood Event of January 2014 - Flood event response reports describe flooding which occurred in Dundalk, Blackrock and Carlingford. On Main Street in Blackrock three properties were affected by flooding caused by a combination of high tide, surge and wave overtopping. Flood depths of approximately 300mm were measured on Main Street (R172). At George's Quay in Dundalk a flood level of 3.45m (OD Malin) was recorded and the Dundalk Port Inner Relief Road (N52) was flooded to a typical depth of around 250mm. Three commercial properties were reported to have been affected. It was also reported that 120m of Old Quay Lane in Carlingford was flooded and a snooker / pool hall was affected.

Flood Event of October 2011 - News sources (Monaghan Life, RTE News) were found during the desk study indicating a flooding event in Monaghan town on 25th October 2011. This was caused by the heaviest 24 hour period of rainfall on record. Photos show major flooding of central streets in Monaghan town and many roads around the town were flooded also. The Irish Times reported that Monaghan town centre was impassable. The website www.mapalerter.com also indicated flooding in Monaghan town, Clones and on the Carrickmacross – Shercock road (R178). The Blackwater River also burst its banks at O'Neills Garden Centre, Piper's Bridge and other local roads were also flooded. Similarly, www.argus.ie reported that Dundalk suffered some flooding although it escaped severe flooding. The heavy rain led to flooding at the Castletown Road and also flooding on the Ardee Road. As the heavy rains coincided with high tides, the council also had 500 sandbags on standby for distribution if necessary.

Flood Event of September 2010 - On 6th September 2010, flooding occurred due to heavy rainfall, high tides and strong easterly winds. Anecdotal information reported in the Dundalk Democrat estimated this event to have an Annual Exceedance Probability (AEP) of 2%. St Alphonsus Road was reported to be one of the areas worst affected.

Flood Event of November 2009 - Information was found on www.floodinfo.ie which indicated that flooding occurred in the vicinity of Monaghan town and Ardee on 19th November 2009. Photographs show flooding occurred in the Monaghan Creamery area, Crover area, Coolshannagh area and at Ballyalbony Graveyard. Low lying lands, roads and some properties were flooded by the Blackwater. Furthermore, photos also show the New Road area flooded by Shambles River. In addition, photographs were found depicting flooding of farmland and roads in the Ardee Bog area.

Flood Event of August 2008 - Information was found on a website (www.dundalkdemocrat.ie) during the desk study which indicated that roads were flooded in the Carlingford area on 16th August 2008. Similarly, information was found on www.floodinfo.ie which indicated that flooding occurred in some areas near Monaghan town, adjacent to the Shambles and Blackwater rivers. However no reports were found of flooding

in the town itself. In addition, photographs were found on www.floodinfo.ie indicating flooding of farmland and roads in the Ardee Bog area.

Flood Event of October 2005 - Information was found on www.floodinfo.ie which indicated that flooding occurred in Carlingford on 24th October 2005. Landscaping works and realignment of the channel of the mountain river was taking place at the time of this particular rainfall event. Heavy rainfall washed material from landscaping works downstream which blocked grills on the river channel, causing the river to spill onto the public roads and flood adjacent buildings. In addition, photos indicate that the flood waters washed silt/gravels onto roads.

Flood Event of October 2004 - Details were found on www.floodinfo.ie which indicated that flooding occurred in Annagassan and Dundalk in October 2004. In Dundalk, flooding was caused by heavy rainfall (20.5mm on October 27th and 16.5mm on October 28th). High tides impeded drainage although gullies had been cleaned prior to this event. However, no details of flood extents or damage caused are available. In Annagassan, high tides and wave action caused flooding coastal flooding. Strand Road was flooded. However no further details were available.

2.6 EXISTING FLOOD RISK MANAGEMENT MEASURES

2.6.1 Dunleer Flood Risk Assessment Study

The village of Dunleer in County Louth has been vulnerable to fluvial flooding from the White River. The Dunleer Flood Risk Assessment Study was completed in 2016 following major recent flooding events. The Study is a strategic flood assessment and has produced flood risk mapping for the village. LCC intend to move to the next stage to a Flood Management Plan including the following:

- Detailed flood risk assessment including economic damage assessment.
- Short listing of flood risk management measures based on screening in relation to technical, economic, social and environmental considerations.
- Modelling of potential options to assess effectiveness.
- Appropriate Assessment and Environmental Assessment of options undertaken in parallel to the option development process.
- Consideration of future scenarios in relation to flood risk management options.
- Ongoing data collection, particularly in relation to flood events which may occur in the period up to development of the preferred measure.
- Further consultation on viable flood risk management options.
- Development of a preferred measure such that it can be developed through a further stage of project-level assessment to implementation.

2.6.2 Louth Coastal Erosion Study

Louth Coastal Erosion Study was completed in 2016, following significant coastal erosion since 2010 at Greenore, Templetown and Dillonstown / Salterstown and included coastal erosion, flood mapping and a coastal erosion risk management plan identifying the measures to manage the risk. LCC intend to move to the next stage, to provide the Coastal Erosion Defences identified in the Study.

2.6.3 Bellurgan Embankment Works

The Bellurgan embankment works were initiated in 2014, and commenced construction in 2017. It is expected that the Scheme will be completed in 2018. The Scheme, that comprises raising and widening of the existing embankment together with crest and back slope

armouring over the full length, will provide protection against a 200-Year flood (0.5% Annual Exceedance Probability) for 38 properties against coastal flooding.

2.6.4 Arterial Drainage Schemes and Drainage Districts

The following Arterial Drainage Schemes and Drainage Districts have been completed, and are maintained by the OPW or local authority respectively, in the Neagh Bann River Basin.

- Monaghan Blackwater AD Scheme: OPW
  - Unit of Management (Hydrometric Area): UoM06 (HA03)
  - Scheme Name: Monaghan Blackwater
  - Years of Works: Started 1986 Completed 1992
  - Length of Channel: 288 Km
  - Length of Embankment: 18 Km
  - Benefitting Area (km^2): 23.61
- Glyde and Dee AD Scheme: OPW
  - Unit of Management (Hydrometric Area): UoM06 (HA06)
  - Scheme Name: Glyde and Dee
  - Years of Works: Started 1950 Completed 1957
  - Length of Channel: 759 Km
  - Length of Embankment: 14 Km
  - Benefitting Area (km^2): 106.85
- Blackwater DD Scheme: Monaghan CoCo
- Fane DD Scheme: Louth CoCo
- Wottanstown DD Scheme: Louth CoCo

2.6.5 Minor Works

The Minor Flood Mitigation Works and Coastal Protection Scheme (the 'Minor Works Scheme') is an administrative scheme introduced in 2009 and operated by the OPW under its general powers and functions to provide funding to local authorities to enable the local authorities, to address qualifying local flood problems with local solutions.

Under the scheme, applications from local authorities are considered for projects that are estimated to cost up to €750,000 in each instance. Funding of up to 90% of the cost is available for approved projects, with the balance being funded by the local authority concerned. Local authorities submit funding applications in the prescribed format, which are then assessed by the OPW having regard to the specific technical, economic, social and environmental criteria of the scheme, including a cost benefit assessment. With regard to the latter, proposals must meet a minimum benefit to cost ratio of 1.35 or 1.5 : 1 (depending on cost) in order to qualify. Full details are available on www.opw.ie.

By the end of 2017, over 650 applications for flood relief works under the Minor Works Scheme have been approved since the inception of the Scheme in 2009. Details of the Scheme and works for which funding under the Scheme have been approved are available from the OPW Website:

- http://www.opw.ie/en/floodriskmanagement/operations/minorfloodworkscoastalprotectionscheme/

3 PRELIMINARY FLOOD RISK ASSESSMENT

3.1 INTRODUCTION

The Preliminary Flood Risk Assessment (PFRA) was a national screening exercise, based on available and readily-derivable information, to identify areas where there may be a significant risk associated with flooding.

The PFRA in Ireland was finalised in December 2011, following public consultation. A summary of how the PFRA was undertaken is provided in Appendix C.

3.2 OUTCOMES OF THE PFRA

The OPW designated 300 AFAs around Ireland, informed by the PFRA, the public consultation outcomes and the Flood Risk Reviews (further details available in Appendix C of this Plan and from the OPW website: www.floodinfo.ie). The AFAs were the focus of the CFRAM Studies and parallel detailed studies.

A list of all AFAs is provided in Appendix C of the Report on the Designation of the Areas for Further Assessment (OPW, 2012). Table 3.1 identifies the AFAs that are within the area covered by this Plan, and the sources of flood risk that were deemed to be significant for each AFA, which are also shown in Figure 3.1.

Table 3.1 List of the AFAs within the Neagh Bann River Basin

ID No.	COUNTY	NAME	SOURCE(S) OF FLOOD RISK
60013	Louth	Annagassan	Fluvial & Coastal
60014	Louth	Ardee	Fluvial
60016	Louth	Carlingford & Greenore	Fluvial & Coastal
60017	Monaghan	Carrickmacross	Fluvial
60019 & 60015	Louth	Dundalk & Blackrock South	Fluvial & Coastal
60020	Monaghan	Inniskeen	Fluvial
30011	Monaghan	Monaghan	Fluvial
60024	Louth	Termonfeckin	Fluvial & Coastal

3.3 FURTHER INFORMATION

The Main Report on the PFRA, the Report on the Designation of the Areas for Further Assessment and a number of technical reports are available from the OPW website (www.floodinfo.ie). These reports describe the process followed in the first cycle of the PFRA, describe how the AFAs were designated and provide a full national list of the AFAs.

The PFRA will be reviewed as required under the relevant legislation.
It is anticipated that the review of the PFRA will consider and support a range of issues in more detail than in the first cycle of the implementation of the 'Floods' Directive, and other issues that were not possible to consider in the first cycle given the information that was available or readily-derivable at the time. Such issues may include:

- Rural and dispersed flood risk: The CFRAM Programme has focused on communities at potentially significant flood risk (the AFAs) where the risk was understood to be concentrated and where it is more likely that viable measures could be identified. In the second cycle, it is foreseen that there will be a greater level of assessment of rural and dispersed risk.
- The potential impacts of climate change: The OPW has supported research commissioned by the EPA to investigate potential impacts of climate change on extreme rainfall patterns and hence on flood flows. This should support future assessments of potential future changes in flood risk.
- Critical Infrastructure: Assets that are critical to normal societal function and that may be at risk from flood events need to be identified. This will enable assessments of the potential 'knock-on' effects for other assets and services, such that appropriate risk management measures can be implemented to help ensure Ireland's resilience to severe flood events.

The outcomes of the PFRA undertaken in the second cycle of the 'Floods' Directive implementation, which will include environmental screening / assessments as appropriate, will inform the need for further detailed assessment and flood mapping and the review of the Plans.

Figure 3.1 Map of the AFAs within the Neagh Bann River Basin

4 PUBLIC AND STAKEHOLDER CONSULTATION AND ENGAGEMENT

4.1 OVERVIEW

Public and stakeholder engagement is a critical component to the process of developing a sustainable, long-term strategy for flood risk management. This engagement is necessary to ensure that flood risk management measures are suitable and appropriate, as well as technically effective.

This section describes the public and stakeholder consultation and engagement that has been undertaken under the CFRAM Study for the Neagh Bann River Basin in the development of this Plan. An overview of the CFRAM consultation stages and structures is provided diagrammatically in Figure 4.1.

4.2 AVAILABILITY OF PROJECT INFORMATION

A website for the National CFRAM Programme and the PFRA was established in 2011, and a Project-specific website was developed upon inception of the NWNB CFRAM Project. Relevant information from these websites is now available from the OPW website (www.floodinfo.ie,) which provides information on the 'Floods' Directive and SI Nos. 122 of 2010 and 495 of 2015, the PFRA and the CFRAM Programme, and provides access to view and download reports, the Plans and other project outputs.

Information on OPW flood relief schemes and other, parallel projects is provided through the OPW Website, www.opw.ie.

Flood maps prepared through the CFRAM Programme and through other projects are available through the OPW website (www.floodinfo.ie).

4.3 STAKEHOLDER ENGAGEMENT

4.3.1 The CFRAM Steering and Progress Groups

4.3.1.1 The National CFRAM Steering Group

The National CFRAM Steering Group was established in 2009, and met on nine occasions to the date of publication of this Plan. It was established to provide for the engagement of key Government Departments and other state stakeholders in guiding the direction and the process of the implementation of the 'Floods' Directive, including the National CFRAM nProgramme. The membership of this Group is provided in Appendix D.1.

The National CFRAM Steering Group reported, through the OPW, to the Interdepartmental Co-ordination Group (now the Interdepartmental Flood Policy Co-ordination Group).

4.3.1.2 NWNB CFRAM Project Steering Group

A Project Steering Group was established for the NWNB CFRAM Project that includes the Neagh Bann River Basin, in 2011. This Group, which included senior representatives of the members, provided for the input of the members to guide the CFRAM Programme and act as a forum for communication between the CFRAM Programme and senior management of key stakeholders. The Project Steering Group typically met twice a year.

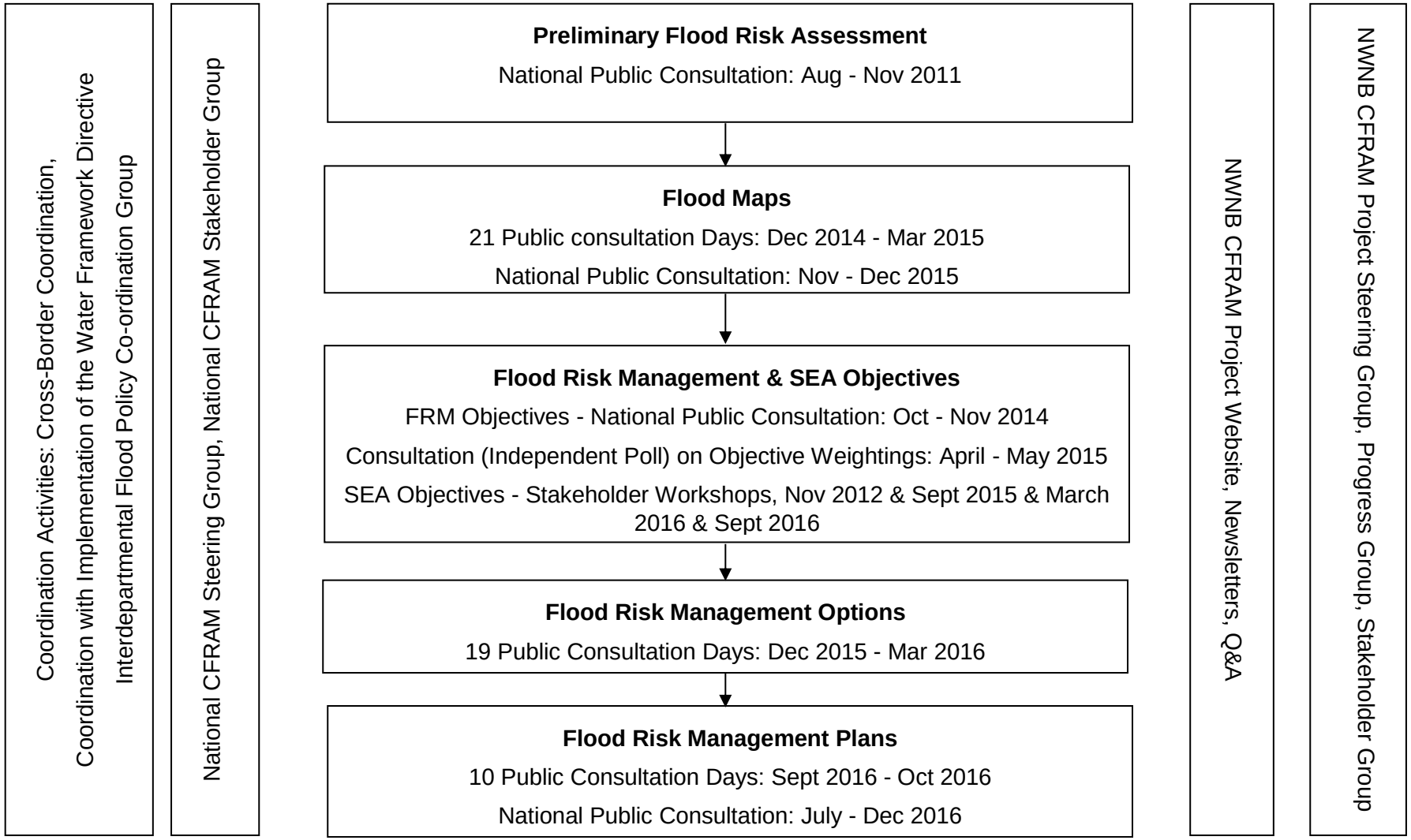

Figure 4.1: Overview of the CFRAM Consultation Stages and Structures

The membership of this Group is provided in Appendix D2.

4.3.1.3 NWNB CFRAM Project Progress Group

A Project Progress Group was established for the NWNB CFRAM Project in 2012. This group was a working group that supported the Project Steering Group and met approximately every six weeks. The Group was established to ensure regular communication between key stakeholders and the CFRAM Project and to support the successful implementation of the Project.

The membership of this Group was the same as for the NWNB CFRAM Project Steering Group.

4.3.2 Stakeholder Consultation Groups

Stakeholder Groups were formed at national and regional level to provide an opportunity for input by non-governmental stakeholder groups to participate in the 'Floods' Directive and CFRAM processes.

4.3.2.1 National CFRAM Stakeholder Group

The National CFRAM Stakeholder Group was established in 2014, and met three times to the date of publication of this Plan. It was established to provide for the engagement of key national non-governmental stakeholder organisations at key stages in the process of the implementation of the National CFRAM Programme. Members of the organisations listed in Appendix D.3 were invited to meetings of this Group.

4.3.2.2 Project (Regional) CFRAM Stakeholder Group

The NWNB CFRAM Stakeholder Group was established in 2012, and met on four occasions to the date of publication of this Plan. It was established to provide for the engagement of local non-governmental stakeholder organisations at key stages in the process of the implementation of the NWNB CFRAM Project. The organisations listed in Appendix D.4 attended meetings of this Group, although many other organisations were also invited to attend.

4.3.3 Coordination with the Implementation of the Water Framework Directive

The Water Framework Directive (WFD) is concerned with the protection of the ecological quality of our waters. While the 'Floods' Directive is concerned with the protection of people and society from our waters, both Directives are concerned with water and river basin management, and hence coordination is required between the two processes to promote integrated river basin management, achieve joint benefits where possible and address potential conflicts.

There has been, and will continue to be, coordination with the authorities responsible for the implementation of the WFD through a range of mechanisms, including bi-lateral meetings and cross-representation on various management groups, as set out in Section 6.5.

4.4 PUBLIC CONSULTATION AND ENGAGEMENT

In addition to the structured engagement with relevant stakeholders through the Steering, Progress and Stakeholder Groups, the public have also been given the opportunity and encouraged to engage with the implementation of the 'Floods' Directive and the CFRAM process. These engagement and consultation steps are set out in Figure 4.1, and are described in the sub-sections below.

4.4.1 Consultation on Preliminary Flood Risk Assessment

The public and stakeholder consultation and engagement in the Preliminary Flood Risk Assessment (PFRA) is described in Section 3.

4.4.2 Launch of the NWNB CFRAM Project

The NWNB CFRAM Project commenced in 2012.

4.4.3 Consultation on Flood Maps

The preparation of the flood maps, which serve a range of functions (see Section 5.3) is the second key requirement of the 'Floods' Directive. The initial preparation of the flood maps involved extensive consultation with the NWNB Progress Group and planners within the various relevant local authorities. This led to the development of draft flood maps that were then consulted upon with the public through local Public Consultation Days and a national, statutory consultation.

4.4.3.1 Public Consultation Days

The OPW identified that effective consultation and public engagement would require local engagement at a community level, and hence determined that Public Consultation Days (PCDs) would be held in each AFA (where possible and appropriate) to engage with the communities at various stages of the Projects, including during the production of the flood maps.

The PCDs were advertised locally in advance, and were held at a local venue in the community during the afternoon and early evening. OPW, Local Authority and RPS staff were present to explain the maps that were displayed in the venue and answer any questions on the maps and the CFRAM process, and to collate local information to refine or confirm the maps. The PCDs in the Neagh Bann River Basin were held for consultation on the flood maps at the venues listed in Appendix D.5.

While the number of attendees at the PCDs were variable, overall the PCDs were very useful in updating and validating the flood maps. The PCDs were also useful as a means to raise awareness of flooding and flood risk in the community, and to begin the discussion on potential measures to manage or reduce the risk.

Figure 4.2 Public Consultation Day

4.4.3.2 National Flood Map Consultation

The Government considered it appropriate to stipulate in SI No. 122 of 2010 that a national consultation exercise should be undertaken[5]. The consultation on the flood maps for all areas was launched in November 2015. Observations and Objections submitted through the consultation process have been assessed and the flood maps amended accordingly, where appropriate.

4.4.4 Consultation on Flood Risk Management Objectives

The Flood Risk Management Objectives of the National CFRAM Programme define what the process is trying to achieve in terms of reduction of flood risk, and where possible provide wider benefits, to human health, the environment, cultural heritage and economic activity. The Objectives are described further in Section 1.4.

The OPW considered it appropriate to publicly consult on the proposed flood risk management Objectives, and launched a public consultation in October 2014. Submissions received were duly considered and amendments made to the Objectives where appropriate. The Objectives were finalised in March 2015.

A Multi-Criteria Assessment (MCA) is used as part of the process for assessing potential options for reducing or managing flood risk for each AFA. The MCA and this process are described in Section 7 herein. The MCA makes use of weightings to rank the importance of the Objectives. The OPW considered it appropriate to consult on the weightings that would be assigned to each Objective, and commissioned an independent poll of over 1000 members of the public on the weightings through a structured questionnaire. The results of this poll were analysed by UCD[6], and the weightings for each of the Objectives then set.

4.4.5 Consultation on Options

Based on the flood hazard and risk identified in the flood maps, options for reducing or managing flood risk in each AFA were developed and assessed. This process is described in Section 7 herein.

PCDs, similar to those held for the consultation on the flood maps were held during the development and assessment of options. These were an opportunity to engage with the community and for the community to set out what local issues were particularly important and what measures they considered would be most suitable and comment on which identified options might be effective and appropriate, or otherwise. The PCDs in the Neagh Bann River Basin were held during the option development stage at the venues listed in Appendix D.6.

4.4.6 Consultation on Draft Plans

The Draft Plan for the Neagh Bann River Basin as published for the purposes of public consultation on 19/08/16. Observations from the public and from relevant Councils were to be submitted to the OPW by 28/10/16 and 21/11/16 respectively. Presentations were made to Councils during the public consultation period.

In parallel and complementary to the formal public consultation process, a series of PCDs, similar to those held for the consultation on the flood maps (Section 4.4.3 above), were held to engage locally and directly with the community and provide people with opportunity to discuss and fully understand the Draft Plans. A total of 223 elected representatives and

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5 Sections 12, 13 and 14, SI No. 122 of 2010

6 (UCD, 2015): Weighting the Perceived Importance of Minimising Economic, Social and Environmental/ Cultural Risks in Flood Risk Management, University College Dublin, 2015

members of the public attended. The PCDs in the Neagh Bann River Basin were held in relation to the Draft Plans at the venues listed in Appendix D.7.

The observations submitted to the OPW through the public consultation processes were considered and the Plans amended accordingly where appropriate. A synopsis of the observations submitted and amendments made to the Plan arising from the observations is available from the OPW website (www.floodinfo.ie).

4.5 CROSS-BORDER COORDINATION

The OPW has an on-going relationship with the former Rivers Agency (now part of the Dept. for Infrastructure), Northern Ireland, which is the Competent Authority for the implementation of the 'Floods' Directive in Northern Ireland.

In 2009, it was agreed between the two Authorities that a Cross-Border Coordination Group would be established to coordinate the implementation of the 'Floods' Directive across the border, and that this would be supported by a Cross-Border Technical Coordination Group. These groups first met in February 2010 and November 2009 respectively, and met on a number of occasions since to coordinate on the identification of AFAs and Significant Flood Risk Areas ('SFRAs' - the terminology in Northern Ireland used for an AFA), to share information and agree approaches to and the production of flood mapping in border areas and to coordinate on the identification of measures and the preparation of Plans.

The Rivers Agency have developed, in coordination with the OPW as above, Plans for the areas within Northern Ireland for the North-Western and Neagh-Bann River Basin Districts (https://www.infrastructure-ni.gov.uk/publications/flood-risk-management-plans).

One major watercourse flows between the Republic of Ireland and Northern Ireland in the Neagh Bann River Basin. The downstream extents of the Monaghan Blackwater River flows into Northern Ireland, forming the border in its lower reach. Additionally Carlingford and Greenore discharge into Carlingford Lough which is a shared waterbody with County Down in Northern Ireland. There are no potential cross border impacts associated in the trans boundary watercourses or water bodies. The Rivers Agency have been consulted on the preferred measure.

For the NWNB CFRAM Study, Rivers Agency have been represented throughout the CFRAM study on the steering, progress and stakeholders groups. Rivers Agency and the OPW have undertaken information exchange at all deliverable stages, including delivering joint presentations to stakeholders and also joint attendance at relevant consultation events.

5 FLOOD HAZARD AND RISK ASSESSMENT

A general description of flooding and flood risk has been provided in Section 1.2 of this Plan. This Section describes the assessment processes followed under the CFRAM Progamme to determine the extent and nature of flooding in the AFAs within the Neagh Bann River Basin, and the resultant flood risk. A description of these processes and outcomes for other projects is provided in the relevant project reports (see Section 1.3.5).

To ensure consistency in approach where required, a National Technical Coordination Group was established under the National CFRAM Programme to bring together all of the Consultants with the OPW, and other organisations as necessary, to determine common standards and methodologies.

5.1 HYDROLOGICAL ANALYSIS

For AFAs where fluvial flooding is a potentially significant risk, the hydrological assessment under the CFRAM Programme has been limited to rivers and streams with a catchment area of more than 1km^2. Smaller streams may also give rise to some flood risk, and such risk would need to be considered where relevant at the project-level of assessment (see Section 8.1), when the interaction between urban storm water drainage systems, fluvial flooding and proposed measures would also need to be considered in detail.

Good hydrometric data exists within the larger channels of the Neagh Bann River Basin which is of sufficient quality to be of use for design flow estimation and as such there is generally a high degree of certainty in design flow estimates along main watercourses such as the Monaghan Blackwater, Glyde, Dee, and Fane. Flow predictions have been adjusted on the basis of gauge sites to prevent under-prediction of flows, however, in the case of smaller tributaries that are less comparable to the larger sites, alternative adjustment factors have been reviewed and applied where relevant. There is good availability of meteorological data, both daily and hourly within and in close proximity to the Neagh Bann River Basin. These provide the high temporal resolution data needed for driving the rainfall runoff model that has been undertaken at station 03051. Elsewhere, the good availability of high quality stations already provides high confidence in flow data such that there is no need for additional hydrological modelling.

There are many potential future changes to the catchment, margins of error and uncertainties which must be considered within the study. However the cumulative application of worst case scenarios, one on top of the other could lead to erroneous flood extents which do not take into account the diminishing cumulative joint probability of these factors. For this reason the hydrology report has separated future Neagh Bann River Basin changes that have a high degree of certainty in the projections from those changes which are less certain. Future changes which have a high degree of uncertainty, along with margins of error and other uncertainties have been risk assessed individually. This risk assessment was taken forward and built upon through the hydraulic modelling phase to provide a single error margin for the flood extent maps on an AFA by AFA basis.

The Neagh Bann River Basin catchment can be characterised hydrologically as follows:

- The catchment has a wide range of climatic and physiographic characteristics. The drier, lowland areas in the Glyde and Dee floodplain have SAAR values as low as 762mm while catchments in the upland areas of Carlingford Mountain have SAAR values in excess of 1200mm.
- Hydrometric data is of good quality and availability for larger channels but is not available for smaller modelled tributaries.

- Meteorological data is of good availability in the catchment.
- Flood behaviour when defined in terms of the growth curve, i.e. in orders of magnitude greater than the median event, is relatively more extreme in the upper catchment than would have been thought based on older Flood Studies Reports (FSR). This is in line with other more recent, catchment specific studies.
- The 1% AEP flood event ranges from approximately 1.9 to 3.5 times larger than the median flood flow. This compares to approximately 2 under FSR.

Design flow estimation is the primary output of this study and has been developed from analysis based on previous observed data and estimation / modelling techniques further refined through calibration of hydraulic models. This is reflective of best practice in hydrology / hydraulic modelling for flood risk assessment.

The main potential source of uncertainty in the analysis is due to the lack of hydrometric gauge data in the majority of smaller catchments.

After this cycle of the NWNB CFRAM Study the main potential adverse impacts on the hydrological performance of the catchment are the effects of climate change and urbanisation (section 5.5).

Full details of the methodology, datasets used and outcomes of the hydrological analysis for the NWNB CFRAM Study area can be found www.floodinfo.ie.

5.2 HYDRAULIC MODELLING

For AFAs where fluvial flooding is a potentially significant risk, the hydraulic assessment and modelling under the CFRAM Programme has been limited to rivers and streams with a catchment area of more than 1km^2. Smaller streams may also give rise to some flood risk, and such risk would need to be considered where relevant at the project-level of assessment (see Section 8.1), when the interaction between urban storm water drainage systems, fluvial flooding and proposed measures would also need to be considered in detail.

Hydraulic analysis was undertaken in order to identify the location and frequency of flooding within the extents of the Neagh Bann River Basin modelled watercourses. The analysis utilised computational modelling software informed by detailed topographical (channel sections, in-channel/flood defence structures, bathymetric and floodplain) survey information, combined with hydrological inputs (riverine inflows and sea levels) and water-level control parameters (such as channel-roughness), to determine flood hazard. A series of flood extent, zone, depth, velocity and risk-to-people maps known collectively as flood hazard maps were generated based on the model results.

The principal modelling software package that has been used is the MIKE FLOOD software shell which was developed by the Danish Hydraulics Institute (DHI). This provides the integrated and detailed modelling required at a river basin scale and provides a 1-/2-dimensional interface for all detailed hydraulic model development thus enabling seamless integration of fluvial and coastal models in the AFAs for which this is required. There is one model in the Neagh Bann River Basin in which ISIS, developed by CH2M HILL was used. ISIS 2D has a fully hydrodynamic computational engine designed to work alone or with ISIS 1D, enabling dynamic interaction between 1D and 2D models. 1D and 2D models are linked through shapefiles specifying the model cells in the 2D domain to be linked to 1D model nodes. Models can be linked by water level (levels computed by the 1D model are sent to the 2D model) or by flow (flows computed by the 1D model are sent to the 2D model). These linking methods allow ISIS 1D and ISIS 2D to represent lateral floodplains, a 1D channel running into a 2D estuary, spill over defences, and other representations of river, coastal or

floodplain systems. Multiple 2D domains, with different cell sizes, time steps and simulation times can be coupled to a single 1D model to represent different areas of floodplain at different resolutions.

The influence of coastal water levels has been modelled by applying an appropriate water level boundary profile to the downstream extent of the rivers discharging to coastal waters along the Co Louth coastline. Tidal data has been taken from the Irish Coastal Protection Strategy Study (ICPSS). The effects of the sea levels are propagated upstream by the modelling software allowing the interaction of river flows and coastal water levels to be modelled accurately. The subsequent combined water level profiles are then applied as the downstream boundaries for each of the tributaries i.e. Dundalk and Annagassan ensuring both coastal and fluvial flooding mechanisms are investigated. Model tests included variation in fluvial-tidal joint probability and temporal variations, along with parameters such as eddy viscosity and bed resistance. In some AFAs, relative timings between fluvial and coastal peaks were adjusted to establish the worst case flood outlines, for a particular combination of events.

RPS assessed the potential for wave overtopping leading to coastal flooding in selected AFAs using calculated overtopping rates for relevant coastal structures under a range of combined tidal levels and wave heights of known joint return period using the EurOtop application. This identified the critical structure/overtopping rate/event combination for the frontage. The temporal variation in overtopping rate is subsequently determined to analyse the performance of the critical structure, under the critical wave conditions and a range of tidal levels associated with a generic storm profile derived from a combination of the normal astronomical tidal profile and an appropriate sinusoidal surge profile with a duration of 48 hours. The instantaneous overtopping rates resulting from this analysis were combined to create boundary “hydrographs” that can be applied to the coastal flood models at the locations of the overtopping defences to facilitate simulation of the flood pathways and flood extents resulting from overtopping of the defences. The results of the coastal modelling were then combined with the output of the direct tidal inundation mapping to establish the coastal flood hazard maps.

Key flood events were used where available in the calibration of each model whereby the model is reviewed in order to make sure historic flooding is accurately represented; the principal model parameters that are reviewed and amended during the model calibration process are:

- Bed and floodplain roughness coefficients.
- Structure roughness and head loss coefficients.
- Timing of hydrographs.
- Magnitude of hydrographs.
- Incorporation of additional survey information (e.g. additional cross-sections or missed structures).

The accuracy of the models representing existing conditions in terms of flood level, depth, extent and flow velocity allows potential flood options to be meaningfully assessed, enabling the appropriate actions/decisions to be taken. The calibrated models were used to simulate present day and future flood hazard conditions and potential options to facilitate the appraisal of possible flood risk management actions and measures.

Defence failure scenarios (where relevant) and sensitivity tests have been conducted for each model and reported within the Neagh Bann River Basin Hydraulics Report. The parameters selected were dependent on the specific model but generally include:

- roughness coefficients

- 2D domain grid cell size
- Critical structure coefficients
- Flow inputs
- Operation of dynamic structures

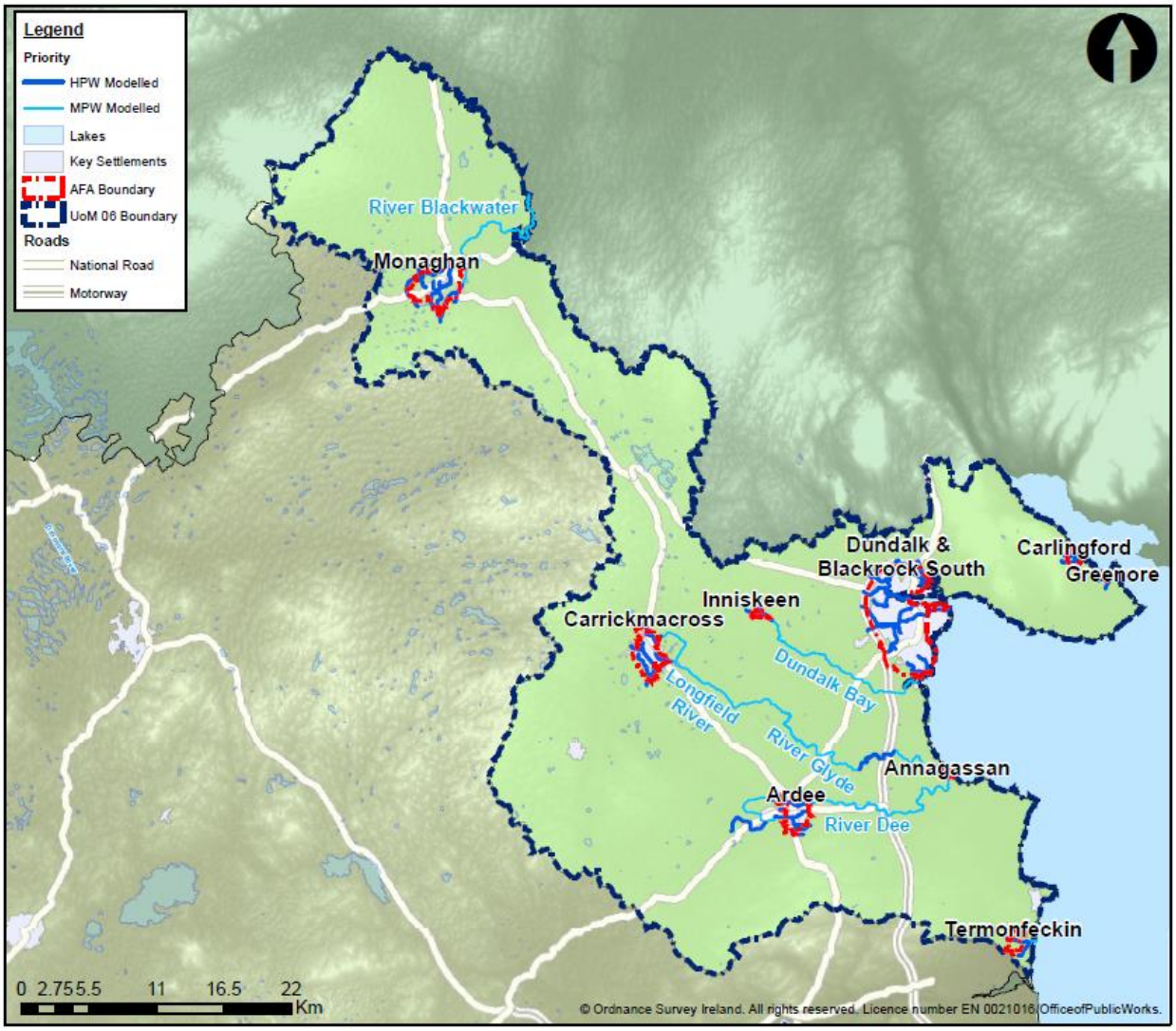


Figure 5.1 Modelled Watercourses within the Neagh Bann River Basin

Future potential changes which may affect the outputs of the CFRAM Study were also assessed:

- The climate change allowances are applied to all models. Urbanisation allowances are applied on a case by case basis as required, the factors themselves having been derived during the hydrology analysis by looking at historic urbanisation growth indicators and estimating appropriate growth factors for Mid-Range Future Scenario (MRFS) and High-End Future Scenario (HEFS).
- The effect of arterial drainage within the Neagh Bann River Basin relates to the catchments of Monaghan, Carrickmacross, Annagassan and Ardee. The Glyde and Dee Arterial Drainage Scheme took place between 1950 and 1957 and was a pilot drainage scheme implemented shortly after the 1945 Arterial Drainage Act. The Monaghan Blackwater Scheme was a smaller, more recent scheme that took place between 1984 and 1992. However, In terms of the modelled watercourses, the recently acquired channel cross section survey data reflects the current status of the watercourses in terms

of siltation based on the measurements taken for modelling purposes. Therefore the models will reflect present day channel conditions as closely as possible with the input flows reflecting post drainage conditions where appropriate.

There are inherent assumptions, limitations and uncertainty associated with hydraulic modelling, which are detailed for each hydraulic model within the Neagh Bann River Basin Hydraulic Report. The issues addressed include:

- Schematisation decisions regarding out-of-bank flow routes,
- Culvert/bridge schematisation (including skew angle considerations),
- Sweetening flow assumptions,
- Comments and notes throughout to reflect data sources; changes to parameters from default,
- Explanation of parameters used that are outside of the expected ranges, and
- Any other atypical assumptions made.

The Neagh Bann River Basin hydraulic report describes the overall conceptualised models and details the key aspects of each modelling software package used, including model inputs, how channel structures are represented and model parameters selected. The integration of hydraulic analysis with previously undertaken hydrology analysis is also outlined, with AFA specifics provided. Full details of the methodology, datasets used and outcomes of the hydraulic analysis for the NWNB CFRAM Study area can be found at www.floodinfo.ie.

5.3 FLOOD HAZARD MAPPING

The flood maps serve a range of functions:

Public Awareness:
Flood maps, and in particular flood extent maps and flood depth maps, inform the public, home owners, business owners, landowners and farmers, landlords and tenants about the likely risk of flooding in their areas, including the likely frequency of occurrence and depth. This knowledge can help people make decisions and prepare for flood events to reduce the potential impacts of flooding.

Planning & Development Management:
The flood maps should inform the Spatial Planning processes and support Planning Development decisions to avoid unnecessary development in flood-prone areas, in line with the 2009 Guidelines on The Planning System and Flood Risk Management[7].

Emergency Response Management:
The flood maps should aid in the preparation and implementation of flood event emergency response plans, by providing information on areas prone to flooding, the potential depths of flooding and what might be at risk in the event of a flood.

Flood Risk Management Decision Support:
Flood maps, and in particular various flood risk maps, are intended to be used as a decision support tool in the identification, planning, development, costing, assessment and prioritisation of flood risk management options, such as flood defence schemes, flood warning systems, public awareness campaigns etc.

[7] DHPLG/OPW 2009: Guidelines on The Planning System and Flood Risk Management

Based on extensive survey and analysis of river flows and the development of computer models to determine how flooding occurs, a range of flood hazard maps has been produced for each AFA within the Neagh Bann River Basin.

Flood hazard maps include maps of the projected extent of flooding for a range of flood events of different severity or probability, and the depth of flooding that would be expected for these events. The range of flood event probabilities include frequent events that may have recently been observed, up to very extreme events that may not have been previously seen, but which could occur at some point in the future.

The mapping also provides tabulated information on water level and flow for key points during the mapped flood event probabilities. These key locations include AFA boundaries / centres, river confluences, gauging stations along the watercourses and other locations approximately every 5km along a modelled watercourse. Model flows were validated against the estimated flows at hydrological estimation check points to determine if the model is well anchored to the hydrological estimates. The comparisons indicated that the models were generally well anchored to the hydrological estimates with very good correlation during the high frequency events were little flow is lost to overland flow. Any differences there may be between model flows and hydrological estimates during the medium to low frequency events can be attributed to the loss of flow from the watercourse to the floodplain. There is a change in the shape of the hydrograph due to attenuation, the higher return period hydrographs become longer as the attenuated flow makes its way through the system.

Extensive consultation on the draft hazard mapping was undertaken during 2015 as described in Section 4.4.3 via local authority workshops, stakeholder workshops, public consultation days, elected members' briefings, project-level website correspondence and formal SI consultation.

In excess of 300 members of the public attended the series of Public Consultation Days in their local AFAs across the NWNB CFRAM study area.

Many property and land owners expressed concern in relation to, either the impact of, or conversely the lack of impact of, the flood maps on local authority planning decisions and zoning. Many property owners expressed concern that their properties may be devalued by being identified as being within an area of flood risk. The information obtained was used to verify the hydrological and hydraulic modelling outputs based on the degree to which participants presented with local knowledge in agreement or disagreement with the draft mapping. As a result many of the models were updated in order to better represent the flood hazard and risk.

The formal SI consultation resulted in sixteen additional observations/comments pertaining to the NWNB CFRAM study area, two of which were relevant to Dundalk within the Neagh Bann River Basin, both these submissions requested information in relation to flooding and noted the importance of drainage within the watercourses (two objections were received relating to the NWNB CFRAM study area).

Flood maps represent the current understanding of areas prone to flooding and the nature of the flood in a given area for a flood event of a given probability. The maps therefore need to be updated on an ongoing basis to reflect changes in the physical environment, the availability of new information (e.g. after a major flood has occurred, new calibration data is captured or where improved hydrological / flood flow estimates are available), or for other reasons that could indicate that improvements in map accuracy can be achieved. The flood maps, including the risk maps (see below), for Monaghan are currently under review and will be updated following this review. In the event that any changes are made to the maps, the measure for Monaghan will also be reviewed (see Section 7).

The flood maps will be reviewed on an ongoing basis as new information becomes available (e.g. in relation to future or recent floods), with a formal review to be completed by the end of 2019 (see Section 8.4).

The final flood hazard mapping for the NWNB CFRAM Study area can be found at www.floodinfo.ie.

5.4 FLOOD RISK ASSESSMENT AND MAPPING

The Flood Risk Analysis is undertaken to assess and map the existing and potential future flood risk within the Study Area.

The analysis focuses on the receptors at risk from flooding and are categorised as social (including risk to people), environmental, cultural heritage or economic receptors. The risk to a receptor can be affected by its location within the flood extent or the proportion of the receptor within the flood extent, the depth to which it floods, the velocity of the water adjacent to the receptor and the receptors' vulnerability to flooding.

The clearest way to present the flood risk within an area being studied is through flood risk maps. The flood risk maps show the potential consequences of flooding. These maps detail the source of the risk and the receptors at risk. The flood risk maps include:

- Social Risk map
- Environmental Risk map
- Cultural Heritage Risk map
- Economic Risk map
- Economic Activity map
- Number of Inhabitants map
- Economic Risk Density map

Receptors were determined to be at risk from flooding if they were located within the flood extent, or with any part of their footprint intersecting with the flood extent. The degree of flood risk within buildings depends on the internal floor levels in comparison to simulated flood levels; internal floor levels were established by adjusting topographical ground levels outside the building, by allowance for threshold level change (based on the number of external steps visible externally).

The risk mapping presents risk to number of inhabitants, environment and types of economic activity and these were also consulted on alongside the draft hazard mapping for each AFA. The final flood risk mapping for the NWNB CFRAM Study area can be found at www.floodinfo.ie.

As set out in Section 1.2.2 there are flooding impacts where receptors are located within the floodplain. During a flood event, there is a heightened risk to people in both rural and urban environments. However such risks are considered to be more severe particularly at locations where high velocities have been predicted (which is in all of the AFAs within the Neagh Bann River Basin) or known vulnerable properties have been identified within the floodplain (which is in Monaghan AFA commencing at the 10% AEP present day event and similarly Dundalk/ Blackrock and Inniskeen AFAs at the 1%AEP event).

Table 5.1: Summary of Flood Risk in the Neagh Bann River Basin

AFA / Area	No. of Residential Properties at Risk		No. of Non-Residential Properties at Risk		NPVd[2] (€ millions)
	1% / 0.5% AEP[1]	0.1% AEP	1% / 0.5% AEP[1]	0.1% AEP	
Annagassan	0 Fluvial 9 Coastal 1 17 Coastal 2	0 Fluvial 33 Coastal 1 26 Coastal 2	0 Fluvial 4 Coastal 1 4 Coastal 2	0 Fluvial 7 Coastal 1 5 Coastal 2	6.6
Ardee	6	28	1	8	13
Carlingford & Greenore	136 Fluvial 117 Coastal 1 59 Coastal 2	351 Fluvial 183 Coastal 1 128 Coastal 2	54 Fluvial 34 Coastal 1 9 Coastal 2	65 Fluvial 47 Coastal 1 10 Coastal 2	232
Carrickmacross	7	69	3	13	0.5
Dundalk & Blackrock South	420 Fluvial 1233 Coastal 1 52 Coastal 2	952 Fluvial 3395 Coastal 1 60 Coastal 2	23 Fluvial 119 Coastal 1 33 Coastal 2	42 Fluvial 257 Coastal 1 33 Coastal 2	259
Inniskeen	10	19	4	18	6
Monaghan	13	77	34	66	27
Termonfeckin	5 Fluvial 0 Coastal 1	12 Fluvial 0 Coastal 1	2 Fluvial 0 Coastal 1	4 Fluvial 0 Coastal 1	0.7
D/S of Monaghan AFA - NI/ROI Border	7	9	8	12	N.A.
D/S of Carrickmacross AFA - U/S of Annagassan AFA	0	3	0	1	N.A.
D/S of Ardee AFA - U/S of Annagassan AFA	0	0	0	0	N.A.
D/S of Inniskeen AFA - Coast	8	12	9	15	N.A.
D/S of Termonfeckin AFA - Coast	4 Fluvial 4 Coastal1	20 Fluvial 9 Coastal1	0 Fluvial 1 Coastal1	1 Fluvial 1 Coastal1	N.A.

Notes: 1: AEP Flood Event Probabilities: 1% (or 100-year flood) for Fluvial Flooding, 0.5% (or 200-year flood) for Coastal / Tidal Flooding

2: NPVd = Net Present Value Damages (accumulated, discounted damages over 50 years)

Table 5.1 presents a summary of the current risk within the Neagh Bann River Basin, including the number of residential and non-residential properties at risk in each AFA and in the floodplains of other river reaches modelled outside of the AFA. The numbers of properties presented are determined independently for each source of flooding. For AFAs which are affected by more than one source of flooding, some properties may be at risk by more than one source, and as such properties may have been included in the numbers for both sources.

Further details of properties and assets (receptors) at risk in each AFA are given in Appendix E.

The numbers of properties at risk and the damage values set out in Table 5.1 are as determined at this stage of assessment under current conditions. The numbers and values

may change when the risk is assessed in more detail at the project-level of development of measures and/or due to the potential impacts climate change, future development and price inflation.

5.5 CONSIDERATION OF FUTURE CHANGES

It is likely that climate change will have a considerable impact on flood risk in Ireland.

- Sea level rise is already being observed and is projected to continue to rise into the future, increasing risk to our coastal communities and assets, and threatening damage to, or elimination of, inter-tidal habitats where hard defences exist (referred to as 'coastal squeeze').
- It is projected that the number of heavy rainfall days per year may increase, which could lead to an increase in both fluvial and pluvial (urban storm water) flood risk, although there is considerable uncertainty associated with projections of short-duration, intense rainfall changes due to climate model scale and temporal and spatial down-scaling issues.
- The projected wetter winters could give rise to increased fluvial flood risk and groundwater flood risk associated with turloughs.

These potential impacts could be significant for Ireland, where most of the main cities are on the coast and many of the main towns are on large rivers.

While there is considerable uncertainty associated with most aspects of the potential impacts of climate change on flood risk, it is prudent to take the potential for change into account in the development of Flood Risk Management policies and strategies and the design of Flood Risk Management measures.

Other changes, such as in land use, farming practices and future development could also have an impact on future flood risk through increased runoff and a greater number of people and number and value of assets within flood prone areas.

The National CFRAM Programme and parallel projects include the assessment of risk for two potential future scenarios; the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). These scenarios include for changes as set out in Table 5.2.

Table 5.2: Allowances in Flood Parameters for the Mid-Range and High-End Future Scenarios

Parameter	MRFS	HEFS
Extreme Rainfall Depths	+ 20%	+ 30%
Peak Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year[1]	- 0.5 mm / year[1]
Urbanisation	*No General Allowance – Review on Case-by-Case Basis*	*No General Allowance – Review on Case-by-Case Basis*
Forestation	- 1/6 Tp[2]	- 1/3 Tp[2] + 10% SPR[3]

Note 1: Applicable to the southern part of the country only (Dublin – Galway and south of this)
Note 2: Reduction in the time to peak (Tp) to allow for potential accelerated runoff that may arise as a result of drainage of afforested land
Note 3: Add 10% to the Standard Percentage Runoff (SPR) rate: This allows for temporary increased runoff rates that may arise following felling of forestry.

The impacts on flooding and flood risk under the MRFS and HEFS for the AFAs within the Neagh Bann River Basin are outlined in Appendix E.

Section 7.3.3 briefly describes how climate change was taken into account in the assessment of flood risk management options, which is detailed further in the relevant project reports.

5.6 COMMUNITIES (AFAs) OF LOW RISK

The AFAs were determined through the PFRA, as described in Section 3. The flood hazard and risk analysis undertaken through the Neagh Bann River Basin CFRAM Project has been significantly more detailed than the analysis undertaken for the PFRA.

For certain AFAs, this more detailed analysis has determined that there is in fact currently a low level of flood risk to the community from rivers and/or the sea. In such cases, the development of flood risk management measures aimed specifically at reducing the risk in such AFAs (i.e., local flood protection schemes) has not been pursued. Some of the River Basin-level measures will however still be relevant and applicable as some infrastructure, such as roads, may nonetheless be prone to flooding, and land around the AFA may be prone to flooding.

In the Neagh Bann River Basin, the level of risk has been determined as being low in the following AFA:

- Carrickmacross

The level of risk in the AFAs where the CFRAM process has determined that there is currently a low level of flood risk will be reviewed, along with all areas, as part of the review of the PFRA (see Section 3.3). This includes AFAs where the current level of risk may be low, but where the level of risk may increase in the future due to the potential impacts of climate change and so action in the future may be required to manage such impacts.

It is important to note that a low level of existing risk does not infer that undeveloped lands around the community are not prone to flooding, only that a limited number of existing properties are prone to flooding. When considering planning and development management, the potential for flooding in undeveloped areas needs to be fully considered for the AFAs where the risk to the existing community is low, as well as for all other communities, in accordance with the Guidelines on the Planning System and Flood Risk Management (see Section 7.4.1.1).

6 ENVIRONMENTAL CONSIDERATIONS

6.1 OVERVIEW

The Plan for the Neagh Bann River Basin has been the subject of a Strategic Environmental Assessment (SEA) and an Appropriate Assessment (AA) to meet the requirements of the Irish Regulations transposing the EU SEA and Habitats Directive respectively[8]. This Section provides a description of the process used to ensure that the environmental considerations within the Neagh Bann River Basin were addressed appropriately in the preparation of this Plan. The considerations with respect to each AFA, and the overall Plan, are summarised below and are detailed in the accompanying environmental documents.

The Draft Plan issued for consultation was accompanied by an SEA Environmental Report, which documented the SEA process. The Environmental Report identified, evaluated and described the likely significant effects on the environment of implementing the potential measures set out in the Draft Plan, with a view to avoiding adverse effects, and also, where appropriate, to set out recommendations as to how any identified adverse effects can be mitigated, communicated and monitored.

A Natura Impact Statement also accompanied the Draft Plan, to set out the potential impacts of possible measures on Natura 2000 sites (core breeding and resting sites for rare and threatened species, or sites for some rare natural habitat types)[9].

Following consideration of observations made in response to the public consultation on the Draft Plan, including comments received on the SEA Environmental Report and the Natura Impact Statement, the final Plan has been prepared. The Plan has been published with a SEA Conclusion Statement, which documents changes made to the Plan and its overall effects, and an Appropriate Assessment Conclusion Statement.

It is emphasised that the Plan sets out the strategy, actions and measures that are considered to be the most appropriate at this stage of assessment.

It should be noted that potential flood relief works or 'Schemes' set out herein will need to be further developed at a local, project-level before public exhibition or submission for planning approval. Local information that cannot be captured at the Plan-level of assessment, such as ground investigation results and project-level environmental assessments, may give rise at that stage to some amendment of the proposed works to ensure that it is viable and fully adapted, developed and appropriate within the local context, and that it is compliant with environmental legislation.

While the degree of detail of the assessment undertaken to date would give confidence that any amendments should generally not be significant, the potential works set out in the Plan may be subject to amendment prior to implementation.

In this context, it should be noted that the SEA and AA undertaken in relation to the Plan are plan-level assessments. The Plan will inform the progression of the proposed measures, but project-level assessments will need to be undertaken as appropriate under the relevant legislation for consenting to a Scheme or works that involves physical works and that may progress in the future. The approval / adoption of the Plan has not and does not confer approval or permission for the installation or construction of any physical works. EIA and/or AA Screening, and, where so concluded from the screening, Environmental Impact

8 SI No. 435 of 2004 (SEA Directive) and SI No. 477 of 2011 (Habitats Directive)
9 http://ec.europa.eu/environment/nature/natura2000/index_en.htm

Assessment and / or Appropriate Assessment, must be undertaken in accordance with the relevant legislation where relevant as part of the progression of measures that involve physical works. The body responsible for implementation of such measures (see Section 7) is required to ensure that these requirements will be complied with.

The environmental assessments set out herein relate to the Plan, and measures set out and proposed under the Plan (see Table 7.9). Flood relief schemes and works proposed or progressed through other projects and plans (see Table 7.10) are not the focus of the environmental assessments of the Plan, but are considered in terms of their in-combination or cumulative effects with the measures set out within the Plan.

Figure 6.1 shows the Interaction and stages of the optioneering, SEA and AA Processes.

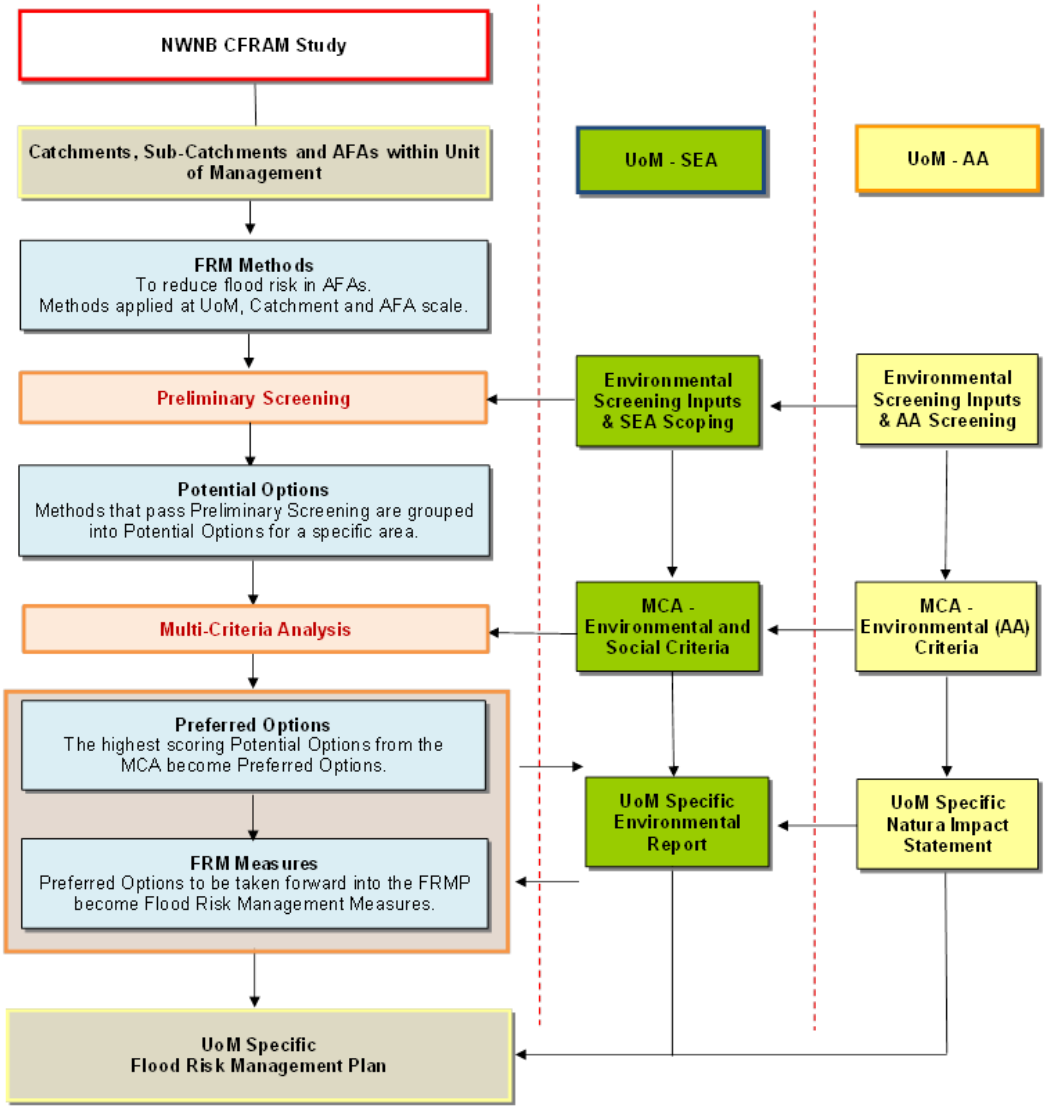


Figure 6.1 Interaction and stages of the optioneering, SEA and AA Processes

Particular issues such as knowledge gaps or mitigation measures that are expected to be necessary are set out in Section 6.3 and Sections 7.4.4 to 7.4.10 for each preferred measure.

6.2 ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES IN THE NEAGH BANN RIVER BASIN

The Neagh Bann River Basin is of high environmental value, particularly in terms of its protected areas, WFD Annex IV sites and its important landscapes. The maintenance and protection of these areas need to be taken into consideration when considering potential FRM options. With the location of the UoM bordering Northern Ireland there was the consideration of the environmental baseline in Northern Ireland and any potential transboundary impacts.

There are five SACs and five SPAs located within the Neagh Bann River Basin (Figure 6.2). Many of these sites lie on the coast and contain wetland and sea cliff habitats, along with their associated flora and fauna. As well as these wetland habitats supporting nationally and internationally important populations of Annex I bird species (including brent geese and red shank), they also play a vital role in flood management, as they act as sponges – holding water and allowing a gradual release over time.

The WFD, similar to the Floods Directive, supports the management of water resources on a catchment wide basis, however focuses on water status rather than flood risk management. All waterbodies are classified under the WFD according to their chemical, biological and hydromorphological status. In the Neagh Bann River Basin, 25% of rivers, 12% of lakes, and 84% of coastal and transitional water bodies were classified as being of satisfactory condition in the WFD first cycle Neagh Bann River Basin Management Plan.

Ten lakes and nearly 12km of rivers in the Neagh Bann River Basin are designated as Drinking Water Lakes/Rivers (Figure 6.2).

There are four designated bathing waters in the study area. In 2015, three beaches in the Neagh Bann River Basin achieved “Blue Flag” status.

There are 14 Industrial Emission Directive (IED) sites within the area, flooding of which has the potential to generate new pathways for pollutants to reach rivers and other waterbodies and result in failure to achieve WFD objectives.

All waterbodies within the Neagh Bann River Basin need to either remain at Good/High Status or improve to at least Good Status under the WFD.

Furthermore, it is vital that designated drinking waters are not negatively impacted upon by the development of FRM Options.

There are a variety of important landscapes within the Neagh Bann River Basin, designated by the Louth and Monaghan Landscape Character Assessments. Carlingford Lough and Mountains are a major tourist attraction and are designated as a landscape of international importance. Dundalk Bay is named as a sensitive landscape of regional and local importance due to the Dundalk Bay SPA saltmarsh and mudflats, with its full range of plant communities and impressive coastal routes of high scenic quality. The conservation and enhancement of these landscapes is vital.

Environmental considerations must be taken into account while assessing FRM options, in order to ensure that the key sites, features and landscapes located in the Neagh Bann River Basin remain protected.

Throughout the development and assessment of FRM Methods and Options environmental criteria were taken into consideration through the inputs from environmental professionals; initially at the methods screening stage, then via the weighting and scoring of relevant

objectives in the MCA options phase and ultimately by the SEA and AA of the draft plan in order that mitigation measures could be developed for inclusion in further detailed studies recommended by this plan. Examples of the strong and ongoing environmental influence are; development of alternatives, positional improvements of methods and incorporation of methods into options to enhance sustainability.

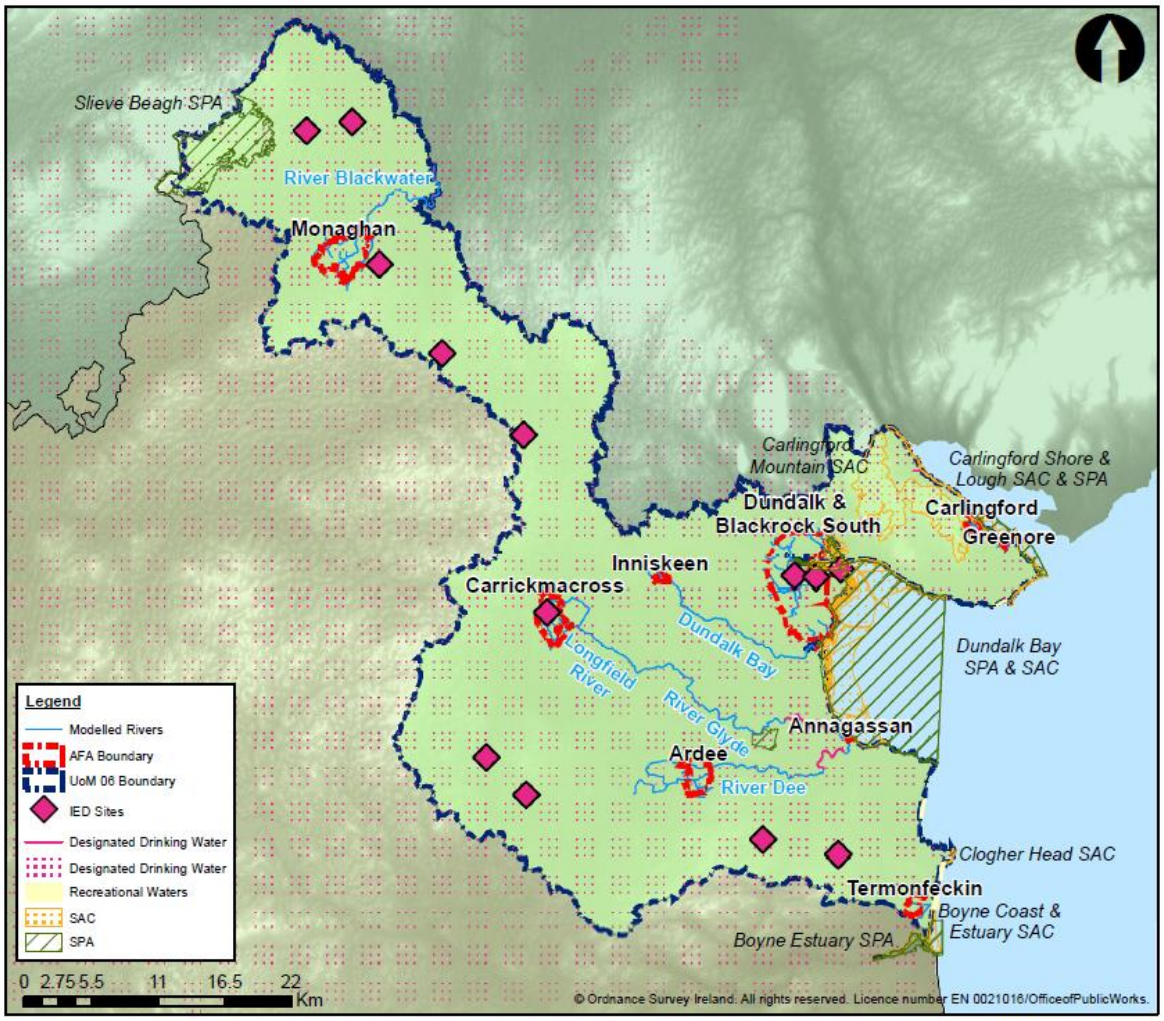


Figure 6.2 Map of Relevant Environmental Sites and Features

6.3 STRATEGIC ENVIRONMENTAL ASSESSMENT

A Strategic Environmental Assessment (SEA) Environmental Report for this Plan has been prepared in accordance with the European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2011 [S.I. 200/2011] and the Planning and Development (Strategic Environmental Assessment) (Amendment) Regulations 2011 [S.I. 201/2011] and in recognition of the Environmental Assessment of Plans and Programmes Regulations (Northern Ireland) 2004 (S.R. 280/2004), given the transboundary nature of the UoM. The purpose of this Environmental Report is to provide a formal and transparent assessment of the likely significant impacts on the environment as a result of implementing the Plan measures for the Neagh Bann River Basin under the North West – Neagh Bann CFRAM Study.

The OPW carried out a SEA Screening in 2011 for all the CFRAM Studies in Ireland and determined that SEA of the Plans would be required. A SEA Scoping Report, a SEA Scoping Summary Report, an Environmental Constraints Report and a table of High Level Impacts of FRM Methods were produced as part of the scoping phase of the SEA for the North West

– Neagh Bann CFRAM Study in 2015. The purpose of the Scoping Report and associated documents was to provide sufficient information on the North West – Neagh Bann CFRAM Study to enable the consultees to form an opinion on the appropriateness of the scope, format, level of detail, methodology for assessment and the consultation period proposed for the Environmental Report. All SEA Scoping documentation was made available to the public and formal consultations were undertaken with statutory bodies, local authorities and project stakeholders.

The MCA framework adopted to assist the decision making in the Plan (presented in Section 6 and 8.3), has environmental and social objectives on an equal weighting and importance as the technical and economic objectives. The wider environment has therefore been considered in the development of the Plan. As the Plan objectives cover a range of topics these were matched to the SEA Directive requirements. Many of the Plan objectives could therefore be used directly within the SEA as they are directly compatible. Much of the data used in the SEA process had to be nationally consistent and at a strategic level, to reflect the strategic nature and national scale of the CFRAM studies. Site visits and walkovers were however also undertaken throughout the CFRAM Studies by various technical, environmental and surveying staff, to gain an appreciation of local issues.

The SEA further informed the development of the Plan through the recommendation of mitigation measures to minimise or eliminate any potential negative environmental impacts of the options and the recommendation of environmental monitoring, to measure any wider environmental impacts of the Plan. All SEA documents published in support of the Plan for the Neagh Bann River Basin can be found at: www.floodinfo.ie.

6.4 APPROPRIATE ASSESSMENT

The Habitats Directive (Council Directive 92/43/EEC) on the conservation of natural habitats and of wild fauna and flora obliges member states to designate, protect and conserve habitats and species of importance in a European Union context. Article 6(3) of the Habitats Directive requires that "*Any plan or project not directly connected with or necessary to the conservation of a site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives*." This Directive was initially transposed into Irish Law through several pieces of legislation; however these have now been consolidated into the European Communities (Birds and Natural Habitats) Regulations 2011. Any proposed plan or project in Ireland that has potential to result in a significant effect on a designated European Site will require an Appropriate Assessment (AA). A key outcome of the Habitats Directive is the establishment of Natura 2000, an ecological infrastructure developed throughout Europe for the protection of sites that are of particular importance for rare, endangered or vulnerable habitats and species. In Ireland, Special Areas of Conservation (SACs), together with Special Protection Areas (SPAs) designated under the 'Birds Directive' (Council Directive 2009/147/EC - codified version of Directive 79/409/EEC on the Conservation of Wild Birds, as amended), are included in the Natura 2000 network, and are the 'European sites'.

An AA Screening was undertaken for the North West – Neagh Bann CFRAM Study in late 2015 / early 2016, which demonstrated there were nine European sites (four SACs and five SPAs) assessed as having the potential to experience an impact from the implementation of FRM methods in the catchments of seven of the AFAs in the Neagh Bann River Basin. The findings of the AA Screening were used to guide the development of the alternatives to be considered as part of the SEA. A Stage 2 AA was also undertaken in parallel with the SEA process. The outputs of the Stage 2 AA were integrated into the SEA Environmental Report and subsequently into this Plan. A source – pathway – receptor model approach was taken in the assessment of potential impacts on European sites, taking into account

their qualifying interests, conservation objectives and condition. The AA further impacted upon the development of the Plan again through the abandonment of particular methods, development of alternatives, positional improvements of methods and incorporation of methods into options to enhance sustainability having regard for the objectives of the particular protected areas.

Relevant mitigation measures are discussed in Section 6.3.

All AA documents published in support of the Plan for UoM36 can be found at: www.floodinfo.ie.

6.5 COORDINATION WITH WATER FRAMEWORK DIRECTIVE

The Water Framework Directive (WFD) is concerned with the protection of the ecological quality of our waters. While the 'Floods' Directive is concerned with the protection of people and society from our waters, both Directives are concerned with water and river basin management, and hence coordination is required between the two processes to promote integrated river basin management, achieve joint benefits where possible and address potential conflicts.

6.5.1 Bi-Lateral Meetings

The Department of Housing, Planning and Local Government (DHPLG) is the lead Government Department for the WFD, and the nominated Competent Authority for establishing the environmental objectives and preparing a programme of measures and the River Basin Management Plans. The OPW has held bi-lateral meetings with senior representatives in DHPLG to establish the appropriate methods and approaches to coordination, which were agreed to be primarily through cross-representation on management / governance groups.

For the second cycle of implementation of the WFD, the Environmental Protection Agency (EPA) has been defined as the Competent Authority for undertaking the characterisation and reporting of same to the Commission, and is also required to assist the DHPLG in its assigned duties. The OPW has held bi-lateral meetings with the EPA since 2013 to determine the suitable approaches to the practical aspects of implementation, which were agreed to be through cross-representation on management / governance groups, and ongoing bi-lateral meetings. These meetings have included workshops to share relevant data.

6.5.2 Cross-Representation on Management Groups

The governance structure for the WFD in Ireland was restructured for the second cycle under SI No. 350 of 2014, with a number of groups subsequently set up in 2014 and 2015.

6.5.2.1 WFD: Water Policy Advisory Committee

The Water Policy Advisory Committee (WPAC) was formally established in 2014 as the 'Tier 1' management committee. Its role is to provide strategic direction and advise the Minister for Housing, Planning and Local Government on the implementation of the WFD.

The OPW is represented on the WPAC to help ensure coordination in the implementation of the WFD and the 'Floods' Directive at a strategic level.

6.5.2.2 WFD: The National Implementation Group

The 'Tier 2' management committee is the National Implementation Group (NIG), which was established in March 2015. The purpose of the NIG is to assist the EPA and DHPLG with the technical and scientific implementation aspects of the WFD to ensure effectiveness,

consistency and efficiency. The Group has also been established to provide a mechanism for coordination with the implementation of the 'Floods' Directive.

Working Groups have been established by the NIG to assist with the implementation of certain aspects of the WFD, including characterisation and hydromorphology. A working group on the programme of measures has also been established under the WPAC.

The OPW is represented on the NIG, and also on the characterisation and hydromorphology working groups, to promote coordination on the technical and scientific aspects of mutual relevance in implementation.

6.5.2.3 WFD: Catchment Management Network

The Catchment Management Network was convened to provide a forum for the organisations involved in implementation of the WFD, and other key stakeholders, at the regional and local level, including the local authorities. The Network first met at a launch event and workshop in November 2014, which the OPW attended. The OPW has since continued to engage with the Network to consider the coordination issues in implementation at a local level.

Local Authorities Water and Communities Office

The Local Authority Water and Communities Office (LAWCO) was established in 2015 and is led jointly by Kilkenny and Tipperary County Councils on behalf of the local authority sector. LAWCO's functions include supporting communities to take action to improve their local water environment and provision of coordination at a regional level across public bodies involved in water management. The OPW has been kept aware of the development of the LAWCO through the WPAC and NIG. This local level of activity may provide a suitable point of coordination for local flood risk management activities such as flood protection works being implemented under the Minor Works Scheme or the promotion of natural water retention measures.

6.5.2.4 'Floods' Directive: Steering and Progress Groups

The EPA are represented on the National CFRAM Steering Group, as described in Section 4.3.1.1 above, and have advised on coordination matters, such as defining Objectives relevant to the WFD (see Section 1.4). EPA representatives and the WFD Project Coordinators (appointed in the first cycle of WFD implementation, and to be replaced by LAWCO officers) are also represented on the Project Steering and Progress Groups as described.

6.5.3 Exchange of Information

Relevant information was exchanged between the Competent Authorities relating the 'Floods' Directive and the WFD as necessary.

6.5.4 Coordination on Measures

One of the Flood Risk Management Objectives (Objective 3.a, Table 1.2) is to support the objectives of the WFD. This required an assessment of potential flood risk management measures against the objectives and requirements of the WFD to determine which measures might have a benefit or cause an impact in terms of the objectives of the WFD, varying in scale and duration. In this way, the potential contribution of flood risk management measures towards, or potential impacts on, the objectives of the WFD are embedded into the process for the identification of proposed measures.

Following approval of the Plans, the next stage to progress the proposed flood risk management measures will be to undertake more detailed assessment and design at a

project-level, before submitting the proposals for public exhibition (under the Arterial Drainage Acts) or planning permission. This assessment will normally include an Environmental Impact Assessment (EIA) and, where necessary, a project-level Appropriate Assessment (AA) in line with the Birds and Habitats Directives.

The assessment at the project-level will also enable a detailed appraisal of the potential impacts of the final measure on the water body hydromorphology, hydrological regime and status to be undertaken including, where necessary (if impacts cannot be avoided or mitigated), a detailed appraisal under Article 4(7) of the WFD (derogation related to deterioration caused by new modifications). This will build on the initial work done during the preparation of the Plans.

The work planned by EPA to improve assessment methods for river morphology has the potential to assist in:

- assessing the potential impact of flood management measures on WFD objectives,
- identifying the most appropriate mitigation measures, and,
- supporting decisions on the application of Article 4(7) derogations.

The EPA and OPW will work together to develop technical methods to assist in the assessment of impacts from flood protection schemes.

The OPW is also liaising with the EPA on the potential impact of WFD measures on flood risk, which are typically neutral (no impact), or may have some benefit in reducing runoff rates and volumes (e.g., through agricultural measures such as minimising soil compaction, contour farming or planting, or the installation of field drain interception ponds).

The OPW will continue to work with the EPA and other agencies implementing the WFD to identify, where possible, measures that will have benefits for both WFD and flood risk management objectives, such as natural water retention measures. It is anticipated that this is most likely to be achieved in areas where phosphorous loading is a pressure on ecological status in a sub-catchment where there is also an identified potentially significant flood risk (i.e., an AFA). This coordination will also address measures that may otherwise cause potential conflict between the objectives of the two Directives.

6.6 PROGRESSION OF MEASURES AND ASSESSMENT OF FUTURE WORKS

6.6.1 Approval of the Plan

As set out in Section 6.1 above, the approval / adoption of the Plan has not and does not confer approval or permission for the installation or construction of any physical works.

The progression of any measure towards the implementation of flood relief works or a 'Scheme' must, where applicable, include EIA and/or AA Screening, and, where so concluded from the screening, Environmental Impact Assessment and / or Appropriate Assessment, in accordance with the relevant legislation, and taking into account new information available at that time (e.g., as available from the Environmental Monitoring Framework and from the www.catchments.ie website).

As part of the EIA, alternatives to the potential works set out in the Plan must be considered. It is emphasised that the Plan sets out the strategy, actions and measures that are considered to be the most appropriate at this stage of assessment. Potential flood relief works or 'Schemes' set out herein will need to be further developed at a local, project-level

before exhibition under the Arterial Drainage Acts 1945 and 1995 (OPW managed schemes) or submission for planning approval under the Planning and Development legislation/regulations (Local Authority managed schemes). The project-level assessment will include the consideration of alternatives, taking into account local information that cannot be captured at the Plan-level of assessment, such as ground investigation results and project-level environmental assessments. The project-level assessment may give rise at that stage to amendment of the proposed works to ensure that the works:

- Are viable and fully adapted, developed and appropriate within the local context.
- Comply with environmental legislation.
- Consider at a project-level of detail the potential impacts and benefits related to the objectives of the Water Framework Directive (see Section 6.5.4).
- Provide benefits with regards to other objectives (e.g., water quality, biodiversity) where reasonably possible and viable, such as through the use of natural water retention measures, removing barriers to fish migration or the creation of habitat features.

No measure in the Plan has been considered for, or been subject to an assessment under, the 'Imperative Reasons of Over-riding Public Interest (IROPI)' procedure under the Birds and Habitats Directive (Article 6[4]).

In addition to planning or confirmation, licences may be required by the implementing body to progress certain physical works, such as those that may cause damage or disturbance to protected species or their habitats, and the granting of such licences during or following the project-level assessment would be required before such works could proceed.

The body responsible for the implementation of such measures (typically the OPW or a local authority - see Section 8) is required to ensure that the requirements above, and the requirements of all relevant environmental legislation (such as the Environmental Liability and Water Framework Directives), are complied with.

6.6.2 Implementation Routes for Physical Works

6.6.2.1 Works Requiring Planning Consent or Confirmation

As set out above, the body responsible for the implementation of measures that will involve physical works, such as a flood relief scheme, will typically be either the OPW or the relevant local authority. There are three primary legislative routes by which such works may progress to construction stage, as set out in Figure 8.1, are:

- Project led by OPW (or by a Local Authority on behalf of the OPW), under the Arterial Drainage Acts.
- Project led by the relevant Local Authority under the Planning and Development Regulations.
- Project led by the relevant Local Authority under the Strategic Infrastructure Act.

As noted above, while the Plans have conducted a Strategic Environmental Assessment and Appropriate Assessment, the progression of any measure by either the OPW or a local authority will include all applicable project-level assessments, such as:

- Environmental Impact Assessment: For a project above the thresholds specified under Article 24 of the European Communities (Environmental Impact Assessment) Regulations, 1989 as amended or a project likely to have significant effects on the environment, having regard to the criteria specified for under Article 27 of the same EIA Regulations 1989 as amended.

– Appropriate Assessment: All projects will be screened for Appropriate Assessment and, where there is a potential for a significant effect on a European (Natura 2000) site, an Appropriate Assessment will be undertaken in accordance the European Communities (Birds and Natural Habitats) Regulations 2011.

6.6.2.2 Exempted Development

For some measures, the physical works involved are of limited scale and scope. These will typically be works that would be progressed by the local authority, with funding provided by the OPW through the Minor Flood Mitigation Works and Coastal Protection Scheme (the 'Minor Works Scheme' - see Section 2.6.5), that are deemed as exempted development in accordance with the Planning and Development Act 2000 (as amended).

As public bodies, the local authorities are required to comply with all relevant legislation, and hence must undertake EIA and/or AA screening for physical works where relevant (i.e., where the works are not exempt or below relevant thresholds) and as required by legislation. As a condition of the provision of funding for such works, the OPW requires written confirmation from the local authority of compliance with all relevant environmental legislation.

6.6.3 Mitigation Measures

Projects stemming from the Flood Risk Management Plans (FRMP) will apply a range of standard processes and measures that will mitigate potential environmental impacts. While the applicability of processes and particular measures will be dependent on the nature and scale of each project, examples of typical processes and measures that will be implemented where applicable at the different stages of project implementation are set out below.

6.6.3.1 Project Mitigation: Consenting Process

As set out in Section 6.6.2 above, the consenting process for the progression of measures involving physical works will require the applicable environmental assessments. Also, the consenting authorities may set out specific environmental conditions as part of the project approval.

6.6.3.2 Project Mitigation: Pre-Construction / Project Level Assessment

For the project-level assessment of projects, where options are available, the design uses a hierarchy to mitigation measures along the following principles:

– Avoidance: avoid creating the potential impact where feasible.

– Mitigation: minimise the potential impact through mitigating measures.

– Enhancement: Enhance the environment to better than pre-project conditions, where reasonably possible.

The progression of a flood management project through the project-level assessment phase can entail a series of surveys to inform the design, where the scale of surveys would be proportionate to the complexity and potential impacts of the project. These can include:

– Engineering structure surveys

– Topographical surveys

– Habitat & species surveys[10]

[10] In the context of ecological mitigation, the habitat and species surveys are conducted as required to assess the various aspects for the project, such as ecological surveys for:

– protected or notable habitats and species, including Annex 1 habitats, Annex II and Annex IV species,

- Ornithological surveys
- Bat surveys
- Fish surveys
- Water quality surveys
- Archaeological surveys
- Landscape and visual assessments
- Land valuation surveys
- Other surveys as deemed necessary to prepare a project

Where necessary, Wildlife Derogation Licences and archaeological licences will be sought from Department of Culture, and the Gaeltacht.

The scope of the EIS will include a hydro-morphological assessment to more clearly consider and support the Water Framework Directive (WFD) objectives (see Section 6.5.4).

The potential role for non-structural measures for each flood risk area, including natural type flood management measures will be examined in more detail and incorporated into the scheme design if deemed appropriate.

6.6.3.3 Project Mitigation: Construction Stage

For large and complex projects and sites, where environmental management may entail multiple aspects, a project specific Construction Environmental Management Plan (CEMP) may be developed. This will form a framework for all environmental management processes, mitigation measures and monitoring and will include other environmental requirements such as invasive species management measures, if applicable.[11]

A designated environmental officer, project ecologist and project archaeologist will be appointed, as appropriate for the project.

6.6.3.4 Project Monitoring

The Plan, with its associated SEA and plan-level AA, sets out a series of monitoring requirements, in connection with the SEA objectives and the predicted effects of the Plan. For measures involving physical works, the project-level EIA and AA, where conducted, will set out the specific monitoring required for each measure.

- species protected under the Wildlife Acts,
- species protected under the Flora Protection Order,
- the resting and breeding places of relevant species and,
- invasive species, both plant and animal.

[11] There are a range standard type mitigation measures consisting of good construction practices and good planning of works, that are used within flood management projects such as for example: Refuelling of plant and vehicles away from watercourses, Installation of wheel-wash and plant washing facilities, working only within environmental windows e.g. in-stream works in salmonid channels from May to September, Integrate fisheries in-stream enhancement through the Environmental River Enhancement Programme

7 MANAGING FLOOD RISK

7.1 OVERVIEW

The purpose of the Plan is to set out the strategy for the sustainable, long-term management of flood risk in the Neagh Bann River Basin, focussed on the AFAs. The strategy comprises a set of potential measures, that may be actions, physical works or 'Schemes', further assessments or data collection. For each area or location, a number of options would typically have been available as to what measures could be brought forward and proposed as part of the Plan.

This Section describes the process pursued under the National CFRAM Programme and other policies, projects or initiatives for identifying what flood risk management measures might be suitable for a given area or location, and then how the options for such measures were appraised to determine which options would be most effective and appropriate for each area or location. This process makes use of the flood mapping (Section 5), information provided through public consultation events and processes, and a range of other data and information, as appropriate. Similar processes were followed for the Pilot CFRAM Projects and other projects undertaken in parallel with the CFRAM Programme. The Section concludes with a summary of the measures proposed under this Plan.

Further information on the process set out within this Section on the identification and appraisal of options for managing flood risk within the Neagh Bann River Basin is set out in the Preliminary Options Report for the NWNB CFRAM Project, and in similar reports for parallel studies. These reports are available from the OPW website; www.floodinfo.ie.

7.2 METHODS OF FLOOD RISK MANAGEMENT

There are a wide range of different approaches, or methods, that can be taken to reduce or manage flood risk. These can range from non-structural methods, that do not involve any physical works to prevent flooding but rather comprise actions typically aimed at reducing the impacts of flooding, to structural works that reduce flood flows or levels in the area at risk or that protect the area against flooding. The range of methods for managing flood risk that are considered include those outlined below.

7.2.1 Flood Risk Prevention Methods

Flood risk prevention measures are aimed at avoiding or eliminating a flood risk. This can be done by not creating new assets that could be vulnerable to flood damage in areas prone to flooding, or removing such assets that already exist. Alternatively, prevention can be achieved by completely removing the potential for flooding in a given area, although in practice this is rarely possible (the frequency or magnitude of flooding can be reduced by flood protection measures, but it is generally not possible to remove the risk of flooding entirely).

Flood prevention is hence generally focussed on sustainable planning and / or the re-location of existing assets, such as properties or infrastructure, and includes:

- Sustainable Planning and Development Management
- Sustainable Urban Drainage Systems (SUDS)
- Voluntary Home Relocation
- Preparation of Local Adaptation Planning
- Land Use Management and Natural Flood Risk Management Measures

7.2.2 Flood Protection Methods

Flood protection measures are aimed at reducing the likelihood and/or the severity of flood events. These measures, typically requiring physical works, can reduce risk in a range of ways, such as by reducing or diverting the peak flood flows, reducing flood levels or holding back flood waters.

Protection measures typically considered include:

- Enhance Existing Protection Works
- Flood Defences
- Increasing Channel Conveyance
- Diverting Flood Flows
- Storing Flood Waters
- Implementing Channel Maintenance Programmes
- Maintenance of Drainage Schemes
- Land Commission Embankments

The preferred Standard of Protection offered by flood protection measures in Ireland is the current scenario 1% Annual Exceedance Probability (AEP) flood for fluvial flooding and 0.5 % AEP flood for tidal flooding (also referred to as the 100-year and 200-year floods respectively), although these standards can increase or decrease depending on local circumstances.

7.2.3 Flood Preparedness (Resilience) Methods

In some instances, it may not be possible to reduce the likelihood or severity of flooding to an area at risk. However, actions and measures can be taken to reduce the consequences of flooding, i.e., reduce the risk to people and of damage to properties and other assets, and make sure that people and communities are resilient to flood events. This can be achieved by being aware of and preparing for the risk of flooding, knowing when floods are going to occur, taking actions immediately before, during and after a flood. The actions and measures of this type include:

- Flood Forecasting and Warning
- Emergency Response Planning
- Promotion of Individual and Community Resilience
- Individual Property Protection
- Flood-Related Data Collection

7.2.4 Continue Existing Regime / Do Nothing / Minor Measures

In some circumstances the existing programme of works may be sufficient to effectively manage the existing flood risk. For instance, the OPW Arterial Drainage Maintenance Programme ensures that some towns and villages around the country have already been afforded a significantly reduced level of flood risk, and in some communities, the 1% AEP flood is contained within the river channel and so there is very little flood risk. In such circumstances, there may be no need to implement additional measures, and so continuing the existing regime of works may be sufficient to adequately meet the flood risk management Objectives.

In other areas, the level of risk may be relatively low and the cost of implementing any substantial additional measures may be significant. Where the costs of implementing new measures are higher than the benefits of such measures, in terms of risk reduction, then it will not be possible to justify such works. In this case, it may not be possible to undertake any new measures, or only implement low-cost actions such as local maintenance of a channel or minor repairs / alterations to existing structures to reduce the risk and/or avoid a future increase in risk.

7.2.4.1 Maintain Existing Flood Risk Management Works

Flood protection works require maintenance to keep them in good order and able to offer the Standard of Protection they were designed to provide (subject to further works that may be necessary arising from the impacts of climate change). If the level of maintenance is inadequate, the condition can deteriorate and the likelihood of failure of the measure during flood events, including those below the standard of protection, can increase. Maintenance of existing flood risk management works, such as flood relief schemes, should therefore be undertaken by the owner of the works to ensure their performance as designed.

7.3 DEVELOPMENT AND APPRAISAL OF FLOOD RISK MANAGEMENT OPTIONS

This Section describes the process, or steps, pursued under the National CFRAM Programme for identifying the measures that would be most effective and appropriate for each area and location. Section 7.3.8 describes how other measures were identified through other policies, projects and initiatives.

7.3.1 Spatial Scales of Assessment

Measures to manage flood risk can be applied at a range of spatial scales, namely the whole River Basin, at a catchment- or sub-catchment level, or at an AFA or local level. The assessment of possible flood risk management measures has been undertaken at each of these spatial scales of assessment under the CFRAM Programme, to ensure that a catchment-based approach is taken. This is to ensure that a measure that may benefit multiple areas or AFAs is fully considered, and that potential impacts of measures elsewhere in the catchment (e.g., up- and down-stream) are assessed and understood.

Identifying the appropriate spatial scale of assessment (SSA) informs the optioneering process by assuring that only flood risk management methods appropriate to the spatial scale are considered, to identify measures that may benefit mutilple areas, and to ensure measures proposed for smaller SSAs are not redundant or do not conflict with other areas within a catchment. When considering which methods to assess it is accepted that certain methods will be more appropriate at larger spatial scales and others at smaller spatial scales. It is important therefore to define what spatial scale is being assessed at the beginning of the method screening process. This is to avoid a situation where the full impact of a FRM method is missed due to the spatial scale of assessment (SSA) being too small, or the FRM method being considered is ineffective as the SSA is too large

The following SSAs are defined within the NWNB CFRAM Study Area:

- Unit of Management SSA - refers to the whole Unit of Management. There are three Units of Management within the NWNB CFRAM study area one of which is UoM06.
- Sub-Catchment SSA - refers to the catchment of the principle river on which multiple AFAs sit.
- AFA SSA - refers to the individual AFA being considered only.

- IRR SSA - refers to Individual Risk Receptor (IRR). There are no such IRR identified in the NWNB CFRAM Study area.

Table 7.1 and Figure 7.1 detail the SSAs for the Neagh Bann River Basin.

Table 7.1 – List of SSAs in the Neagh Bann River Basin

SSA	Name	AFAs within SSA		
UoM	Neagh Bann River Basin	All		
Sub Catchment	Glyde-Dee	Carrickmacross	Ardee	Annagassan
AFA	Annagassan			
	Ardee			
	Carlingford & Greenore			
	Dundalk & Blackrock South			
	Inniskeen			
	Monaghan			
	Termonfeckin			

Carrickmacross AFA is low risk under CFRAMS.

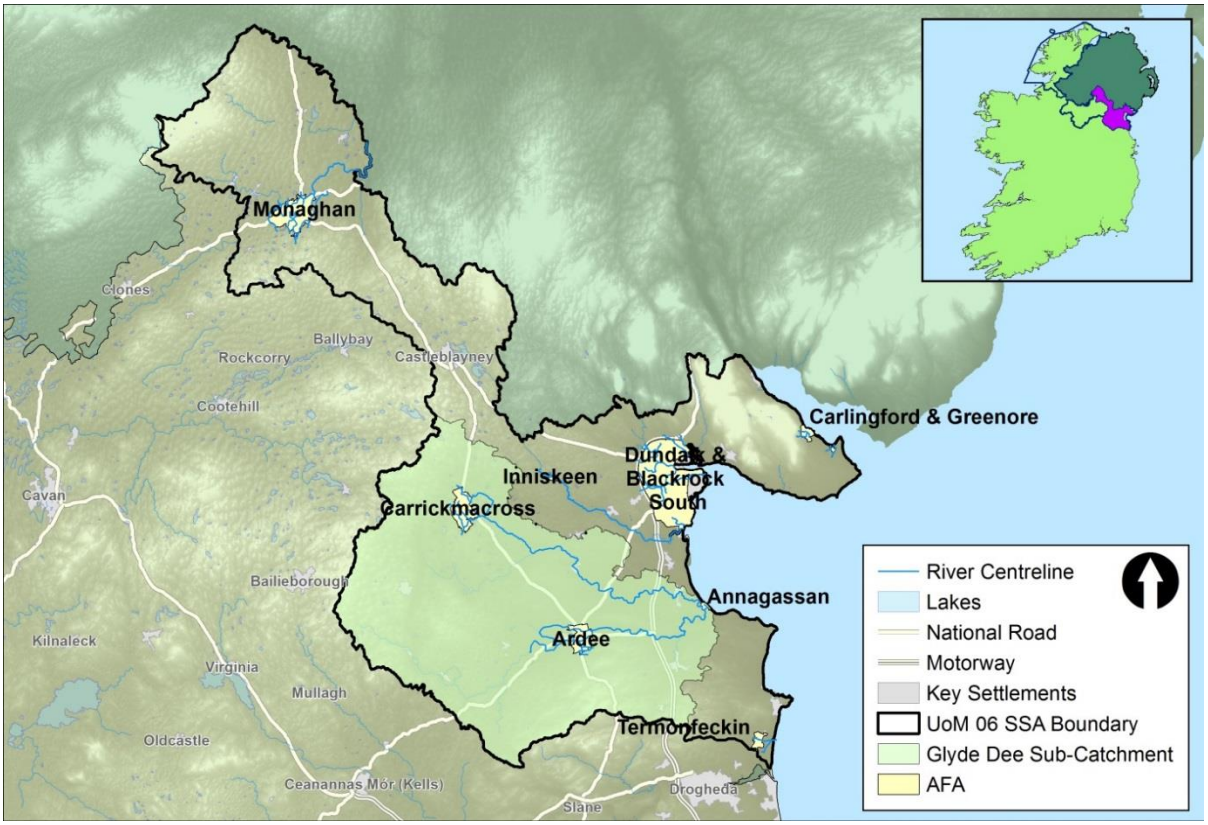


Figure 7.1: Neagh Bann River Basin Spatial Scales of Assessment

The process for developing and appraising potential flood risk management options as described herein was hence undertaken at the catchment- or sub-catchment level, as well as the AFA or local level.

Flood risk management measures applicable at the River Basin level are generally non-structural measures already in-place or mandated under existing legislation or policy (as set

out in Table 1.1 or determined through Government Decisions). These measures are set out in the Plan for clarity, and are being kept under review.

7.3.2 Step 1: Screening of Flood Risk Management Methods

Not all of the available methods for flood risk management will be applicable in all areas or locations. Some may, for example, not be socially or environmentally acceptable, be excessively expensive or may not be effective in managing or reducing flood risk in a particular community.

Screening is a process that is undertaken for the catchment and AFA spatial scale to filter out flood risk management methods that are not going to provide applicable, acceptable or viable measures for managing flood risk, either alone or in combination with other methods, for a given area or location. The methods were screened, based on an initial assessment, against the following criteria:

- ***Applicability:*** Effectiveness in managing or reducing flood risk
- ***Economic:*** Indicative costs relative to economic benefits
- ***Environmental:*** Potential impacts for the environment
- ***Social:*** Potential impacts for people, the community and society
- ***Cultural:*** Potential impacts for assets and collections of cultural importance

The outcome of the screening process was a set of flood risk management methods that might form, alone or in combination, potentially viable options for flood risk management measures.

For some communities (AFAs), typically those where the risk is relatively low, no local flood risk protection methods were found to be applicable, acceptable and viable, based on the screening process. In such cases, the process does not move to the next steps described below. However, the River Basin-level prevention and preparedness measures will generally be applicable or available to manage the flood risk that does exist in the community. These cases are described along with other AFAs under Section 7.4.

7.3.3 Step 2: Development of Options for Flood Risk Management Measures

The set of flood risk management methods identified through the screening process as being potentially effective or appropriate for each area or location were considered as to how they might be used to form potential measures aimed at achieving the flood risk management Objectives. This process involved professional experience and judgement, informed and guided by local knowledge and suggestions, to develop potentially viable options that incorporate one, or more often a combination of, the screened methods.

The options for possible measures were then developed to outline design, typically to the target Standards of Protection (see Section 7.2.2), based on the information available at the time of development. This permitted an estimation of the cost of the option, and also an appraisal of the option to determine how well it would achieve the flood risk management Objectives, the potential negative impacts arising, and whether it would be economically viable.

The development of options under the CFRAM Programme, while focused primarily on existing risk, included consideration of potential future flood extents, depths and risks based on the flood mapping undertaken for the Mid-Range and High-End Future Scenarios (see Section 5.5). This was completed to identify what flood protection or other measures might

be required in the future, and how adaptable measures aimed at addressing existing risks would be to meet future needs.

The development of options typically included the modelling of the measures where these include physical works. This was to determine the effectiveness of the option in reducing risk, and also to assess any impacts up- or down-stream with the objective of ensuring that any proposed measure does not increase risk up- or down-stream. Where a possible increase in risk elsewhere has been identified as being significant then the option would have been rejected or amended. Where a minor increase in risk was identified, then this will be addressed and mitigated at the project-level of assessment (see Section 8.1) to ensure that the measure would not increase risk elsewhere.

The options considered include 'No Change', which means continuing only the current flood risk management activities.

7.3.4 Step 3: Appraisal by Multi-Criteria Analysis

A range of possible options for measures are typically available to manage and reduce flood risk in a given area or location, and so a method of analysis was needed to determine which of the options might be the most effective and appropriate. This analysis needed to take account of the goals of the Plan, i.e., the flood risk management Objectives (see Section 1.4), and also the general importance of each Objective (the 'Global Weighting' - see below) and the local importance or relevance of each Objective (the 'Local Weighting' - see below).

The method of analysis used to appraise the options is called a 'Multi-Criteria Analysis', or 'MCA'. This is a method for appraising an option against a weighted range of diverse Objectives, to produce a mark or score of performance, referred to as the 'MCA-Benefit Score'. To produce the overall MCA-Benefit Score, a number of steps were followed, as below:

1. Each option was scored on how it performed against each Objective in turn (i.e., its benefits in reducing risk or contributing to other objectives, or its negative impact in terms of increasing risk or causing harm or detrimental impacts).
2. This score was then multiplied by both the Global and Local Weightings (see below).
3. The weighted scores for each Objective were then added up to give the overall MCA-Benefit Score for the option.

The MCA-Benefit Score permitted the comparison of one option against another to identify which option would perform best on balance across all of the Objectives, whereby the higher the score, the better the option would perform. The MCA-Benefit Score reflects the balance of benefits and impacts across all sectors and Objectives.

A critical consideration in selecting a preferred, or best-performing, option is cost. One option may perform marginally better than another, but cost considerably more, and it would be in the best interest of the tax-payer to achieve the best performance per Euro invested. The preferred measure, based on the MCA Appraisal, was hence initially determined as that which had the highest MCA-Benefit Score relative to cost.

A detailed description of the MCA Appraisal process is set out in the CFRAM Technical Methodology Note on Option Appraisal and the Multi-Criteria Analysis (MCA) Framework, which is available from the OPW website (www.floodinfo.ie).

7.3.4.1 Assigning Global Weightings for Each Objective

The MCA makes use of 'Global Weightings' to rank the general importance, or level of 'societal value', for each of the Objectives. The more important the Objective, the higher the Global Weighting, and hence the more influence the Objective has in determining the overall MCA-Benefit Score and the choice of preferred flood risk management measure.

Given the key role the Objectives and their Global Weightings have in selecting preferred measures for managing flood risk, the OPW considered it appropriate to consult on the Global Weightings that would be assigned to each Objective (see Section 4.4.4).

The final Global Weightings adopted for each Objective, which are consistent nationally (i.e., do not vary between River Basins or AFAs), are included in Table 1.2.

7.3.4.2 Assigning Local Weightings for Each Objective

Local Weightings are intended to reflect the relevance of each Objective within the context of each catchment or AFA for which flood risk management measures are being considered. For example, in a given AFA there may be no Utility Infrastructural assets, or no Environmentally Protected Areas, and hence the Local Weighting for the relevant Objectives should be reduced as they are not relevant for that AFA. A Local Weighting value from 0 up to 5 was assigned for each Objective for each catchment and AFA, depending on the relevance of the Objective in the given area.

The Local Weightings were determined by the Project Consultants in consultation with the OPW and the Project Steering and Progress Groups, and informed by:

- Public and stakeholder consultation through questionnaires that were available from the Project Website and issued at the PCDs and through the Project Stakeholder Group.
- Guidance issued by the OPW to ensure a consistent approach nationally (see www.floodinfo.ie, CFRAM Technical Methodology Note - Option Appraisal and the Multi-Criteria Analysis (MCA) Framework).

The Local Weightings for the AFAs for the Neagh Bann River Basin are set out in the Preliminary Options Report available from the OPW website (www.floodinfo.ie).

7.3.5 Step 4: Economic Appraisal

As well as an MCA, flood risk management investments must be economically viable, i.e., the economic benefits of a measure (reduction in flood damages) must outweigh the cost of the measure, to ensure value for money. This equation is called the Benefit - Cost Ratio (or 'BCR'), where the BCR should be equal to or greater than one.

The appraisal to determine whether options meet this requirement, is called a cost-benefit analysis. This analysis was undertaken to determine the economic viability of each option for each area or location. A more detailed description of the cost-benefit analysis is set out in the CFRAM Technical Methodology Note on Cost-Benefit Analysis (CBA), which is available from the OPW website, www.floodinfo.ie.

7.3.6 Step 5: Public And Stakeholder Engagement

Public and stakeholder engagement and participation in the process to develop effective and appropriate flood risk management measures is critical. The local community typically have a wealth of knowledge about flooding in their area that can help identify possible solutions and ensure that any proposed measures are effective. Community participation is also essential to make sure that any proposed measure is locally-acceptable, addressing

key areas of concern and ensuring that the measure, if structural, will fit into the community environment in a way that local people will welcome.

The engagement process with the public and stakeholders to identify potentially suitable measures began at the Public Consultation Days (PCDs) held for the flood mapping (see Section 4.4.3), where people were asked to identify what they saw as potential solutions for the flood problems in their area, and also what was locally important to guide the identification of the Local Weightings for the MCA Appraisal (see Section 7.3.4).

As options were being considered and appraised, following the processes set out above, a further set of PCDs were held in relevant communities. Members of the local community and other stakeholders attending were presented at these events with the possible options and the findings of the appraisal processes to that time, and were asked for their opinions and input to help guide the process of identifying a preferred measure. The list of PCDs that were held at this stage of the Project is provided in Appendix D.6.

7.3.7 Step 6: Identification of Preferred Measures

The measures set out in this Plan have been determined based on a range of considerations, namely:

- The MCA Benefit - Cost Ratio (BCR)
- The economic viability (the economic BCR)
- The environmental considerations and assessments
- The adaptability to possible future changes, such as the potential impacts of climate change
- Professional experience and judgement of the OPW, local authorities and RPS
- Public and stakeholder input and opinion

A further series of PCDs were held to engage locally and directly with the community and provide people with opportunity to discuss and fully understand the Draft Plans (see Section 4.4.6). The PCDs in the Neagh Bann River Basin were held during the option development stage at the venues listed in Appendix D.7.

The measures to be taken forward to project-level development through the implementation of this Plan are described in Section 7.4 below, and are summarised in Section 7.7.

7.3.8 Measures Identified from Other Policies, Projects and Initiatives

In addition to the measures identified through the CFRAM Programme, a number of other measures and actions are required or have been deemed to be of benefit in managing flood risk through other policies, projects and initiatives. A range of policy and legal requirements, as identified in Table 1.1, mandate that certain measures be implemented, such as the ongoing maintenance of Flood Relief Schemes and Arterial Drainage and Drainage District Schemes, or the consideration of flood risk in planning and development management. Other measures and actions have been identified through past or ongoing projects, such as certain flood relief schemes in AFAs not addressed by the CFRAM Programme, or through other initiatives, such as policy recommendations from the Interdepartmental Flood Policy Co-ordination Group. These measures are identified within the draft Plan along with those developed through the CFRAM Programme.

7.4 OUTCOMES

The application of the process and the resultant outcomes for the Neagh Bann River Basin, and for the catchments, sub-catchments and AFAs within the River Basin are set out in the sub-sections below.

7.4.1 Measures Applicable for All Areas

There are certain prevention and preparedness measures related to flood risk management, as described in Section 7.2 above and in Appendix F, that form part of wider Government policy. These measures, set out below under the themes of prevention, protection and preparedness, should be applied as appropriate and as applicable across all areas of the River Basin, including properties and areas outside of the AFAs, as well as within.

7.4.1.1 Prevention: Sustainable Planning and Development Management

The application of the Guidelines on the Planning System and Flood Risk Management by the planning authorities is essential to avoid inappropriate development in flood prone areas, and hence avoid unnecessary increases in flood risk into the future. The flood mapping produced through the CFRAM Programme and parallel projects will facilitate the continued application of the Guidelines.

Measure Name:	Application of the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009)
Code:	GBNIIENB-UoM-9011-M21
Measure:	The Planning Authorities will ensure proper application of the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009) in all planning and development management processes and decisions, including where appropriate a review of existing land use zoning and the potential for blue/green infrastructure, in order to support sustainable development, taking account of the flood maps produced through the CFRAM Programme and parallel projects.
Implementation:	Planning Authorities
Funding:	Existing duties (Planning Authorities)

7.4.1.2 Prevention: Sustainable Urban Drainage Systems

Sustainable Urban Drainage Systems (SUDS) can play a role in reducing and managing run-off from new developments to surface water drainage systems, reducing the impact of such developments on flood risk downstream, as well as improving water quality and contributing to local amenity.

Measure Name:	Implementation of Sustainable Urban Drainage Systems (SUDS)
Code:	GBNIIENB-UoM-9012-M34
Measure:	In accordance with the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009), planning authorities should seek to reduce the extent of hard surfacing and paving and require, subject to the outcomes of environmental assessment, the use of sustainable drainage techniques.
Implementation:	Planning Authorities
Funding:	Existing duties (Planning Authorities)

7.4.1.3 Prevention: Voluntary Home Relocation

In extreme circumstances, the flood risk to a home may be such that the homeowner may consider that continuing to live in the property is not sustainable and would choose to relocate.

In response to the floods of Winter 2015/2016, the Government has agreed to the administrative arrangements for a voluntary homeowner relocation scheme, to provide humanitarian assistance for those primary residences worst affected by these floods. At present, there is no Scheme to provide financial assistance to other home-owners choosing to relocate due to their flood risk.

The Interdepartmental Flood Policy Co-ordination Group is considering the future policy options for voluntary home relocation for consideration by Government.

Measure Name:	Voluntary Home Relocation Scheme
Code:	GBNIIENB-UoM-9052-M22
Measure:	Implementation of the once-off Voluntary Homeowner Relocation Scheme that has been put in place by Government in 2017. The Interdepartmental Flood Policy Co-ordination Group is considering the policy options around voluntary home relocation for consideration by Government.
Implementation:	Home-Owners with humanitarian assistance to those qualifying under the Voluntary Homeowners Relocation Scheme, 2017
Funding:	Homeowners and the OPW, under the 2017 Scheme

7.4.1.4 Prevention: Local Adaptation Planning

The consultation document on the National Climate Change Adaptation Framework recognises that local authorities also have an important role to play in Ireland's response to climate adaptation. Given the potential impacts of climate change on flooding and flood risk, the local authorities should take fully into account these potential impacts in the performance of their functions, in particular in the consideration of spatial planning and the planning and design of infrastructure, in line with the Local Authority Adaptation Strategy Development Guidelines (EPA, 2016).

Measure Name:	Consideration of Flood Risk in local adaptation planning
Code:	GBNIIENB-UoM-9013-M21
Measure:	Local authorities should take into account the potential impacts of climate change on flooding and flood risk in their planning for local adaptation, in particular in the areas of spatial planning and the planning and design of infrastructure.
Implementation:	Local Authorities
Funding:	Existing duties (Local Authorities)

7.4.1.5 Prevention: Land Use Management and Natural Flood Risk Management Measures

The OPW has been liaising with the EPA on the potential impact of WFD measures on flood risk, which are typically neutral (no impact), or may have some benefit in reducing runoff rates and volumes (e.g., through agricultural measures).

The OPW will work with the EPA, local authorities and other agencies to identify, where possible, measures that will have benefits for both WFD and flood risk management objectives, such as natural water retention measures, and also for biodiversity and potentially other objectives. This will form part of the project-level assessment required to progress physical works and flood relief schemes towards planning or exhibition and confirmation (see Section 8.1), where potential works may be amended or enhanced by the introduction of natural water retention and similar measures. The work will include seeking, and where possible implementing, pilot studies in coordination with the Local Authority WFD Offices and other relevant agencies. It is anticipated that this is most likely to be achieved in areas where there are pressures on the ecological status of a water body in a sub-catchment where there is also an identified potentially significant flood risk (i.e., an AFA). This coordination will also facilitate the resolution of issues for measures that may otherwise cause potential conflict between the objectives of the two Directives in certain water bodies.

Measure Name:	Assessment of Land Use and Natural Flood Risk Management Measures
Code:	GBNIIENB-UoM-9021-M31
Measure:	The OPW will work with the EPA, local authorities and other agencies during the project-level assessments of physical works and more broadly at a catchment-level to identify, where possible, measures that will have benefits for both WFD and flood risk management objectives, such as natural water retention measures, and also for biodiversity and potentially other objectives, including the use of pilot studies and applications, where possible.
Implementation:	Local Authority WFD Offices, OPW, EPA, Others
Funding:	Existing Duties (OPW, Others)

7.4.1.6 Protection: Minor Works Scheme

The Minor Flood Mitigation Works and Coastal Protection Scheme (the 'Minor Works Scheme') is an administrative scheme operated by the OPW under its general powers and

functions to support the local authorities through funding of up to €750k to address qualifying local flood problems with local solutions.

Measure Name:	Minor Works Scheme
Code:	GBNIIENB-UoM-9051-M61
Measure:	The OPW will continue the Minor Works Scheme subject to the availability of funding and will keep its operation under review to assess its continued effectiveness and relevance.
Implementation:	OPW, Local Authorities
Funding:	OPW, Local Authorities

7.4.1.7 Protection: Maintenance of Arterial Drainage Schemes and Existing Flood Relief Schemes

There are two Arterial Drainage Schemes and existing flood relief schemes within the Neagh Bann River Basin, namely the Monaghan Blackwater and the Glyde & Dee Arterial Drainage Schemes, and the existing flood relief schemes set out in Section 2.6. The OPW has a statutory duty under the Arterial Drainage Act, 1945, and the Amendment of the Act, 1995, to maintain the Arterial Drainage and the flood relief Schemes. The local authorities should also maintain those flood relief schemes for which they have maintenance responsibility. This Plan does not amend these responsibilities to provide additional flood relief. The Plan therefore does not set out additional measures in this regard.

The Arterial Drainage Maintenance service has developed and adheres to a suite of Environmental Management Protocols and Standard Operating Procedures which minimise the potential environmental impact of operations. A Strategic Environmental Assessment (SEA) was conducted for the national Arterial Drainage Maintenance activities for the period 2011-2015 and a further SEA process was again carried out for the national Arterial Drainage Maintenance activities for the period 2016-2021. Appropriate Assessments are also carried out on an ongoing basis for Arterial Drainage Maintenance operations. Operations outside the scope of the SEA or AA processes are subject to Ecological Assessment to consider environmental sensitivities around Arterial Drainage Maintenance.

7.4.1.8 Protection: Maintenance of Drainage Districts

There are three Drainage Districts within the Neagh Bann River Basin, namely the Blackwater Drainage District, Fane Drainage District and Wottanstown Drainage District. The local authorities have a statutory duty to maintain the Drainage Districts, and this Plan does not amend these responsibilities to provide additional flood relief. The Plan therefore does not set out additional measures in relation to the maintenance of Drainage Districts.

7.4.1.9 Maintenance of Channels Not Part of a Scheme

Outside of the Arterial Drainage and Drainage District Schemes, landowners who have watercourses on their lands have a responsibility for their maintenance. Guidance to clarify the rights and responsibilities of landowners in relation to the maintenance of watercourses on or near their lands is available at www.flooding.ie.

7.4.1.10 Preparedness: Flood Forecasting

The Government decided in January 2016 to establish a National Flood Forecasting and Warning Service. When fully operational, this will be of significant benefit to communities and individuals to prepare for and lessen the impact of flooding. The Government decision

has provided the opportunity to proceed with a first stage implementation of the service and will involve the following elements:

- Establishment of a National Flood Forecasting Service as a new operational unit within Met Éireann.
- Establishment of an independent Oversight Unit within the Office of Public Works (OPW).

The service will deal with flood forecasting from fluvial (river) and coastal sources and when established it will involve the issuing of flood forecasts and general alerts at both national and catchment scales.

A Steering Group, including representatives from the OPW, the Department of Housing, Planning and Local Government (DHPLG), Met Éireann and the Local Authorities has been established to steer, support and oversee the establishment of the new service. A number of meetings have taken place to progress this complex project.

Given the complexities involved in establishing, designing, developing and testing this new service, it is anticipated that the first stage of the service will take at least 5 years before it is fully operational. In the interim period, existing flood forecasting and warning systems and arrangements will continue to be maintained.

Measure Name:	Establishment of a National Flood Forecasting and Warning Service
Code:	GBNIIENB-UoM-9031-M41
Measure:	The establishment of a new operational unit in Met Éireann to provide, in the medium term, a national flood forecasting service and the establishment of an independent Oversight Unit in the OPW.
Implementation:	OPW, DHPLG, Met Éireann and Local Authorities
Funding:	OPW, DHPLG

7.4.1.11 Preparedness: Review of Emergency Response Plans for Severe Weather

Section 4.7 of the Major Emergency Management (MEM) Framework introduces the concept of self-appraisal as part of the systems approach to emergency management. The purpose of the appraisal process is to assist agencies and regions to review, monitor and assess their activities and to identify issues which may need to be addressed and consider what measures they could adopt to improve preparedness, as part of the major emergency development programmes.

The regional appraisal, which is undertaken annually, is based on a self-assessment questionnaire, for which the answers are evidence-based and supported with references to documentary support (e.g. document dates, exercise reports, etc.). The process is supported by meetings of the National Steering Group project team with Regional Steering Group Chairs (2 per annum) to shape future MEM developments and identify challenging issues and areas for improvement. It is the task of the National Steering Group to review and validate these appraisals and provide appropriate feedback.

Flood planning and inter-agency co-ordination are included in appraisals and remains a key objective for National Steering Group and Regional Steering Groups.

The local authorities should, in particular, review their flood event emergency response plans, making use of the information on flood hazards and risks provided through the CFRAM Programme and this Plan.

Measure Name:	Ongoing Appraisal of Flood Event Emergency Response Plans and Management Activities
Code:	GBNIIENB-UoM-9032-M42
Measure:	Ongoing, regular appraisal of emergency management activities to improve preparedness and inter-agency coordination and to shape future MEM developments as part of the major emergency development programmes, taking into account in particular the information developed through the CFRAM Programme and this Plan.
Implementation:	Principal Response Agencies, Regional Steering Groups, National Steering Group
Funding:	Existing duties (Implementation Bodies)

7.4.1.12 Preparedness: Individual and Community Resilience

While the State, through the OPW, local authorities and other public bodies can take certain actions (subject to environmental assessment, where relevant) to reduce and manage the risk of flooding, individual home-owners, businesses and farmers also have a responsibility to manage the flood risk to themselves and their property and other assets to reduce damages and the risk to personal health in the event of a flood.

Research by the DHPLG is informing a review of the national emergency framework and the supports that can be provided to communities to help them respond to all emergencies, including flooding emergencies. This will build on past initiatives and existing support, such as that provided through the 'Plan, Prepare, Protect' programme (http://www.flooding.ie/) and the 'Be Winter Ready' Campaigns (http://winterready.ie/).

Measure Name:	Individual and Community Action to Build Resilience
Code:	GBNIIENB-UoM-9033-M43
Measure:	All people at flood risk should make themselves aware of the potential for flooding in their area, and take long-term and short-term preparatory actions (subject to environmental assessment, where relevant) to manage and reduce the risk to themselves and their properties and other assets.
Implementation:	Public, business owners, farmers and other stakeholders
Funding:	N/A

Louth County Council operate a Flood Warning Protocol for Bellurgan Embankment, Bellurgan Point, Dundalk, Co. Louth due to the risk of breaches which have occurred in the past of the Bellurgan embankment caused by overtopping of the embankment. The flood warning protocol comprises the following. National weather warnings issued by Met Eireann and flood warnings issued by the OPW are monitored by Operations Section Technical staff. High tide levels in conjunction with predicted sea level surge levels are monitored using the

OPW website http://www.irish-surge-forecast.ie. When a high tide level/surge is predicted, which may over top the Bellurgan embankment, Operations staff notify residents and business at Bellurgan who may be affected by flooding/breach of the embankment of the predicted times of the high tides/surges. Notification is by site visit, phone call and by text. Sand bags are distributed as requested to residents and flood warning signs are held by Council staff who monitor the embankment from a safe distance.

In the event of an embankment breach, residential properties are at risk of flooding and at Bellurgan point 28 residential houses and commercial businesses could have access cut-off by flooding of the local road LS7087. In the event of a breach the major emergency plan, Sub Plan Severe Weather, may be called into operation.

7.4.1.13 Preparedness: Individual Property Protection

Individual Property Protection can be effective in reducing the damage to the contents, furniture and fittings in a house or business, but are not applicable in all situations (for example, they may not be suitable in areas of deep or prolonged flooding, or for some types of property with pervious foundations and flooring). Property owners considering the use of such methods should seek the advice of an appropriately qualified expert on the suitability of the measures for their property, and consider the possible requirements for environmental assessment.

While there may be some existing tax relief for some homeowners works on their homes which are aimed at preventing the risk of flooding, the Interdepartmental Flood Policy Co-ordination Group is considering the administrative arrangements, for consideration by Government, of any appropriate assistance to home owners, where it is suitable, to install Individual Property Protection measures for their property.

Measure Name:	Individual Property Protection
Code:	GBNIIENB-UoM-9053-M43
Measure:	Property owners may consider the installation of Individual Property Protection measures. The Interdepartmental Flood Policy Co-ordination Group is considering the policy options around installation of Individual Property Protection measures for consideration by Government.
Implementation:	Home owners, Interdepartmental Flood Policy Co-ordination Group
Funding:	Home owners, N/A

7.4.1.14 Preparedness: Flood-Related Data Collection

Ongoing collection and, where appropriate, publication of hydrometric and meteorological data, and data on flood events as they occur, will help us to continually improve our preparation for, and response, to flooding.

Measure Name:	Flood-Related Data Collection
Code:	GBNIIENB-UoM-9041-M61
Measure:	The OPW, Local Authorities / EPA and other organisations collecting and, where appropriate, publishing hydro-meteorological data and post-event event flood data should continue to do so to improve future flood risk management.
Implementation:	OPW, Local Authorities / EPA and other hydro-meteorological agencies
Funding:	Existing duties (Implementation Bodies)

It may be possible to upgrade and develop the existing water level only station at Dundalk (06036) which would significantly improve understanding of the flows on the Ramparts watercourse in Dundalk. AFAs which are presently ungauged but are considered to have significant flood risk, and as such would significantly benefit from the installation of new gauge stations are identified as follows:

- Ardee (Rathgory / Mullameelan watercourse)
- Carlingford (Carlingford watercourse and Carlingford Commons watercourse)
- Greenore (Mullatee and Millgrange watercourses)
- Carrickmacross (River Glyde)
- Dundalk (Greengates, Castletown and Accareagh watercourses)
- Monaghan (Monaghan River, Killygowan and Telaydan watercourses)

7.4.2 Glyde-Dee Sub-Catchment Measures

No methods were found to be feasible from the Glyde-Dee Sub-catchment screening. Storage and Improvement of Channel Conveyance methods were screened and found to be technically unfeasible. As no methods have been deemed potentially viable, the next steps in the process, such as identification of options or MCA appraisal have not been implemented.

7.4.3 Annagassan AFA Measure

Description of the Proposed measure

Potentially viable flood relief works for Annagassan AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. However the proposed measure has a BCR below unity. It is considered that the costs for certain works, or smaller schemes, is likely to be conservative in the Unit Cost Database. It is therefore recommended that the proposed measure for Annagassan progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment. Further information on Measures with a Benefit – Cost Ratio below Unity is presented in Section 7.4.10, with Annagassan AFA detailed in Section 7.4.10.1.

7.4.4 Ardee AFA Measure

Description of the Proposed measure

Potentially viable flood relief works for Ardee AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood embankments and walls. These hard defences would protect to the 1% AEP flood event with an average height of 0.8m and a total length of 0.6km. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

It was queried if culvert upgrade would provide an alternative potential option however this had been investigated and found to be economically unviable due to the costs of upgrading a series of culverts and the associated channel capacity improvements.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.2 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure scored better technically and environmentally and has the highest benefit cost ratio compared to other potential measures which were investigated.

Table 7.2 Appraisal of the Flood Risk Management Measure / Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Ardee AFA	900	349	535	-147	738	0.84	875.19	3.16

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and a commercial property, a road and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community and fisheries during construction of the hard defences, and short term sedimentation and water quality impacts. There is potential for medium to long term impacts on the Ardee-Newtown Bedform Field IGH site. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located upstream of Dundalk Bay SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. No significant impacts on these European sites are expected, owing to their distance from the proposed measure.

Specific mitigation measures will be identified at project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Ardee AFA is considered to be at moderate vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require increasing the height of the walls and embankments and extending their length to provide the required SoP, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Ardee AFA
Code:	GBNIIENB-IE-AFA-060014-0206-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Ardee, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Louth CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.5 Carlingford and Greenore AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Carlingford and Greenore AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of hard defences, pumping stations and improvement of channel conveyance.

At risk properties would be protected by a series of flood embankments, walls and two pumping stations. The fluvial Hard Defences would contain the flow of 1% AEP fluvial event within the upper reaches of the Carlingford and Carlingford Commons watercourses to provide partial protection. When required during a fluvial event and at high tidal water levels the two Pumping Stations would extract any flood water that cannot be discharged to Carlingford Harbour as normal. The fluvial Hard Defences and the Pumping Station would both need to be in place to achieve full protection from a 1% AEP fluvial event.

The coastal Hard Defences would provide design SoP for the 0.5% coastal events with an average height of 1m and a total length of 2.5km. At risk properties would be protected by a series of flood embankments, walls, and an upgrade to a culvert. The upgraded culvert would contain the flow of 1% AEP fluvial event within the Mullatee watercourse. The coastal Hard Defences would provide design SoP for the 0.5% coastal event with an average height of 0.7m and a total length of 1km.

The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The height and aesthetics of the wall at the harbour should be considered at project-level assessment stage. An alternative option was discussed relating to the harbour walls and installation of a lock gate. This was found to be unfeasible and therefore was not identified as the proposed measure at this stage in the optioneering process of Carlingford and Greenore, however this alternative may be evaluated further during the project-level assessment stage of the scheme.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.3 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Carlingford and Greenore AFA, consequently this is the proposed measure.

Table 7.3 Appraisal of the Flood Risk Management Measure / Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Carlingford and Greenore AFA	700	1051	874	-596	1329	23.41	56.8	2.7

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, transport links, agricultural land and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, disturbance of birds, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and moderate visual impacts in the medium to long term.

As the proposed works will be located adjacent to and upstream of Carlingford Shore SAC and Carlingford Lough SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to disturbance of protected bird species in Carlingford Lough SPA, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase. Should water levels or flow be altered by the hard defences there is potential for impacts on qualifying habitat of Carlingford Shore SAC.

Specific mitigation measures will be identified at project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Carlingford and Greenore AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Regarding adaptability of the proposed measure there are a number of FRM methods which make up the proposed measure that need to be considered. The hard defences method could be adapted by increasing the height of the retaining structure and extending its length, additional lengths of embankment would also be required upstream. There is no opportunity to adapt the flap valve method, this should continue to function regardless of the water levels in the Carlingford and Carlingford Commons watercourses. The pumping station method is adaptable by either installing a pump which is large enough to cope with future flows or leaving room within the pumping house for additional pumps to be installed at a later date. The improvement of channel conveyance method could be adapted by increasing channel capacity size and culvert sizes. Other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Carlingford and Greenore AFA
Code:	GBNIIENB-IE-AFA-060016-0306-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Carlingford and Greenore, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Louth CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.6 Dundalk and Blackrock South AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Dundalk and Blackrock South AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The preferred solutions for Dundalk and Blackrock South AFA are alternate routes for Hard Defences, combined with improvement of channel conveyance, to provide two complete AFA measures which provide the required standard of protection.

The first proposed measure consists of a series of hard defences, including flood embankments and walls, rock armour coastal protection, demountable barriers, road raising, a sluice gate and tanking of two properties. These defences would be required along with improvement of channel conveyance on the Blackrock River and Dundalk Blackwater River, along with Storage on the Castletown River. This proposed measure would protect to the 0.5% coastal events and the 1% AEP fluvial flood event. Hard defences required have an average height of 1.4m and a total length of 19.5km. The improvement of channel

conveyance requires a 430m length of the Blackrock River to be lowered, along with the replacement of two undersized culverts. On the Dundalk Blackwater, two undersized parallel culverts should be replaced. The storage area to be created is located upstream of the Castletown River, allowing a volume of 84,329m^3 to be stored during the 1% AEP fluvial flood event. This requires a short 15m embankment, along with a culvert and weir in order to retain flow at the 10% AEP event.

The second proposed measure also consists of a series of hard defences, including flood embankments and walls, rock armour coastal protection, demountable barriers, road raising, a sluice gate and tanking of two properties. These defences again would be required along with improvement of channel conveyance on the Blackrock River and Dundalk Blackwater River, along with Storage on the Castletown River. This proposed measure would protect to the 0.5% coastal events and the 1% AEP fluvial flood event; however, one currently uninhabited property in Marsh North would not be protected. Hard defences required have an average height of 1.4m and a total length of 17.7km. The improvement of channel conveyance requires a 430m length of the Blackrock River to be lowered, along with the replacement of two undersized culverts. On the Dundalk Blackwater, two undersized parallel culverts should be replaced. The storage area to be created is located upstream of the Castletown River, allowing a volume of 84,329m^3 to be stored during the 1% AEP fluvial flood event. This requires a short 15m embankment, along with a culvert and weir in order to retain flow at the 10% AEP event

The two proposed measures have alternate routes with hard defences either following the existing line of coastal embankments protecting all properties or a new line of coastal defences set back resulting in a property within Marshes North in the AFA not being protected.

In the second proposed measure there is one property within the Dundalk and Blackrock South AFA that, subject to amendment at project-level development, will not benefit from the proposed measure, and the property owner may wish to consider Individual Property Protection to provide some reduction of flood risk for their property (see Section 7.4.1.13). Property owners considering the use of such method should seek the advice of an appropriately qualified expert on the suitability of the measures for their property, and consider the possible requirements for environmental assessment.

It should also be noted that, an existing defence wall in Blackrock has sustained damage; a full structural assessment of the wall is required at project-level assessment stage to identify any other areas of damage and to provide appropriate repair/replacement solutions. Also a small stream (the Ecco Road Stream) which was not assessed under CFRAMs, flows along the Dublin-Belfast railway line and discharges into the Castletown River, should be considered at the project-level assessment phase.

Louth CoCo is progressing extension of an existing 1350mm surface drainage pipe as an interim flood relief method in the Balmers Bog area. This pipe was assessed under the CFRAM study (as a sealed culvert with a positive outlet). The pipe provides additional flow capacity which may be significant during high frequency events and affords partial upstream flood mitigation during a 1% AEP event, however alternative FRM methods would still require to be added to provide the preferred SoP under CFRAM for Dundalk AFA.

The NIS for the Neagh Bann River Basin has identified the potential for post-mitigation residual impacts on European sites with both proposed measures for Dundalk and Blackrock South, which will need further assessed in a project-level Stage 2 Appropriate Assessment, based on project-level assessments and construction management plans.

The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

People who attended the Public Consultation were informed of the alternative options, those who commented were in favour of either proposed measure however there is an overall concern for the time it will take for the final option to be put in place.

The public and elected representatives would be very keen for interim measures and as such Louth CoCo is progressing the extension of a 1350mm diameter pipe in the Balmers Bog area, which has been investigated as an interim flood relief measure.

The line of the coastal embankments along the North Marshes is the difference between the alternative proposed measures; nearby residents prefer seaward line based on use of agricultural land and property drainage, others are open to a new set back line which involves relocation of one property. Likewise there were comments about the Lord Limerick embankment, many commented that the reuse of the existing line was the preferred solution and would allow some parts of the existing structure to be incorporated into the new scheme.

Residents in the area expressed supported improved channel conveyance on fluvial flood risk areas as this would reduce any impact on back drainage. In the Mounthamilton /Cambrooke areas concern for sewage works was raised (with back drainage to be provided for in design).

Some concern was raised for defences at Blackrock (demountable defences suggested in the overtopping zone due to visual amenity) other residents were concerned to have overtopping protection in place.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.4 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measures. The preferred alternative measures scored better than other potential measures which were investigated, however as both these options have similar economic merits and potentially require further environmental assessment under the Habitats Regulations at project-level assessment stage, both have been retained as proposed measures.

The proposed measures will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, monuments, utilities, transport links, agricultural land and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures. They include the potential for short term disturbance of the local community and fisheries during construction of the hard defences, direct morphological impacts during construction, disturbance or loss of habitats and/or species in the direct footprint of the hard defences, disturbance of bird species, and construction phase and potentially recurring sedimentation and water quality impacts. There is also potential for moderate visual impacts in the medium to long term.

As the proposed measures will be located adjacent to and upstream of Dundalk Bay SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences (particularly in the Marsh North / Ballymascanlan area, where defences may bisect designated areas) and disturbance of protected bird species of Dundalk Bay SPA, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction of hard defences and from dredging and culvert works in Blackrock River, which may include recurring sedimentation impacts during flood events or maintenance works. Should water levels or flow be altered by the hard defences there is potential for impacts on qualifying habitat.

Specific mitigation measures will be identified at project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Table 7.4 Appraisal of the Flood Risk Management Measure / Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
First Proposed measure - Progress the development of a Flood Relief Scheme for Dundalk and Blackrock South AFA	300	1269	896	-1031	1134	40.54	27.98	3.33
Second Proposed measure - Progress the development of a Flood Relief Scheme for Dundalk and Blackrock South AFA	600	1269	656	-385	1540	40.58	37.96	3.33

One option positions the defences at Marsh North / Ballymascanlan further inland, to avoid bisecting the designated areas; however this does not protect one currently uninhabited property. This may be a viable if the impacts on the European sites are deemed to be unacceptable, and includes potential positive impacts, as repositioning of coastal hard defences at Marsh North / Ballymascanlan will allow inundation of the land currently behind hard defences and potentially lead to an increase in the extent of wetland coastal habitats.

Climate Change Adaptability

Dundalk and Blackrock South AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Regarding adaptability of the proposed measure there are a number of FRM methods which make up the proposed measure that need to be considered. The hard defences method could be adapted by increasing the height of the walls, embankments, demountables and road raises along with extending the lengths. Existing defences would need to be altered, with rock armour needing widening and sea walls requiring additional length. Additional lengths of hard defences would also be required where properties were not at risk under the present day. A sluice would need to be replaced. The storage area does not have any more capacity to store water for future scenarios. The improvement of channel conveyance method could be adapted by increasing channel

capacity size and upgrading culverts. Other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Dundalk and Blackrock South AFA
Code:	GBNIIENB-IE-AFA-060019-0406-M61 or GBNIIENB-IE-AFA-060019-0506-M61
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Dundalk and Blackrock South, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Louth CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.7 Inniskeen AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Inniskeen AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood embankments and walls. Hard Defence would also include a 253m long section of raised road where space is restricted for walls or embankments. The raising of the road would require that the soffit level of a critical bridge structure be raised in conjunction with the road raise. These hard defences would protect to the 1% AEP fluvial flood event with an average height of 1.36m and a total length of 0.64 km. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

Works have been carried out on the Fane to improve the habitat for fish. Work has also been carried out to limit scour and erosion. It was noted that a property basement is subject to flooding (this is via groundwater pathways and will require further investigation during subsequent project-level assessment of any options for Inniskeen AFA).

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.5 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure has a slightly higher benefit cost ratio compared to other potential measures which were investigated.

Table 7.5 Appraisal of the Flood Risk Management Measure / Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Inniskeen AFA	800	821	452	-224	1049	2.10	499.91	1.27

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, and coincidental protection, in line with OPW policy, of the Inniskeen WWTP in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located upstream of Dundalk Bay SAC and SPA, with the potential for indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. No significant impacts on these European sites are expected, owing to their distance from the proposed measure.

Specific mitigation measures will be identified at project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Inniskeen AFA is considered to be at low vulnerability from the mid-range future scenario and moderate vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the walls, embankments and road raises along with extending the lengths. Other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Inniskeen AFA
Code:	GBNIIENB-IE-AFA-060020-0606-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Inniskeen, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Monaghan CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.8 Monaghan AFA Measures

The flood maps for Monaghan AFA are currently under review on foot of information provided through objections, observations or other sources, and will be updated following this review. The measure for Monaghan will then be reviewed to ensure that the proposed measure is still applicable. This review may take place when the measure is progressed to further development at a local, project-level, before exhibition or submission for planning approval.

Description of the Proposed measure

Potentially viable flood relief works for Monaghan AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood embankments and walls with additional measures in place to protect properties in the Milltown area. These FRM methods would protect properties only to the 1% AEP flood event. The Hard Defences would provide design SoP with an average height of 1m and a total length of 3km. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

A submission received from Monaghan County Council resulted in a change of the proposed measure. Given the frequency and implications of flooding within Monaghan town centre along the N54 Macartan Road, the R162 Glen Road and Castle Road, Monaghan County Council have assessed and developed a high priority flood management assessment and solution for this specific area through separate investigation, outside the scope of the CFRAM Study. Monaghan County Council are currently progressing a scheme independently of the CFRAM process to protect the road junction to the 1% AEP SoP. Due to the advancement of this separate assessment a request was made by Monaghan County Council that the proposed measure for Monaghan change as the separate road scheme will be progressed in advance of the proposed CFRAM works.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage.

Measure Appraisal

Table 7.6 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure has a higher benefit cost ratio than other potential measure that was investigated.

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, and transport links in the medium and long term.

Table 7.6 Appraisal of the Flood Risk Management Measure / Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Monaghan AFA	500	818	525	-389	954	12.50	76.33	1.01

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will not be located in the vicinity of any European site, and there are not considered to be any potential pathways by which impacts could occur on designated habitats and/or species, Appropriate Assessment was not required.

Specific mitigation measures will be identified at project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Monaghan AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require increasing the height of the walls, embankments and road raises along with extending the lengths. There is no opportunity to adapt the flap valve method, this should continue to function regardless of the water levels in the Monaghan watercourses. The pumping station method is adaptable by either installing a pump which is large enough to cope with future flows or leaving room within the pumping house for additional pumps to be installed at a later date. Other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Monaghan AFA
Code:	GBNIIENB-IE-AFA-030011-0706-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Monaghan, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Monaghan CoCo - To be confirmed
Funding:	OPW

The proposed measure has changed for Monaghan AFA as Monaghan County Council are currently progressing a scheme, independent of the CFRAM process, to protect the road junction in the town centre.

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.9 Termonfeckin AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Termonfeckin AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. However the proposed measure has a BCR below unity. It is considered that the costs for certain works, or smaller schemes, is likely to be conservative in the Unit Cost Database. It is therefore recommended that the proposed measure for Termonfeckin progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment. Further information on Measures with a Benefit – Cost Ratio below Unity is presented in Section 7.4.10, with Termonfeckin AFA detailed in Section 7.4.10.2. Any further assessment in this location should bear in mind the outcome of public consultation which reported that there have been some in channel modifications within the Termonfeckin AFA.

7.4.10 Measures with a Benefit - Cost Ratio below Unity

For some AFAs, no economically viable measure (i.e., a measure with a benefit - cost ratio of greater than 1.0) has been found through the analysis undertaken to date, but a technically viable measure has been identified with a benefit - cost ratio of between 0.5 and 1.0. A more detailed assessment of the costs of such measures may indicate that the measure could be implemented at a cost below that determined through the analysis undertaken to date.

While it would not be prudent to progress such measures to full project-level assessment towards planning / public exhibition based on the information available at present, a more detailed assessment of the costs can be progressed to determine if an economically viable measure may in fact exist that could justify the progression to full project-level assessment.

7.4.10.1 Annagassan

Description of the Proposed measure

Potentially viable flood relief works for Annagassan AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of walls and embankments and by improving the existing embankment. New defences would, where possible, be set back from the existing rock amour along the coastline. These hard defences would protect to the 0.5% AEP coastal event with an average height of 1.13m and a total length of 2.4km. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

There was a concern there may not be enough space for embankments alongside roads at some locations and if the embankments will cause a significant effect on the hydrodynamics around the harbour or elsewhere along the coast. If there is an increase in velocities resulting from the proposed embankments this may compromise the existing coastal erosion

defences in the area. A condition survey of existing embankments along the River Dee and the River Glyde during low tide was recommended. There was a suggestion to tier the river where it discharges at the harbour and divert it to the right at the harbour wall, in order to increase velocities and desilt the outfall.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.7 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Annagassan, consequently this is the proposed measure.

Table 7.7 Appraisal of the Flood Risk Management Measure / Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Undertake a Detailed Assessment of the Costs of the Potential Measure for Annagassan AFA	800	594	871	-546	919	3.70	248.34	0.85

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, a monument, a utility, rural land, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, disturbance of protected bird species, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located adjacent to and upstream of Dundalk Bay SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences, and disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase. Should water levels or flow be altered by the hard defences there is potential for impacts on qualifying habitat.

Specific mitigation measures will be identified at project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Annagassan AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation would require increasing the height of existing and proposed walls and embankments to provide the required SoP, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Undertake a Detailed Assessment of the Costs of the Potential Measure for Annagassan AFA
Code:	GBNIIENB-IE-AFA-060013-0106-M25
Measure:	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.
Implementation:	OPW and/or Louth CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.10.2 Termonfeckin

Description of the Proposed measure

Potentially viable flood relief works for Termonfeckin AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of improvement of channel conveyance in two areas along the Termonfeckin watercourse. This FRM option would protect to the 1% AEP flood event by removing a weir downstream of Drogheda Bridge, dredging approximately 1135m^3 of material and underpinning four bridges along Strand Road. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.8 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure scored better environmentally and has a higher benefit cost ratio than other potential measure that was investigated.

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, a monument and transport links in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures. They include the potential for short term

disturbance of the local community during construction, direct morphological impacts, and short term sedimentation and water quality impacts during conveyance works, with potential for recurring sedimentation impacts during maintenance of the conveyance works. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the works.

Table 7.8 Appraisal of the Flood Risk Management Measure / Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Undertake a Detailed Assessment of the Costs of the Potential Measure for Termonfeckin AFA	600	128	301	-717	-289	0.35	-815.32	0.90

As the proposed works will be located immediately upstream of Boyne Coast and Estuary SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during conveyance works. Recurrent sedimentation impacts are also possible during flood events or maintenance of channel conveyance. Should water levels or flow be altered, there is potential for impacts on qualifying habitat.

In relation to the proposed measure for Termonfeckin AFA, it can be seen from Table 7.8 that the measure may cause detrimental impacts in relation to the environment / cultural heritage, resulting in an overall multi-criteria assessment (MCA) score of below zero. At the project-level development and assessment of the measure for Termonfeckin the potential detrimental impacts of the measure will need to be carefully considered to determine whether, and how, the potential impacts can be mitigated, such that the measure can be progressed without detrimental impacts to the community and its surrounding environment.

Specific mitigation measures will be identified at project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Termonfeckin AFA is considered to be at moderate vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require further dredging/widening the river channel and increasing conveyance through restrictive structures to provide the required SoP, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Undertake a Detailed Assessment of the Costs of the Potential Measure for Termonfeckin AFA
Code:	GBNIIENB-IE-AFA-060024-0806-M25
Measure:	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.
Implementation:	Typically the local authority (Louth CoCo) under the OPW Minor Works Scheme
Funding:	Typically OPW Minor Works Scheme

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.5 PRIORITISATION OF PROPOSED PROTECTION MEASURES

Implementing all of the proposed measures as set out in this, and all, Plans would require a significant capital investment as well as substantial resources to manage the implementation process. The Government's National Development Plan 2018 to 2027 has committed up to €1 billion over the lifetime of the Plan for flood relief measures. This will enable the OPW to continue with the implementation of its existing flood relief capital works programme and will also facilitate the phased implementation of the proposed measures within the Plans. Within this period, it is necessary to prioritise the investment of resources in the delivery of the flood relief capital investment programme.

The basis on which measures in the Plans have been prioritised for implementation is a key consideration in planning the investment of the significant public resources made available for flood relief over the next 10 years. The prioritisation primarily relates to the protection measures to be implemented by the OPW or funded by the OPW but implemented by a local authority.

For the purposes of prioritisation, the measures have been divided into three streams as follows:

1. Large Schemes: Measures costing in excess of €15m
2. Medium and Small Schemes: Measures costing in between €750k/€1m and €15m
3. Minor Schemes: Measures costing less than €750k/€1m

There are only a small number of Large Schemes, all of which will be advanced at an early stage due to their scale and their long lead in period.

It is anticipated that the Minor Schemes will be brought forward by the local authorities, with OPW funding, and so may be advanced at an early stage.

The measures in the remaining stream (Medium and Small Schemes) will be prioritised on a regional basis, by reference to the six CFRAM study areas. The management objective for this €1billion ten year programme of flood relief works is to efficiently utilise available capacity to plan progression and completion of schemes that deliver greatest protection and maximise return.

7.6 FLOOD RISK MANAGEMENT IN OTHER AREAS

This Plan identifies a series of flood risk management measures for the entire River Basin and also viable, locally-specific flood protection measures for the AFAs identified through the PFRA.

While it is considered that the PFRA identified the areas of significant flood risk throughout Ireland, the PFRA will be reviewed in line with legislation, and other areas can be considered for detailed assessment at that stage.

In the interim, local authorities may avail of the OPW Minor Flood Mitigation Works and Coastal Protection Scheme (Section 2.6.5 and 7.4.1.6), where the relevant criteria are met, to implement local solutions to local flood problems, including in areas outside of the AFAs.

7.7 SUMMARY OF PROPOSED MEASURES

Table 7.9 provides a summary of the measures that are to be progressed through the implementation of the Plan for the Neagh Bann River Basin, while Table 7.10 sets out the flood relief schemes and works that have been progressed or proposed through other projects or plans.

Table 7.9: Summary of Flood Risk Management Measures

Measure	Implementation	Funding
Measures Applicable for All Areas		
Application of the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW ,2009)	Planning Authorities	Planning Authorities
Implementation of Sustainable Urban Drainage Systems (SUDS)	Planning Authorities	Planning Authorities
Voluntary Home Relocation	Inter-Dept. Flood Policy Review Group	OPW (2017 Scheme)
Consideration of Flood Risk in Local Adaptation Planning	Local Authorities	Local Authorities
Assessment of Land Use and Natural Flood Risk Management Measures	EPA, OPW, Others	OPW, Others
Minor Works Scheme	OPW, Local Authorities	OPW, Local Authorities
Establishment of a National Flood Forecasting and Warning Service	OPW, DHPLG, Met Éireann and local authorities	OPW, DHPLG
Ongoing Appraisal of Flood Event Emergency Response Plans and Management Activities	Principal Response Agencies, Regional Steering Groups, National Steering Group	Implementation Bodies
Individual and Community Action to Build Resilience	Public, business owners, farmers and other stakeholders	N/A
Individual Property Protection	Home Owners, Inter-Dept. Flood Policy Review Group	Homeowners
Flood-Related Data Collection	OPW, Local Authorities / EPA, and other hydro-meteorological agencies	Implementation Bodies

Catchment / Sub-Catchment Measures		
No Sub-Catchment methods were found to be feasible		
Community-Level (AFA) Measures		
Progress the project-level development and assessment of a Flood Relief Scheme, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation, for the Communities set out below.		
Ardee	OPW and/or Louth CoCo - To be confirmed	OPW
Carlingford and Greenore	OPW and/or Louth CoCo - To be confirmed	OPW
Dundalk and Blackrock South	OPW and/or Louth CoCo - To be confirmed	OPW
Inniskeen	OPW and/or Monaghan CoCo - To be confirmed	OPW
Monaghan	OPW and/or Monaghan CoCo - To be confirmed	OPW
Undertake a Detailed Assessment of the Costs of the Potential Measure for the Communities set out below.		
Annagassan	OPW and/or Louth CoCo - To be confirmed	OPW
Termonfeckin	Typically the local authority (Louth CoCo) under the OPW Minor Works Scheme	Typically OPW Minor Works Scheme

Table 7.10: Summary of Flood Relief Schemes and Works Progressed or Proposed through Other Projects or Plans

Flood Relief Schemes and Works Progressed or Proposed through Other Projects or Plans		
Community (AFA)	**Scheme or Works**	**Status**
Bellurgan	Bellurgan Embankment Works	Under Construction
Dunleer	Dunleer Flood Risk Assessment Study	Completed
Greenore, Templetown and Dillonstown / Salterstown	Louth Coastal Erosion Study	Completed

8 IMPLEMENTATION, MONITORING AND REVIEW OF THE PLAN

8.1 IMPLEMENTATION OF THE PLAN

The Plan sets out the strategy, actions and measures that are considered to be the most appropriate at this stage of assessment, including a programme of structural and non-structural measures to be implemented and has identified the responsible body/bodies for implementing those measures.

8.1.1 River Basin Level Measures

The River Basin level measures, i.e., those applicable in all areas (Section 7.4.1), typically do not involve physical works, and represent the implementation of existing policy and/or the development of new policies or Schemes.

Many prevention and preparedness measures are already in-hand with the relevant implementing bodies or are being proactively progressed by the Interdepartmental Flood Policy Co-ordination Group. Other such measures requiring new action should be pro-actively and urgently progressed and implemented by the relevant implementing bodies, subject to any licences and/or environmental assessments required, through normal business practices.

8.1.2 Catchment and AFA-Level Physical Measures

Most of the measures at the catchment and/or AFA-level involve physical works. The body responsible for the implementation of measures that will involve physical works, such as a flood relief scheme, will typically be either the OPW or the relevant local authority (see Table 7.9).

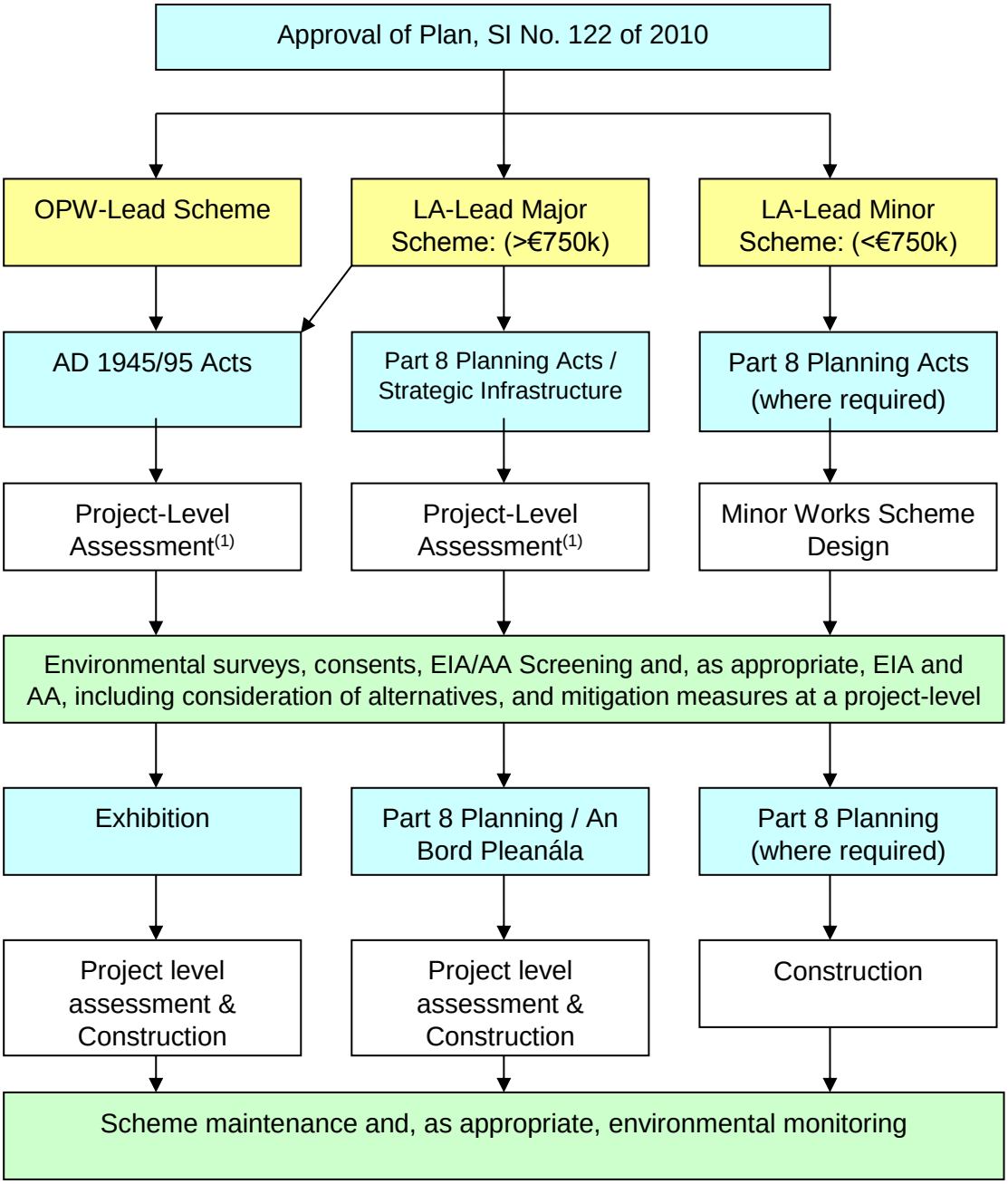
The potential physical flood relief works or 'Schemes' set out in the Plans that have been developed through the CFRAM Programme are to an outline design, and are not at this point ready for construction. Further detailed design through a project-level of assessment will be required for such works before implementation, including more detailed adaptation planning for the potential impacts of climate change along with:

- Project-level environmental assessment and appraisal (e.g., EIA and Appropriate Assessment where relevant)
- Further public and stakeholder consultation and engagement (see Section 8.1.4)
- Statutory planning processes, such as planning permission or public exhibition and confirmation (Ministerial approval), where relevant.

Local information that cannot be captured at the Plan-level of assessment, such as ground investigation results, project-level environmental assessments and interactions with local urban storm water drainage systems, may give rise at that stage to some amendment of the proposed works to ensure that they are viable, fully adapted, developed and appropriate within the local context, and that they are compliant with environmental legislation. The works set out in the Plan may therefore be subject to some amendment.

There are three routes by which such works may progress to construction stage, as set out in Figure 8.1.

Figure 8.1: Options for the Progression of Measures Involving Physical Flood Relief Works



Note (1): Project-level assessment will take account of the potentially viable measures identified in the Plan, but will involve the consideration of alternatives at the project-level and, as appropriate, EIA and AA, including the definition of necessary mitigation measures at the project-level. Only schemes/measures confirmed to be viable following project-level assessment will be brought forward for exhibition/planning and project-level assessment

Where measures require further assessment or hydrometric monitoring before progression to further development at a local, project-level, such assessments or monitoring will be implemented and progressed as soon as possible.

8.1.3 Other Catchment and AFA-Level Measures

Measures may have been identified at the catchment or AFA-level in the Neagh Bann River Basin that do not involve physical works. Such measures might include:

- The need for further hydrometric monitoring / data gathering.
- Further study or analysis (for example, in areas of high technical uncertainty).
- The operation of existing structures to manage water levels or flows.

Measures relating to the operation of existing structures would typically be the responsibility of the ESB or Waterways Ireland, and represent ongoing practice or the enhancement of same.

For the remaining measures under this category, the OPW will advance these, subject to any licences and/or environmental assessments that may be required, as a matter of priority within available resources.

8.1.4 Public and Stakeholder Consultation and Engagement

The project development stage will involve a significant level of further public consultation on the proposed measures in the Plan at key points in the progress of the design work required to bring those measures to a state of readiness to submit for planning approval (in the case of projects being implemented by local authorities under the Planning and Development Acts) or for public exhibition (in the case of projects being implemented by the OPW under the Arterial Drainage Acts ADA). Public Information Days will be organised to inform the communities affected of the progress with the design of the proposed scheme.

In the case of schemes being implemented by the OPW under the ADA, the main public consultation event is the formal public exhibition stage. This involves the preparation of the scheme documentation (schedules setting out details and benefits of the scheme, including names of the proprietors, owners and occupiers of the lands with which the proposed scheme will interfere; maps, drawings, plans, sections setting out the technical detail; Environmental Impact Statement, if required; and Interference Notices sent to each affected person detailing the extent of works proposed on their respective lands or property and any proposed compulsory interference with, or acquisition of, these lands and property). All of the Scheme Documents are forwarded to the relevant Local Authority and they are also placed on formal public exhibition in a public building(s) in the area typically over a period of 4 weeks when interested parties and the public have the opportunity to study the proposals and make comments, observations, objections, etc. OPW staff and/or consultancy staff are available at public exhibition to answer queries and offer clarification. Interference Notices are also forwarded to affected parties in advance of the exhibition period. All observations received are responded to and, if necessary, the scheme may be revised as a result of them. Following public exhibition, the scheme is submitted to the Minister for Finance and Public Expenditure and Reform for Confirmation (approval) of the Scheme.

The OPW is also considering suitable mechanisms at a national level to provide for consultation and engagement for the national flood risk management programme with stakeholders that have a national remit.

8.2 MONITORING OF PROGRESS IN IMPLEMENTATION OF THE PLAN

The OPW will monitor progress in the implementation of measures for which the OPW has responsibility on an ongoing basis as part of its normal business management processes.

The OPW will coordinate and monitor progress in the implementation of the Plans through an interdepartmental co-ordination group.

On a six-yearly cycle, the OPW will undertake a full review of the progress in the implementation of the Plan and the level of flood risk, and will report this progress publicly and to the European Commission as part of obligations of Ireland under the 'Floods' Directive.

In addition to monitoring of implementation of the measures set out in the Plan, monitoring will also be undertaken in relation to:

- Continued collection and analysis of hydro-meteorological data for improved flood flow and sea level frequency analysis and for observation of the potential impacts of climate change.
- Ongoing recording of flood events though established systems, with photographs, peak water levels, duration, etc., for recording and publication on the National Flood Event Data Archive (www.floodinfo.ie).
- Monitoring of compliance with the Guidelines on the Planning System and Flood Risk Management through ongoing review of development plans, local area plans and other forward planning documents.
- Changes that may affect the areas prone to flooding as shown on the flood maps, with the flood maps updated on an ongoing basis as necessary.

8.3 ENVIRONMENTAL MONITORING

The SEA Directive requires that the significant environmental effects of the implementation of a Plan are monitored in order to identify at an early stage unforeseen adverse effects and in order to undertake appropriate remedial action. The proposed monitoring programme in Table 8.1 is based on the Targets and Indicators established in the SEA Objectives and will be undertaken during development of the 2nd cycle of the Plan.

Table 8.1 Environmental Monitoring of the Plan

SEA Topic	Objective	Sub-Objective		Indicator	Possible Data and Responsible Authority
Biodiversity, Flora and Fauna	Support the objectives of the Habitats Directive	i)	Avoid detrimental effects to, and where possible enhance, Natura 2000 network, protected species and their key habitats, recognising relevant landscape features and stepping stones	Area, condition and trend of European sites and species in the UoM (European sites to review are those identified by AA Screening.)	NPWS – Conservation Action Plans NPWS reporting on Irelands Habitats and Species – Article 17 Reports. NPWS reporting on the status of Irelands Birds – Article 12 Reports.
	Avoid damage to, and where possible enhance, the flora and fauna of the catchment	i)	Avoid damage to or loss of, and where possible enhance, nature conservation sites and protected species or other know species of conservation concern	Area, condition and trend of national, regional or local conservation sites in the UoM (National sites to review are those identified in SEA Environmental Report.)	Local Authority – Local Area Plans and County Development Plans. NPWS - Status of Protected Sites and Species in Ireland Reporting
Population and Human Health	Minimise risk to human health and life	i)	Minimise risk to human health and life of residents	Residential property flooding in the UoM	OPW, Local Authority and Emergency Services Reporting.
		ii)	Minimise risk to high vulnerability properties	High vulnerability sites impacted by flooding in the UoM	OPW, Local Authority and Emergency Services Reporting.
Geology, Soils and Landuse	Minimise risk to agriculture	i)	Minimise risk to agriculture	Area of soil resource lost due to flooding and flood risk management in the UoM.	EPA - CORINE landcover mapping. Local Area Plans and County Development Plans – myplan.ie
Water	Support the objectives of the WFD	i)	Provide no impediment to the achievement of water body objectives and, if possible, contribute to the achievement of water body objectives	Status and status trend of waterbodies, where FRM activities are within and upstream of a waterbody.	EPA / ERBD – WFD status reporting and RBMPs.
Climate	Ensure flood risk management options are adaptable to future flood risk	i)	Ensure flood risk management options are adaptable to future flood risk	Requirement for adaptation of FRM management activities for climate change in the UoM.	OPW and Local Authority reporting.
Material Assets	Minimise risk to transport & utility infrastructure	i)	Minimise risk to transport infrastructure	Number and type of transport routes that have flooded in the UoM.	OPW, Local Authority and NRA reporting.
		ii)	Minimise risk to utility infrastructure	Number and type of utilities that have flooded in the UoM.	OPW, Local Authority, ESB, Eirgrid, Eircom, BGE, Irish Water and EPA reporting.
Cultural Heritage	Avoid damage to or loss of features, institutions and	i)	Avoid damage to or loss of features, institutions and collections of architectural value and their setting.	Number of designated architectural heritage features, institutions and collections that have flooded in the UoM.	OPW, Local Authority and DAHRRGA reporting. Archaeological Survey of Ireland Sites and Monuments Records

	collections of cultural heritage importance and their setting	ii)	Avoid damage to or loss of features, institutions and collections of archaeological value and their setting.	Number of designated archaeological heritage features, institutions and collections that have flooded in the UoM.	OPW, Local Authority and DAHRRGA reporting. Archaeological Survey of Ireland Sites and Monuments Records
Landscape and Visual	Protect, and where possible enhance, landscape character and visual amenity within the river corridor	i)	Protect, and where possible enhance, visual amenity, landscape protection zones and views into / from designated scenic areas within the river corridor.	Length of waterway corridor qualifying as a landscape protection zone within urban areas of UoM. Change of quality in existing scenic areas and routes in the UoM. Loss of public landscape amenities in the UoM.	Local Authority – Landscape Character Assessments, County Development Plans and Local Area Plans. EPA - CORINE Landcover.
Fisheries, Aquaculture & Angling	Protect, and where possible enhance, fisheries resource within the catchment	i)	Maintain existing, and where possible create new, fisheries habitat including the maintenance or improvement of conditions that allow upstream migration for fish species.	Improvement or decline in fish stocks and habitat quality in the UoM. Barriers to fish movement within the UoM.	IFI and WFD fish surveys and reports. Local fisheries reporting.
Amenity, Community & Socio-Economics	Minimise risk to community	i)	Minimise risk to social infrastructure and amenity	Social infrastructure and amenity assets impacted by flooding in the UoM.	OPW and Local Authority reporting.
		ii)	Minimise risk to local employment	Non-residential properties impacted by flooding in the UoM.	OPW and Local Authority reporting.

8.4 REVIEW OF THE PFRA, FLOOD MAPS AND THE PLANS

In accordance with the requirements of the EU 'Floods' Directive, the PFRA, flood maps and Plans will be reviewed on a six-yearly cycle, with the first reviews of the PFRA, maps and final Plans due by the end of 2018, 2019 and 2021 respectively.

The review of the PFRA is described in Section 3.3.

The review of the flood maps, on an ongoing basis and formally by the end of 2019, will take account of additional information received and/or physical amendments such as the construction of new infrastructure, and, where appropriate, the amendment of the flood maps.

It is anticipated that this review of the Plans will include any changes or updates since the publication of the Plans, including:

- A summary of the review of the PFRA and the flood maps, taking into account the potential impacts of climate change, including where appropriate the addition or removal of AFAs.
- An assessment of the progress made towards the achievement of the flood risk management Objectives.
- A description of, and an explanation for, any measures foreseen in the final version of the Plan which were planned to be undertaken and have not been taken forward.
- A description of any additional measures developed and/or progressed since the publication of the Plan.

The Review of the Plan, which will include assessments under SEA and Habitats Directives as appropriate, taking into account new information available at that time (e.g., as available from the Environmental Monitoring Framework and from the www.catchments.ie website), will be published in line with relevant legislation, following public and stakeholder engagement and consultation.

GLOSSARY AND ACRONYMS

Annual Exceedance Probability Or AEP	The probability, typically expressed as a percentage, of a flood event of a given magnitude being equalled or exceeded in any given year. For example, a 1% AEP flood event has a 1%, or 1 in a 100, chance of occurring or being exceeded in any given year.
Appropriate Assessment	An assessment of the potential impacts of a plan or project on the integrity of a site designated as a Natura 2000 Site, as required under the Habitats Directive.
Area for Further Assessment Or AFA	Areas where, based on the Preliminary Flood Risk Assessment, the risks associated with flooding are considered to be potentially significant. For these areas, further, more detailed assessment was required to determine the degree of flood risk, and develop measures to manage and reduce the flood risk. The AFAs were the focus of the CFRAM Studies.
Arterial Drainage Scheme	Works undertaken under the Arterial Drainage Act (1945) to improve the drainage of land. Such works were undertaken, and are maintained on an ongoing basis, by the OPW.
Benefiting Lands	Lands benefiting from an Arterial Drainage Scheme.
Catchment	The area of land draining to a particular point on a river or drainage system, such as an Area for Further Assessment (AFA) or the outfall of a river to the sea.
Catchment Flood Risk Assessment and Management Study Or CFRAM Study	A study to assess and map the existing and potential future flood hazard and risk from fluvial and coastal waters, and to define objectives for the management of the identified risks and prepare a Plan setting out a prioritised set of measures aimed at meeting the defined objectives.
Communities	Cities, towns, villages or townlands where there are a collection of homes, businesses and other properties.
Consequences	The impacts of flooding, which may be direct (e.g., physical injury or damage to a property or monument), a disruption (e.g., loss of electricity supply or blockage of a road) or indirect (e.g., stress for affected people or loss of business for affected commerce)
Drainage	Works to remove or facilitate the removal of surface or sub-surface water, e.g., from roads and urban areas through urban storm-water drainage systems, or from land through drainage channels or watercourses that have been deepened or increased in capacity.
Drainage District	Works across a specified area undertaken under the Drainage Acts to facilitate land drainage.
Flood	The temporary covering by water of land that is not normally covered by water.
'Floods' Directive	The EU 'Floods' Directive [2007/60/EC] is the Directive that came into force in November 2007 requiring Member States to undertake a PFRA to identify Areas for Further Assessment (AFAs), and then to prepare flood maps and Plans for these areas.
Flood Extent	The extent of land that has been, or might be, flooded. Flood extent is often represented on a flood map.
Flood Hazard Map	A map indicating areas of land that may be prone to flooding, referred to as a flood extent map, or a map indicating the depth, velocity or other aspect of flooding or flood waters for a given flood event. Flood hazard maps are typically prepared for either a past event or for (a) potential future flood event(s) of a given probability.

Flood Risk Map	A map showing the potential risks associated with flooding. These maps may indicate a particular aspect of risk, taking into account the probability of flooding (e.g., annual average economic damages), but can also show the various receptors that could be affected by floods of different probabilities.
Flood Risk Management Plan (Plan)	A Plan setting out a prioritised set of measures within a long-term sustainable strategy aimed at achieving defined flood risk management objectives. The Plan is developed at a River Basin (Unit of Management) scale, but is focused on managing risk within the AFAs.
Floodplain	The area of land adjacent to a river or coastal reach that is prone to periodic flooding from that river or the sea.
Fluvial	Riverine, often used in the context of fluvial flooding, i.e., flooding from rivers, streams, etc.
Habitats Directive	The Habitats Directive [92/43/EEC] aims at securing biodiversity through the provision of protection for animal and plant species and habitat types of European importance.
Hazard	Something that can cause harm or detrimental consequences. In this context, the hazard referred to is flooding.
Hydraulics	The science of the behaviour of fluids, often used in this context in relation to estimating the conveyance of flood water in river channels or structures (such as culverts) or overland to determine flood levels or extents.
Hydrology	The science of the natural water cycle, often used in this context in relation to estimating the rate and volume of rainfall flowing off the land and of flood flows in rivers.
Hydrometric Area	Hydrological divisions of land, generally large catchments or a conglomeration of small catchments, and associated coastal areas. There are 40 Hydrometric Areas in the island of Ireland.
Indicative	This term is typically used to refer to the flood maps developed under the PFRA. The maps developed are approximate, rather than highly detailed, with some local anomalies.
Individual Risk Receptor Or IRR	A single receptor (see below) that has been determined to represent a potentially significant flood risk (as opposed to a community or other area at potentially significant flood risk, known as an Area for Further Assessment or 'AFA').
Inundation	Another word for flooding or a flood (see 'Flood')
Measure	A measure (when used in the context of a flood risk management measure) is a set of works, structural and / or non-structural, aimed at reducing or managing flood risk.
National CFRAM Programme	The programme developed by the OPW to implement key aspects of the EU 'Floods' Directive in Ireland, which included the CFRAM Studies, and built on the findings of the PFRA.
Pluvial	Refers to rainfall, often used in the context of pluvial flooding, i.e., flooding caused directly from heavy rainfall events (rather than over-flowing rivers).
Point Receptor	Something that might suffer harm or damage as a result of a flood, that is at a particular location that does not cover a large area, such as a house, office, monument, hospital, etc.
Preliminary Flood Risk Assessment Or PFRA	An initial, high-level screening of flood risk at the national level to determine where the risks associated with flooding are potentially significant, to identify the AFAs. The PFRA is the first step required under the EU 'Floods' Directive.

Public Consultation Day Or PCD	A public and stakeholder consultation and engagement event advertised in advance, where the project team displayed and presented material (e.g., flood maps, flood risk management options) at a venue within a community, with staff available to explain and discuss the material, and where members of the community and other interested parties could provide local information and put forward their views.
Receptor	Something that might suffer harm or damage as a result of a flood, such as a house, office, monument, hospital, agricultural land or environmentally designated sites.
Return Period	A term that was used to describe the probability of a flood event, expressed as the interval in the number of years that, on average over a long period of time, a certain magnitude of flood would be expected to occur. This term has been replaced by 'Annual Exceedance Probability, as Return Period can be misleading.
Riparian	River bank. Often used to describe the area on or near a river bank that supports certain vegetation suited to that environment (Riparian Zone).
Risk	The combination of the probability of flooding, and the consequences of a flood.
River Basin	An area of land (catchment) draining to a particular estuary or reach of coastline.
River Basin District Or RBD	A regional division of land defined for the purposes of the Water Framework Directive. There are eight RBDs in the island of Ireland; each comprising a group of River Basins.
Riverine	Related to a river
Runoff	The flow of water over or through the land to a waterbody (e.g., stream, river or lake) resulting from rainfall events. This may be overland, or through the soil where water infiltrates into the ground.
Sedimentation	The accumulation of particles (of soil, sand, clay, peat, etc.) in the river channel
Significant Risk	Flood risk that is of particular concern nationally. The PFRA Main Report (see www.floodinfo.ie) sets out how significant risk is determined for the PFRA, and hence how Areas for Further Assessment have been identified.
Strategic Environmental Assessment Or SEA	An SEA is an environmental assessment of plans and programmes to ensure a high level consideration of environmental issues in the plan preparation and adoption, and is a requirement provided for under the SEA directive [2001/42/EC]
Standard of Protection Or SoP	The magnitude of flood, often defined by the annual probability of that flood occurring being exceeded (the Annual Exceedance Probability, or 'AEP'), that a measure / works is designed to protect the area at risk against.
Surface Water	Water on the surface of the land. Often used to refer to ponding of rainfall unable to drain away or infiltrate into the soil.
Surge	The phenomenon of high sea levels due to meteorological conditions, such as low pressure or high winds, as opposed to the normal tidal cycles
Survey Management Project	A project commissioned by the OPW in advance of the CFRAM Studies to specify and manage a large proportion of the survey work.
Sustainability	The capacity to endure. Often used in an environmental context or in relation to climate change, but with reference to actions people and society may take.
Tidal	Related to the tides of the sea / oceans, often used in the context of tidal flooding, i.e., flooding caused from high sea or estuarine levels.

Topography	The shape of the land, e.g., where land rises or is flat.
Transitional Water	The estuarine or inter-tidal reach of a river, where the water is influenced by both freshwater river flow and saltwater from the sea.
Unit of Management Or UoM	A hydrological division of land defined for the purposes of the Floods Directive. One Plan has been prepared for each Unit of Management, which is referred to within the Plan as a River Basin.
Vulnerability	The potential degree of damage to a receptor (see above), and/or the degree of consequences that could arise in the event of a flood.
Waterbody	A term used in the Water Framework Directive (see below) to describe discrete section of rivers, lakes, estuaries, the sea, groundwater and other bodies of water.
Water Framework Directive Or WFD	The Water Framework Directive [2000/60/EC] aims to protect surface, transitional, coastal and ground waters to protect and enhance the aquatic environment and ecosystems and promote sustainable use of water resources

LIST OF ACRONYMS

AA	Appropriate Assessment
AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
AR5	5th Assessment Report (IPCC)
BCR	Benefit - Cost Ratio
CFRAM	Catchment-Based Flood Risk Assessment and Management
DHPLG	Department of Housing, Planning and Local Government
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
EU	European Union
FRMP	Flood Risk Management Plan
FRR	Flood Risk Review
HEFS	High-End Future Scenario
HPW	High Priority Watercourse
INFF	Irish National Flood Forum
IPCC	Intergovernmental Panel on Climate Change
IROPI	Imperative Reasons of Over-riding Public Interest
MCA	Multi-Criteria Analysis
MPW	Medium Priority Watercourse
MRFS	Mid-Range Future Scenario
NCCAF	National Climate Change Adaptation Framework
OPW	Office of Public Works
PCD	Public Consultation day
PFRA	Preliminary Flood Risk Assessment
RBD	River Basin District
RBMP	River Basin Management Plan

SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SI	Statutory Instrument
SPA	Special Protection Area
SUDS	Sustainable Urban Drainage Systems
UoM	Unit of Management
WFD	Water Framework Directive

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APPENDICES

APPENDIX A

FLOODING AND FLOOD RISK

A.1 INTRODUCTION

A flood is defined in the 'Floods' Directive as a "temporary covering by water of land not normally covered by water", i.e., the temporary inundation of land that is normally dry. Flooding is a natural process that can happen at any time in a wide variety of locations.

Flood ***hazard*** is the potential threat posed by flooding to people, property, the environment and our cultural heritage. The degree of hazard is dependent on a variety of factors that can vary from location to location and from one flood event to another. These factors include the extent and depth of flooding, the speed of the flow over the floodplains, the rate of onset and the duration of the flood.

Flooding only presents a ***risk*** however when people, property, businesses, farms, infrastructure, the environment or our cultural heritage can be potentially impacted or damaged by floods. Flood risk is the combination of the probability of flood events of different magnitudes and the degree of the potential impact or damage that can be caused by a flood. The actual damage that can be caused depends on the vulnerability of society, infrastructure and our environment to damage or loss in the event of a flood, i.e., how sensitive something is to being damaged by a flood.

A.2 Types and Causes of Flooding

Flooding can occur from a range of sources, individually or in combination, as described below.

A.2.1 Coastal Flooding

Coastal flooding occurs when sea levels along the coast or in estuaries exceed neighbouring land levels, or overcome coastal defences where these exist, or when waves overtop the coastline or coastal defences. Mean sea levels around Ireland are rising (Dwyer and Devoy, 2012), and are expected to continue to rise due to climate change in the range of 0.52 to 0.98m (IPCC, 2014) by 2100, with an associated increase in flood risk from the sea over the coming decades.

Coastal flooding can also occur in the form of tsunami, and Ireland has suffered from tsunami flooding in the past[1]. It was determined during the Preliminary Flood Risk Assessment (PFRA, see Section 3) however that this cause of flooding is not, on the basis of our current understanding, a significant cause of flood risk in Ireland, although further investigation is required on this matter. As a result, tsunami risk is not addressed in this Plan.

A.2.2 Fluvial Flooding

Fluvial flooding occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas (the natural floodplains). This can arise where the runoff from heavy rain exceeds the natural capacity of the river channel, and can be exacerbated where a channel is blocked or constrained or, in estuarine areas, where high tide levels impede the flow of the river out into the sea. While there is a lot of uncertainty on the

[1] The tsunami that devastated Lisbon, Portugal in 1755 also hit the south coast of Ireland according to records of that time, and there are reports of tsunami-like flood events around the South coast from 1761 and 1854 (Pers comm., GSI)

impacts of climate change on rainfall patterns, there is a clear potential that fluvial flood risk could increase into the future.

A.2.3 Pluvial Flooding

Pluvial flooding occurs when the amount of rainfall exceeds the capacity of urban storm water drainage systems or the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural or man-made hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall before the flood waters eventually enter a piped or natural drainage system. This type of flooding is driven in particular by short, intense rain storms.

A.2.4 Groundwater Flooding

Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall, to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding results from the interaction of site-specific factors such as local geology, rainfall infiltration routes and tidal variations. While the water level may rise slowly, it may cause flooding for extended periods of time. Hence, such flooding may often result in significant damage to property or disruption to transport. In Ireland, groundwater flooding is most commonly related to turloughs in the karstic limestone areas prevalent in particular in the west of Ireland.

A.2.5 Other Causes of Flooding

The above causes of flooding are all natural; caused by either extreme sea levels or heavy or intense rainfall. Floods can also be caused by the failure or exceedance of capacity of built or man-made infrastructure, such as bridge collapses, from blocked piped sewerage networks, or the failure or over-topping of reservoirs or other water-retaining embankments (such as raised canals). While it is recognised that some of these other sources may cause local problems, it was determined during the PFRA (see Section 3) however that these causes of flooding are not, in the context of the national flood risk and on the basis of our current understanding, causes of significant flood risk, or can not always be foreseen, and hence are not addressed in the Plan.

A.3 IMPACTS OF FLOODING

A.3.1 Impacts on people and society

Flooding can cause physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters can be particularly dangerous. For example, even shallow water flowing at 2 metres per second (m/sec) can knock children and many adults off their feet, and vehicles can be moved by flowing water of only 300mm depth. The risks increase if the floodwater is carrying debris. Some of these impacts may be immediate, the most significant being drowning or physical injury due to being swept away by floods. Floodwater contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) can also cause illnesses, either directly as a result of contact with the polluted floodwater or indirectly, as a result of sediments left behind. Those most likely to be at risk are people living in a single-storey bungalow or below ground in a basement, those outdoors on foot or in a vehicle, or people staying in a tent or caravan.
As well as the immediate dangers, the impact on people and communities as a result of the stress and trauma of being flooded or having access to their property cut-off by floodwaters, or even of being under the threat of flooding, can be immense. Long-term impacts can arise due to chronic illnesses and the stress associated with being flooded and the lengthy recovery process.

The ability of people to respond and recover from a flood can vary. Vulnerable people, such as the elderly, people with mobility difficulties or those who have a long-term illness,

are potentially less able to respond to a flood emergency. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood.

Floods can also cause impacts on communities as well as individuals through the temporary, but sometimes prolonged, loss of community services or infrastructure, such as schools, health services, community centres or amenity assets.

A.3.2 Impacts on property

Flooding can cause severe damage to properties. Floodwater is likely to damage internal finishes, contents and electrical and other services and possibly cause structural damage. The physical effects can have severe long-term impacts, with re-occupation sometimes not being possible for over a year. The costs of flooding are increasing, partly due to increasing amounts of electrical and other equipment within developments. The degree of damage generally increases with the depth of flooding, and sea-water flooding may cause additional damage due to corrosion.

Flooding can also cause significant impacts to agriculture. A certain level of flooding is intrinsic in certain areas, and agricultural management takes this into account, however extreme or summer flooding can have detrimental impacts through loss of production, as well as damage to land and equipment.

A.3.3 Impacts on Infrastructure

The damage flooding can cause to businesses and infrastructure, such as transport or utilities like electricity, gas and water supply, can have significant detrimental impacts on individuals and businesses and also local and regional economies. Flooding of primary roads or railways can deny access to large areas beyond those directly affected by the flooding for the duration of the flood event, as well as causing damage to the road or railway itself. Flooding of water distribution infrastructure such as pumping stations or of electricity sub-stations can result in loss of water or power supply over large areas. This can magnify the impact of flooding well beyond the immediate community. The long-term closure of businesses, for example, can lead to job losses and other economic impacts.

A.3.4 Impacts on the Environment

Detrimental environmental effects of flooding can include soil and bank erosion, bed erosion or siltation, land slides and damage to vegetation and species that are not resilient against flooding, as well as the impacts on water quality, habitats and flora and fauna caused by pollutants carried by flood water. Flooding can however be a necessary element of natural and semi-natural habitats. Many wetland habitats are dependent on continual or periodic flooding for their sustainability and can contribute to the storage of flood waters to reduce flood risk elsewhere.

A.3.5 Impacts on our Cultural Heritage

In the same way as flooding can damage properties, flood events can damage or destroy assets or sites of cultural heritage value. Particularly vulnerable are monuments, structures or assets (including building contents) made of wood or other soft materials, such as works of art and old paper-based items such as archive records, manuscripts or books. Soil erosion during flood events could also destroy buried heritage and archaeological sites.

A.4 Potential Impacts of Future Change

It is likely that climate change will have a considerable impact on flood risk in Ireland, such as through rising mean sea levels, increased wave action and the potential increases in winter rainfall and intense rainfall events. Land use change, for example through new housing and other developments, can also increase potential future flood risk.

APPENDIX B

PHYSICAL OVERVIEW OF THE RIVER BASIN

B.1 TOPOGRAPHY, GEOLOGY, SOILS AND GROUNDWATER

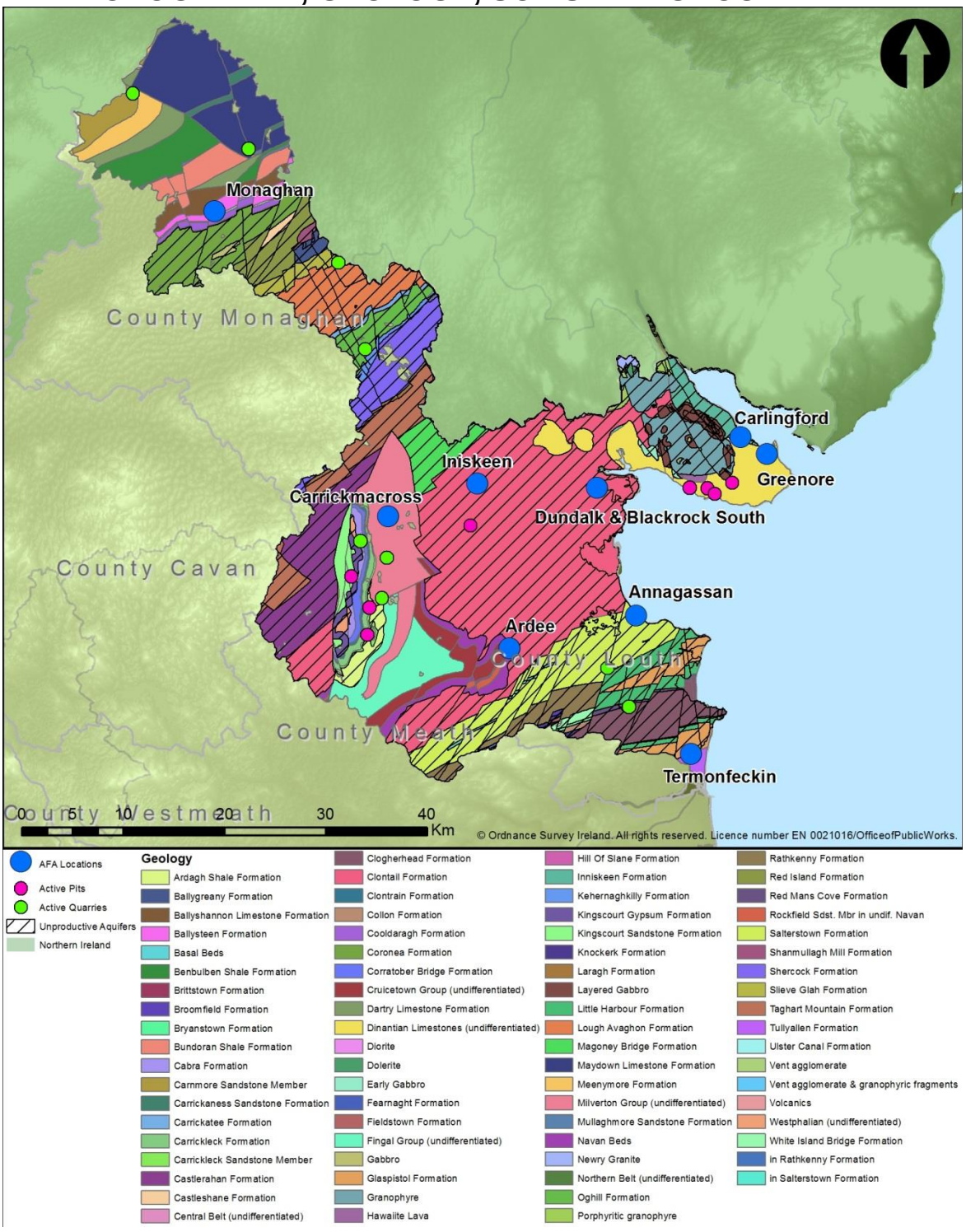


Figure B.1 Geology & Quarries, Mines and Unproductive Aquifers

Section 2, Figure 2.1 demonstrates the topography of the Neagh Bann River Basin showing a generally easterly drainage pattern the southern portion of the study area

towards the Irish Sea, via Dundalk Bay and Carlingford Lough, however the northern portion of the study area, the Ulster Blackwater catchment, drains generally north easterly towards Lough Neagh in Northern Ireland crossing the border downstream of Monaghan town. The area is bounded to the West by UoM36 (the Erne) within the North Western River Basin District and to the South by UoM07 (the Boyne) within the Eastern RBD.

In the northern portion of the Neagh Bann study area, the landscape is dominated by drumlins that stretch across Monaghan and Louth and into Northern Ireland.

The geology of the Neagh Bann River Basin, as shown in Figure B.1, consists of calcareous red-mica greywacke which forms a quarter of the bedrock in the Neagh Bann River Basin, with a large area covering most of County Louth and with some smaller areas in northern Meath, and south east Monaghan. Formations of calcareous greywacke and banded mudstone run in a north east direction in the southern part of the UoM, spanning across northern County Meath and into Louth before reaching the coast. In the northern part of the UoM, argillaceous limestone and siltstone is present in a large area in northern Monaghan along the Northern Irish border. Micrite, crinoidal grainstone/packstone has a large formation in southern Monaghan, but also extends into northern Meath. Other significant formations of bedrock include massive sandstone and microconglomerate in eastern Monaghan, along the Northern Irish border, and dark quartz greywacke and conglomerate extending northwards from northern Meath, through eastern Cavan, to County Monaghan.

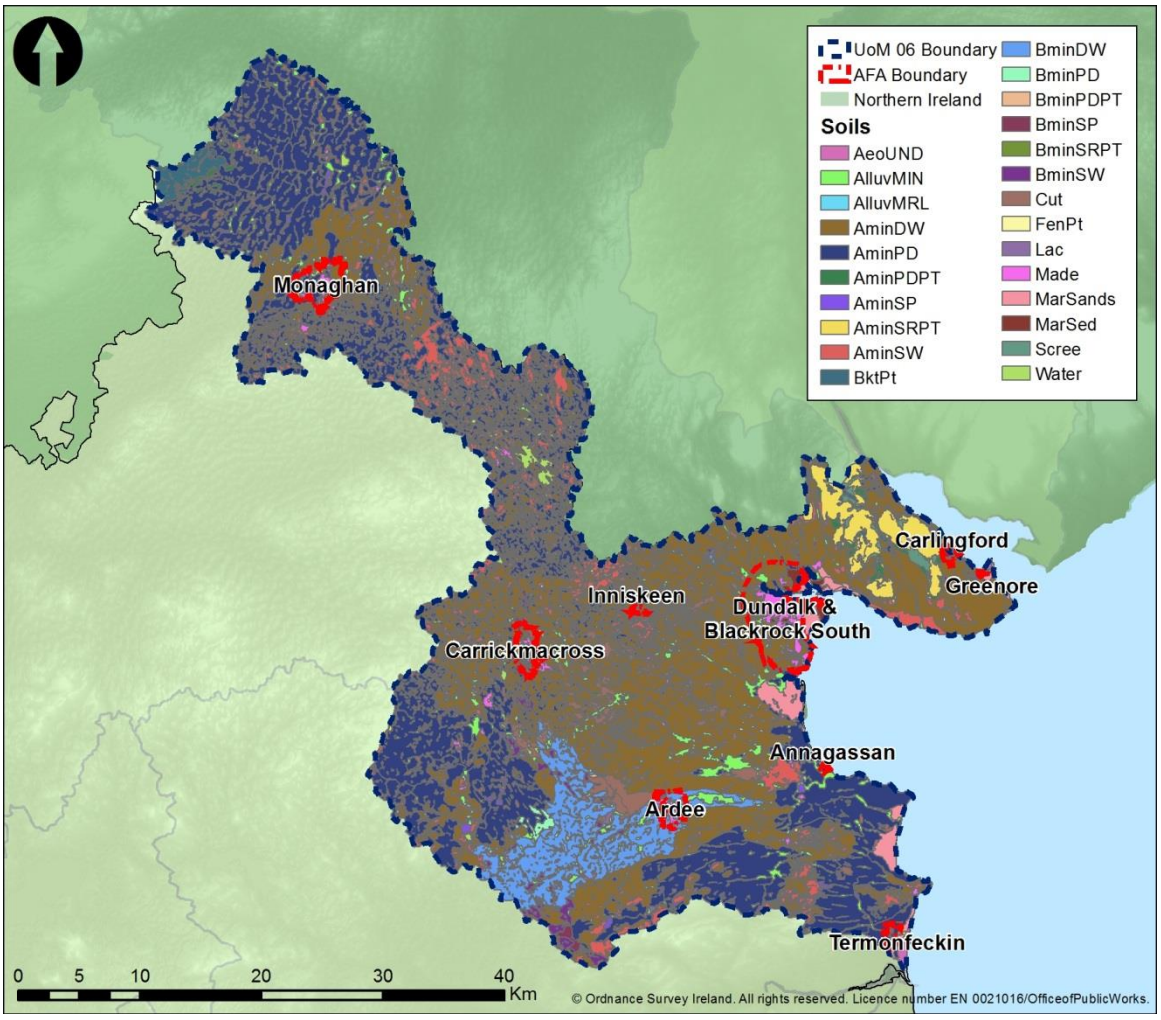


Figure B.2 Soil Types

Figure B.1 also demonstrates the distribution of the Irish Geological Heritage sites, the mines and the areas of unproductive aquifers in the NWNB CFRAM study area. These poorly productive aquifer areas can indicate areas of reduced infiltration and rejected groundwater recharge, which could contribute to flood risk. Most of County Louth has bedrock that is generally unproductive, as well large parts of County Monaghan. Other areas of unproductive bedrock are located in northern Meath, and eastern Cavan.

In terms of soils (Figure B.2), acid brown earths and brown podzolics cover most of the Neagh Bann River Basin. Surface water and ground water gleys derived from non-calcareous parent materials are also widely distributed, particularly in the western and northern parts of the UoM, as well as some areas of the south east near the coast. Shallow acid brown earths/ brown podzolics, lithosols, regosols, and some outcropping rocks are distributed throughout the UoM, while cutaway/cutover basin and blanket peats are located in western inland areas.

B.2 LAND USE AND LAND MANAGEMENT

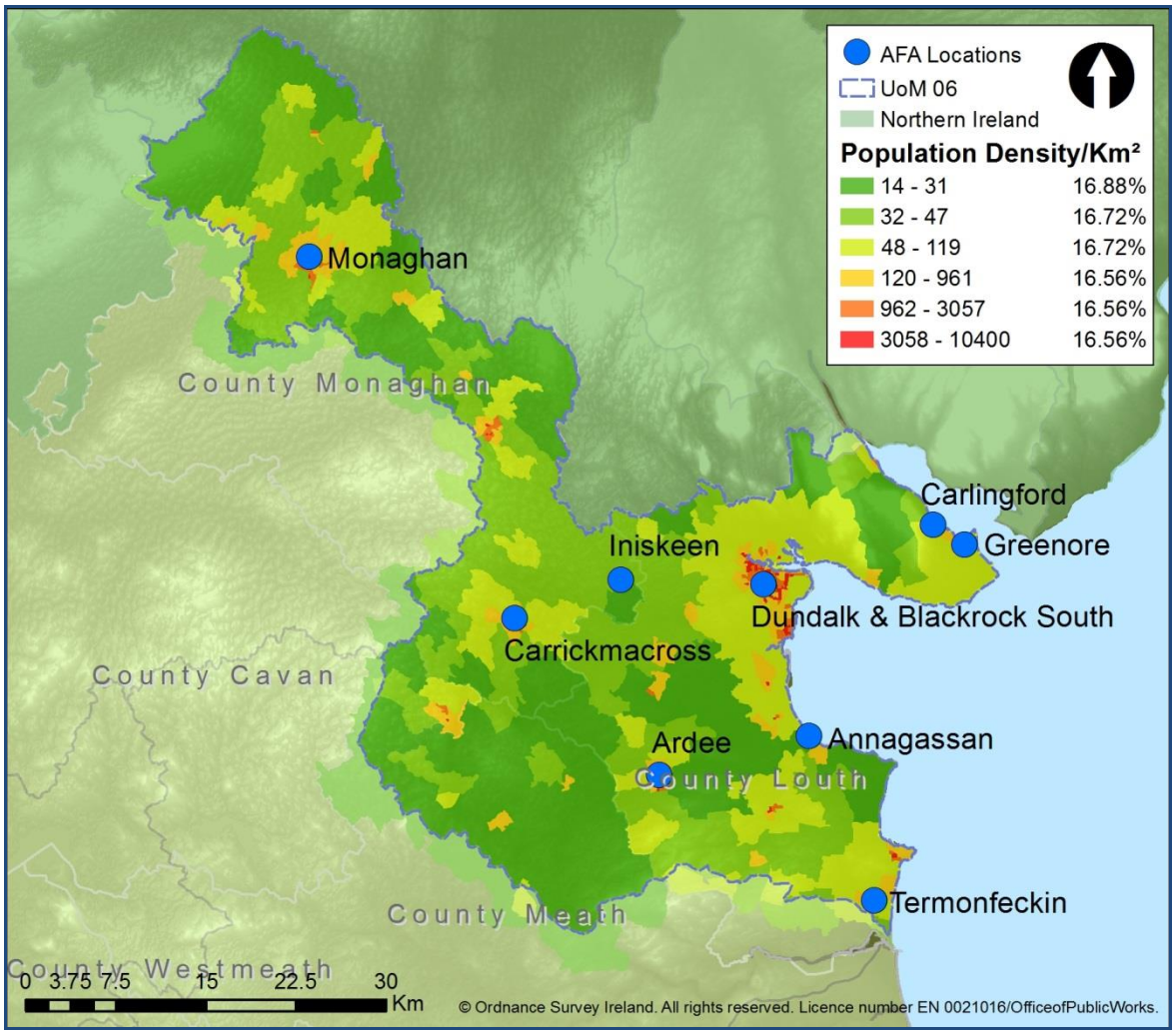


Figure B.3 Population Density (population/km²) by Small Area from 2011 Census

The 2011 census data held by the Central Statistics Office (CSO, 2011) show a total population for the NWNB CFRAM study area of approximately 401,343, of which 147,668 are in the Neagh Bann RBD. The Neagh Bann RBD has a low average population density is rural in nature. The primary settlements include the towns of Dundalk, Monaghan, Ardee, Carrickmacross, Castleblaney and Ardee. Population has increased since the previous census in 2006, with Counties Cavan (+14%) Monaghan (+8%) and Louth

(+11%) recording growth at or above the national average (+8%) over this period. The population density by Small Area for the NWNB CFRAM Study area is shown in Figure B.3 (CSO, 2011).

The 2011 census also revealed the high rates of emigration which have occurred during the economic downturn following the previous census, with a decrease of 12% since 2006 in the population of 19-24 year olds. The CSO confirmed that emigration plays a significant role in the diminishing young population, with around 30,000 young people aged between 15 and 24 leaving the country each year to seek work elsewhere. This has left behind a population with a higher proportion of aging (>65) people and particularly young people (<15) than elsewhere in Europe.

The population trend within the NWNB CFRAM study area is generally one of increasing growth, broadly matching the national average growth through the last census period of around 8%, although some areas, such as County Cavan, are experiencing greater rates of up to 14%. There will be ongoing population pressure on infrastructure and resources and the provision of adequate health care resources for the expanding population, particularly in terms of the expansion of the elderly and young populations that are not economically active.

The population density by electoral division for the Neagh Bann River Basin is shown in Figure B.3 (CSO, 2011). Increases in population pose land use and land management pressures which can influence catchment response. For example, demand to increase agricultural productivity, which coincides with the Irish agricultural industry also aiming to provide more goods to the global market. Associated land drainage to improve soil quality may have effects on flood risk by increasing the speed at which water reaches the main arterial river networks.

The land use in the Neagh Bann River Basin is typified by improved pasture but also includes extensive arable farming, particularly in County Louth. To the northern extent of the study area, agriculture is also the predominant land use. There are pockets of peat bogs and coniferous forestry in upland areas surrounding Carlingford Lough and in Slieve Beagh in Co. Monaghan. Land cover is dominated by agricultural pastureland, with urban areas making up a very small proportion of the study area. While it is unlikely that the general pattern of land use will be substantially changed in the future, the increasing population will continue to drive a requirement for new housing and expansion of developed areas. The broad pattern of land cover, as shown in Figure B.4, in the Neagh Bann River Basin, has been determined from the CORINE Land Cover Database (2012) from which it can be seen that the main land use types in the study area are agricultural lands (pastures, arable, etc.).

Increases in population also can pose development pressures resulting in changes in land use, for example increases in paved areas, which can directly affect the surface and groundwater environments through processes such as run off, infiltration and also changes in abstraction.

The 2011 census shows a dramatic increase in population from the 2006 census. These increases have been centralised around urban areas. The average population growth within the urbanised AFAs in the Neagh Bann River Basin can be shown to be 9% for the period (2% annualised).

In terms of the growth of the urban areas within the Neagh Bann River Basin the average annualised growth in the AFAs for which there is data is 2% based on a comparison of urban areas within each AFA between Corine 2000 and 2006 land use datasets. Dundalk

& Blackrock South represents the highest observed growth of 17% between the two data sets (3% annualised).

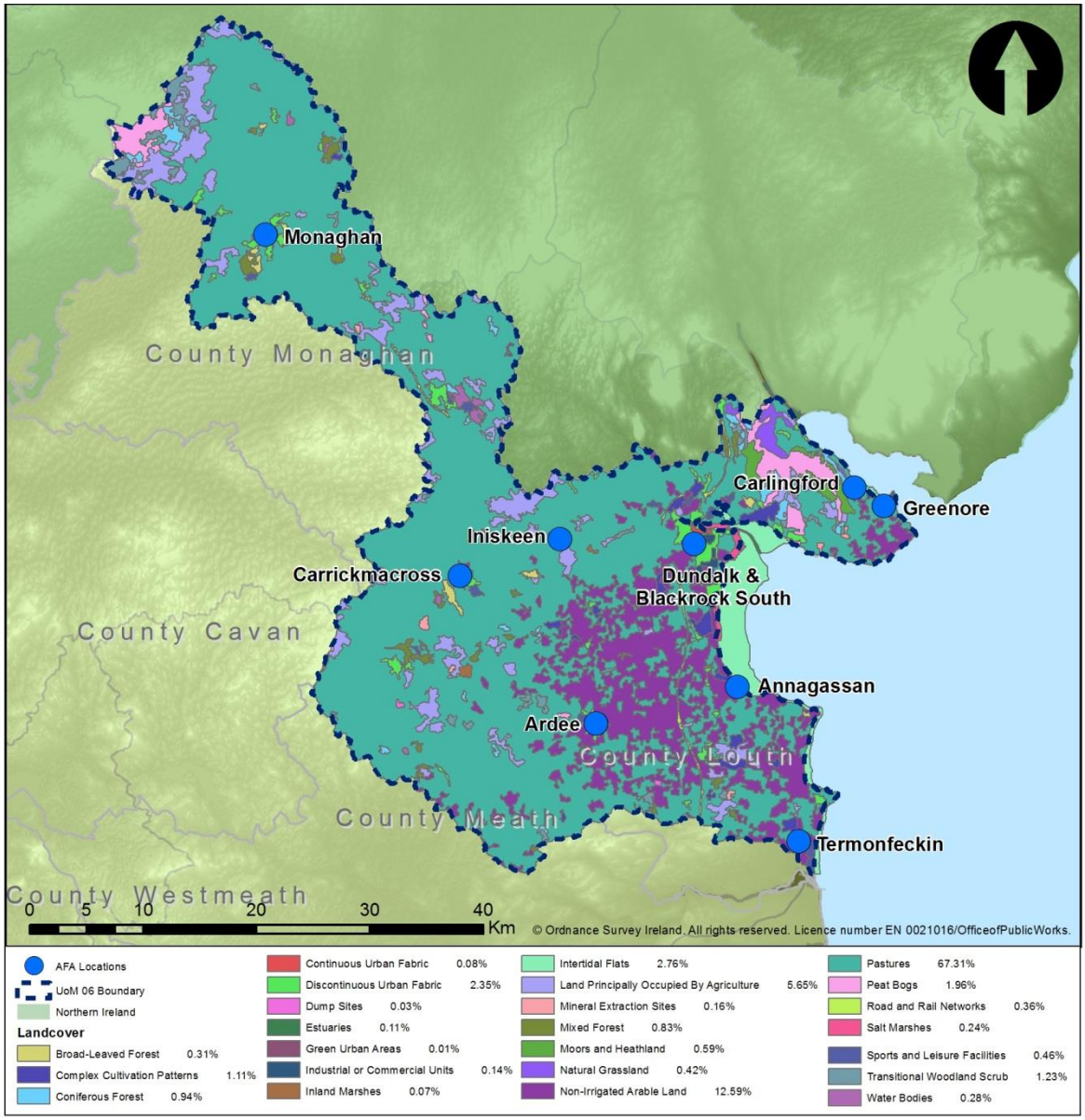


Figure B.4 Land cover in the Neagh Bann River Basin determined from the CORINE Land Cover Database

CSO population projections for the region predict annual population growth rates of 0.4% to 1.5% for the region. Considering a mid-range future scenario (MRFS) growth rate in the urban extents within the catchment of 1% is estimated to result in a 3% increase in the index flood flow (Qmed) over a 100 year time horizon. When a 2.5% growth rate is considered for the High-End Future Scenario (HEFS) it is estimated that the index flood flow would increase by 22% over a 100 year time horizon.

B.3 HYDROLOGY

The principal catchment characteristics for the Neagh Bann River Basin are summarised in Table B.1.

Hydrometric data is available at 23 hydrometric gauge stations (including 3 Rivers Agency stations located in Northern Ireland) on watercourses within HA03 and HA06 as shown in Figure B.5. Eighteen of these stations have water level and flow data available (three of

which are operated by the Department of Agriculture and Rural Development (DARD) Rivers Agency (Northern Ireland).

Of the 18 stations with flow data available, six stations are located on watercourses to be modelled. Five of these stations were rated under Flood Studies Update (FSU) as having a confidence in their rating classification. There is one tidal gauge along the coast of the the Neagh Bann River Basin at Port Oriel between the Annagassan and Termonfeckin AFAs. In general the Neagh Bann River Basin can be considered to be a moderately well gauged catchment.

Table B.1 Hydrological Catchment Characteristics in the Neagh Bann River Basin

NAME	RIVER CATCHMENT	TRIBUTARIES/ MINOR WATERCOURSES	AREA (km^2)	SLOPE (m/km)	Q_{MED} (m^3/s)
Monaghan	Monaghan Blackwater River	Telaydan Crove Tenderages Killygowan Ballymacforban Knockaconny	275.11	6.92	53.43
Carlingford	-	Carlingford Commons Liberties of Carlingford Carlingford Watercourse	2.65	102.74	3.27
Greenore	-	Mullatee Milgrange	3.04	8.86	0.94
Dundalk & Blackrock South	Castletown River	Ramparts River Piorland Killally Donaghmore Fairhill Blackrock Greengates	239.30	6.17	28.46
Inniskeen	River Fane	Inniskeen Lannat Millrace	338.46	2.56	28.93
Carrickmacross	River Glyde	Tullynaskeagh Kilmactrashna Drummond Coolderry Lisanisk	270.70	2.95	21.46
Ardee	River Dee	Garra Mullameelan Rathgory Boharnamoe Cappocksgreen	307.98	2.67	27.37
Annagassan	River Dee River Glyde	White River	794.54	1.55	49.56
Termonfeckin	Termonfeckin River	-	28.48	13.94	6.82

Good hydrometric data exists within the larger channels of the Neagh Bann River Basin which is of sufficient quality to be of use for design flow estimation and as such there is generally a high degree of certainty in design flow estimates along main watercourses such as the Monaghan Blackwater, Glyde, Dee, and Fane.

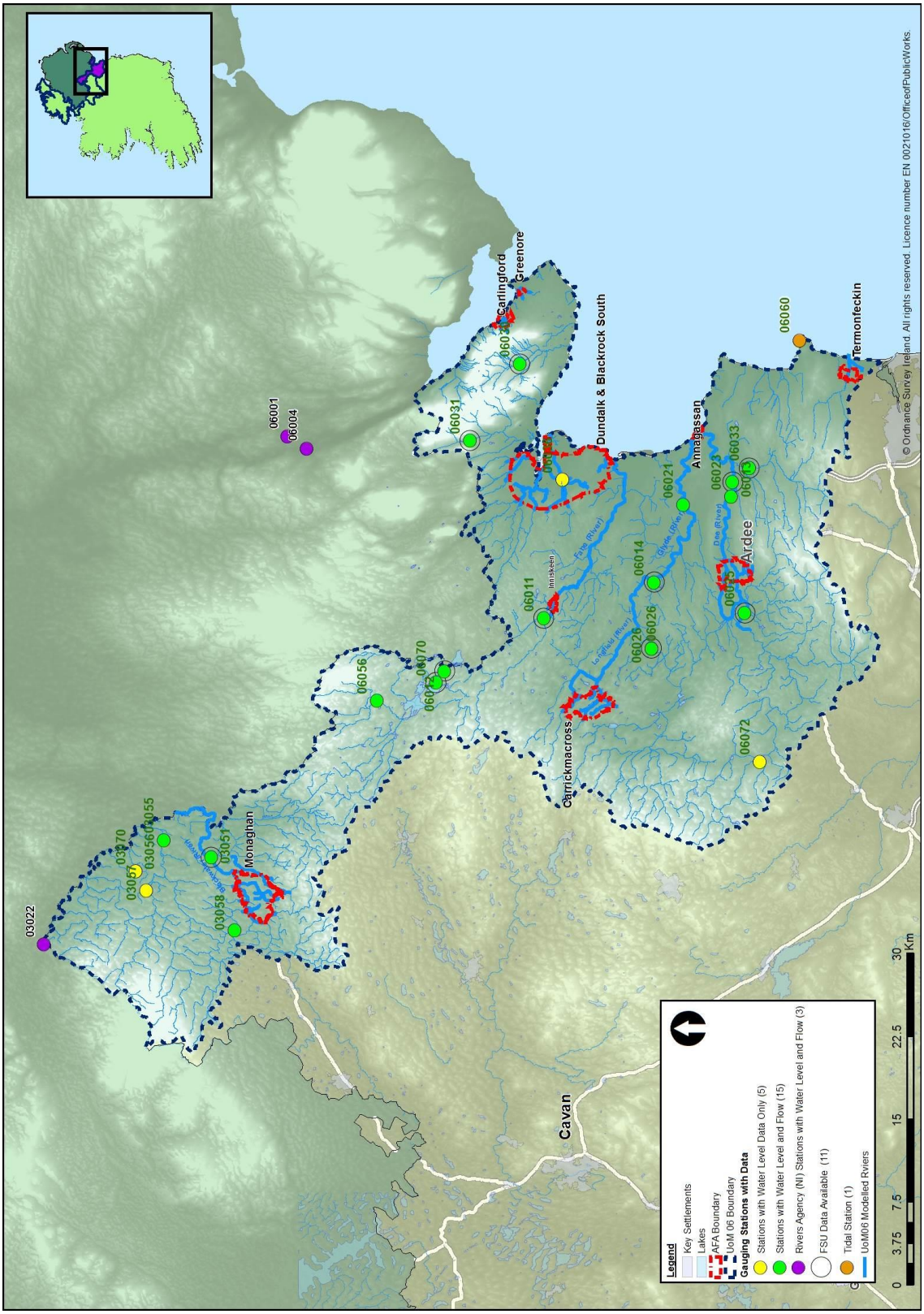


Figure B.5 Hydrometric Data Availability

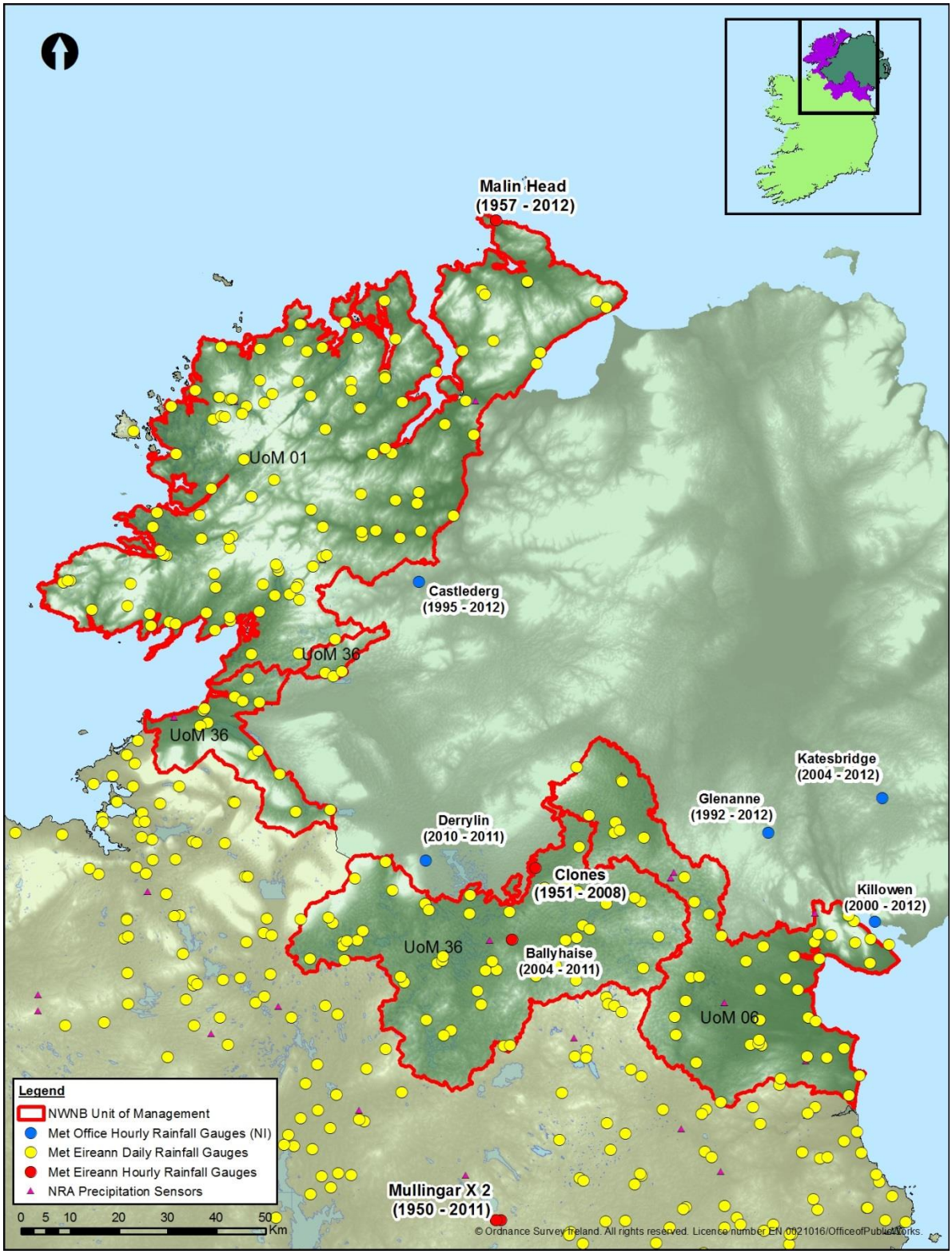


Figure B.6 Meteorological Data Availability

Meteorological data was available from a number of Met Éireann, NRA and UK Met Office daily, sub-daily and hourly rain gauges within the NWNB CFRAM study area and beyond which could potentially be used within the hydrological analysis. In particular, within the RPS methodology the historical time series data was used as an input to catchment scale hydrological rainfall run-off models to simulate a continuous flow records within a catchment. High resolution temporal data was required to achieve the required accuracy within the hydrological models. Daily rainfall data was not considered to be of a high

enough temporal resolution to be used as direct input for hydrological modelling on its own but could be used along with the hourly data to inform the spatial distribution of hourly rainfall data within the catchments.

In relation to the Neagh Bann River Basin the only hourly rainfall station used in hydrological analysis is the Met Éireann hourly gauge at Clones (1951 – 2008). It is the closest gauge to the rainfall runoff model that was constructed (to inform the hydraulic model for Monaghan AFA) and was considered to be of high enough temporal resolution and accuracy to be of use. This is the only location where data was available to construct a calibrated hydrological model that would have provided significant benefit to the Study. This rainfall run-off model was used only as a complementary design flow estimation technique in support of FSU statistical based approaches for design flow estimation.

In addition to the observed historical rainfall data available at the aforementioned rain gauge locations, further meteorological information namely observed evaporation, soil moisture deficits and potential evapotranspiration data was used within the hydrological rainfall run-off model. Historical time series data is available for these parameters at Met Éireann synoptic weather stations which are generally the same locations for which historical hourly rainfall data is available. Figure B.6 shows the locations of all of the rain gauges available and the availability of historic information at the hourly rainfall gauges.

Hydrological methodologies published in the Flood Studies Update have been used as the core methodologies upon which the hydrological analysis has been undertaken. In the case of the Neagh Bann River Basin these methods have been complemented with the use of hydrological techniques published in the FSR. These dual analyses were deemed appropriate for both comparison and design flow estimation, alongside using the hydrological rainfall run-off based modelling methods described previously.

Full details of the methodology, datasets used and outcomes of the hydrological analysis for the NWNB CFRAM study area can be found at www.floodinfo.ie.

APPENDIX C

SUMMARY OF THE PRELIMINARY FLOOD RISK ASSESSMENT

C.1 INTRODUCTION

The Preliminary Flood Risk Assessment (PFRA) is a national screening exercise, based on available and readily-derivable information, to identify areas where there may be a significant risk associated with flooding.

The PFRA in Ireland was finalised in December 2011, following public consultation.

C.2 OVERVIEW OF THE PFRA

The objective of the PFRA is to identify areas where the risks associated with flooding might be significant. These areas (referred to as Areas for Further Assessment, or 'AFAs') are where more detailed assessment will then be undertaken to more accurately assess the extent and degree of flood risk, and, where the risk is significant, to develop where possible measures to manage and reduce the risk. The more detailed assessment, that focussed on the AFAs, was undertaken through the National CFRAM Programme or parallel studies.

It is important to note that the PFRA is not a detailed assessment of flood risk. It is rather a broad-scale assessment, based on available or readily-derivable information, to identify where there is a genuine cause for concern that may require national intervention and assessment, rather than locally developed and implemented solutions.

Three key approaches have been used in undertaking the PFRA to identify the AFAs. These are:

- Historic Analysis: The use of information and records on floods that have happened in the past.
- Predictive Analysis: Undertaking analysis to determine which areas might flood in the future, as determined by predictive techniques such as modelling, analysis or other calculations, and of the potential damage that could be caused by such flooding.
- Consultation: The use of local and expert knowledge of the local authorities and other Government departments and agencies to identify areas prone to flooding and the potential consequences that could arise.

The assessment considered all types of flooding, including natural sources, such as that which can occur from rivers, the sea and estuaries, heavy rain and groundwater, and the failure of built infrastructure. It has also considered the impacts flooding can have on people, property, businesses, the environment and cultural heritage.

Other EU Member States have used similar approaches to undertaking the PFRA as that undertaken in Ireland.

The 'Floods' Directive does not provide a definition for 'significant' flood risk. A highly prescriptive definition is not suitable given the preliminary nature of the PFRA, and so a set of guiding principles were defined. It should however be remembered that, while flooding of one home will be traumatic to the owner or residents of that home, the PFRA needs to consider what is nationally or regionally significant flood risk.

The provisional identification of the AFAs has involved interpretation of information from all three of the above approaches. The final designation of the AFAs also took into account information and views provided through the public consultation and arising from on-site inspections that were undertaken in parallel with the consultation.

C.3 PUBLIC CONSULTATION ON THE PFRA

The 'Floods' Directive requires Member States to publish the PFRA once completed. However, the OPW has also publicly consulted on a draft of the PFRA before it was finalised, published and reported to the European Commission.

Consultation with various bodies has been undertaken during the preparation of the draft PFRA, which has included two rounds of workshops (Summer 2010 and Winter 2010-2011) involving all local authorities. During these workshops, the local authorities provided information on areas known or suspected to be at risk from flooding, and reviewed provisional Areas for Further Assessment (AFAs) identified by the OPW in relation to fluvial and coastal flood risk.

Consultation was also held with the following organisations to inform the process and draft outcomes of the PFRA:

- Dept. of Agriculture, Food and the Marine
- Dept. of Culture, Heritage and the Gaeltacht
    - *National Monuments*
    - *National Parks and Wildlife Service*
- Environmental Protection Agency
- ESB
- Geological Survey of Ireland
- Health Service Executive
- Transport Infrastructure Ireland (formerly National Roads Authority)
- Waterways Ireland

Discussions were also held with utility operators in relation to the location and potential vulnerability of utility infrastructure.

The OPW published the Draft PFRA for consultation on the National CFRAM Programme website (now closed) in August 2011, and placed it on public exhibition in the principal offices of all city and county councils on the same date. While not a requirement of the Directive, SI No. 122 of 2010 set out a requirement for public consultation on the PFRA. The public consultation period began upon publication of the PFRA and extended to 1st November 2011. Submissions were invited in writing, by email, or via the website.

A total of 52 submissions were received under the public consultation process. A breakdown of the source of submissions is set out below:

County and City Councils	18
Councillors	4
Members of the Public	15
Community Groups / Associations	5
Other	10

The principal issues raised in the submissions include the following:

- Recommendations for the inclusion of locations for designation as AFAs, and / or expressions of concern related to past flooding, or the potential for flooding, of a particular location
- Comments that certain bodies, and / or their past or ongoing actions, were responsible for causing or aggravating flooding or flood problems.
- Requests for inclusion in the consultation / engagement process for the CFRAM Studies.
- Comments relating to past planning decisions and / or recommendations for changes to planning law.
- Queries on the accuracy of, or suggested correction to, the PFRA maps
- Recommendations as to how flood risk in a location / region could be managed, or concerns as to how future flood risk management could have detrimental impacts.

Only a very small number of submissions (7) included comments (positive or negative) on the PFRA process and / or the PFRA consultation process. These were carefully considered by the OPW and it was concluded that there was no basis to amend the PFRA process given nature of the exercise.

All submissions were also considered, in parallel with the findings of the Flood Risk Review (see below), in the final designation of the AFAs.

C.4 FLOOD RISK REVIEWS

To assist in the final designation of AFAs, it was deemed appropriate that the probable and possible AFAs be inspected on-site, informed by the PFRA data and findings, by suitably qualified professionals.

The on-site inspections, referred to as Flood Risk Reviews (FRRs), were undertaken by the Consultants. The inspections included a prior review of available relevant information (such as the PFRA data and findings), interviews with local residents and / or local authority staff (where possible), and an on-site inspection of the AFA to confirm, through duly informed professional opinion, the likely flood extents and potential receptors.

Following the FRR, the consultants submitted to the OPW FRR reports that set out the FRR process, described their findings and made recommendations as to whether or not a location should be designated as an AFA. The final FRR reports are available from the OPW website (www.floodinfo.ie).

The CFRAM Steering and Progress Groups (comprising representatives of the local authorities, regional authorities and the EPA as well as of the OPW [2]) considered the FRR reports and their recommendations, and expressed their opinions on the designation of AFAs to the OPW. The OPW has taken these opinions into consideration in the final designation of AFAs.

[2] Representatives of the Rivers Agency of Northern Ireland are also members of the Steering and Progress Groups for CFRAM Studies that cover cross-border catchments.

C.5 OUTCOMES OF THE PFRA

The communities designated as AFAs are set out in Section 3 herein.

Full information on the PFRA, including the outcomes nationally, are set out in the Main Report of the PFRA and the Report on the Designation of the Areas for Further Assessment, which are both available from the OPW website (www.floodinfo.ie).

APPENDIX D

STAKEHOLDER AND PUBLIC ENGAGEMENT AND CONSULTATION

APPENDIX D.1 Membership of the National CFRAM Steering Group

- Office of Public Works
- County and City Managers Association
- Dept. Housing, Planning and Local Government
- Dept. Agriculture, Food and the Marine
- Dept. of Culture, Heritage and the Gaeltacht
- Environmental Protection Agency
- Electricity Supply Board
- Geological Survey of Ireland (Dept. of Communications, Climate Action and Environment)
- Irish Water
- Met Eireann
- Office of Emergency Planning
- Rivers Agency (Northern Ireland)
- Waterways Ireland

APPENDIX D.2 Membership of the NWNB CFRAM Steering Group

- Office of Public Works
- RPS
- Environmental Protection Agency
- WFD Local Authorities Water and Communities Office LAWCO
- Cavan County Council
- Donegal County Council
- Leitrim County Council
- Louth County Council
- Monaghan County Council
- Rivers Agency (Northern Ireland)

APPENDIX D.3 Organisations Invited to Meetings of the National Stakeholder Group

Table D.3 Organisations Invited to Meetings of the National Stakeholder Group

An Bord Pleanála	Iarnród Eireann	Irish Small and Medium Enterprises Association
An Taisce	Industrial Development Agency	Irish Water
Association of Consulting Engineers of Ireland (ACEI)	Inland Fisheries Ireland	Irish Water and Fish Preservation Society
Badgerwatch	Inland Waterways Association of Ireland	Irish Wildlife Trust
Bat Conservation Ireland	Institute of Professional Auctioneers and Valuers	IRLOGI
BirdWatch Ireland	Insurance Ireland	Landscape Alliance Ireland
Bord Gáis Networks	Irish Academy of Engineering	Macra na Feirme
Bord na Mona	Irish Angling Development Alliance	Marine Institute
Canoeing Ireland	Irish Business and Employers Confederation (IBEC)	National Anglers Representative Association
Chambers Ireland	Irish Co-Operative Organisation Society	Transport Infrastructure Ireland (formerly National Roads Authority)
CIWEM Ireland	Irish Countrywomen's Association	Native Woodland Trust
Coarse Angling Federation of Ireland	Irish Creamery Milk Suppliers Association (ICMSA)	Recreational Angling Ireland
Coastal and Marine Resources Centre	Irish Farmers Association (IFA)	Rivers Agency (NI)
Coastwatch Ireland	Irish Federation of Pike Angling Clubs	Rowing Ireland
Coillte	Irish Federation of Sea Anglers	Royal Town and Planning Institute (RTPI)
Construction Industry Federation (CIF)	Irish Marine Federation / Irish Boat Rental Association	Society of Chartered Surveyors of Ireland (SCSI)
Council of Cultural Institutes	Irish National Committee of Blue Shield	St. Vincent de Paul
Dublin City Council / Dublin Flood Forum	Irish National Flood Forum	Sustainable Water Network (SWAN)
Eircom	Irish Natural Forestry Foundation	Teagasc
EirGrid	Irish Peatland Conservation Council	The Heritage Council
Engineers Ireland	Irish Planning Institute (IPI)	Trout Anglers Federation of Ireland
Health Services Executive (HSE)	Irish Red Cross	

APPENDIX D.4 Organisations Represented at Meetings of the NWNB CFRAM Stakeholder Group

Table D.4 Organisations Represented at Meetings of the NWNB CFRAM Stakeholder Group

Scoping Phase	08.11.2012	Rivers Agency
Scoping Phase	08.11.2012	Cavan County Council
Scoping Phase	08.11.2012	Louth County Council
Scoping Phase	08.11.2012	Donegal County Council
Scoping Phase	08.11.2012	OPW
Scoping Phase	08.11.2012	Bord Iascaigh Mhara
Scoping Phase	08.11.2012	Irish Wildlife Trust
Scoping Phase	08.11.2012	Inland Fisheries Ireland
Scoping Phase	08.11.2012	Monaghan County Council
Scoping Phase	08.11.2012	FPM Project
Scoping Phase	08.11.2012	Birdwatch Ireland
Scoping Phase	08.11.2012	Irish Creamery Milk Suppliers Association
Scoping Phase	08.11.2012	Dept. of Arts, Heritage and the Gaeltacht
Scoping Phase	08.11.2012	Irish Farmers Association
Mapping Phase	09.09.2015	Rivers Agency
Mapping Phase	09.09.2015	Loughs Agency
Mapping Phase	09.09.2015	ICA. Donegal
Mapping Phase	09.09.2015	Irish Creamery Milk Suppliers Association
Mapping Phase	09.09.2015	OPW
Mapping Phase	09.09.2015	Inland Fisheries Ireland
Mapping Phase	09.09.2015	Environment
Mapping Phase	09.09.2015	RBCT
Mapping Phase	09.09.2015	Dept. of Culture, Heritage and the Gaeltacht
Mapping Phase	09.09.2015	Irish Central Border Area Network
Mapping Phase	09.09.2015	Donegal County Council
Mapping Phase	09.09.2015	Birdwatch Monaghan
Mapping Phase	09.09.2015	Monaghan Irish Farmers Association
Mapping Phase	09.09.2015	Cavan Irish Farmers Association

Mapping Phase	09.09.2015	Louth County Council
Mapping Phase	09.09.2015	Louth Irish Farmers Association
Mapping Phase	09.09.2015	Monaghan County Council
Mapping Phase	09.09.2015	Donegal County Council
Options Phase	08.03.2016	Dept. of Agriculture
Options Phase	08.03.2016	Inland Fisheries Ireland
Options Phase	08.03.2016	Irish Central Border Area Network
Options Phase	08.03.2016	Leitrim County Council
Options Phase	08.03.2016	Cavan County Council
Options Phase	08.03.2016	Monaghan County Council
Options Phase	08.03.2016	Rivers Agency
Draft Plan Phase	15.09.2016	Louth County Council
Draft Plan Phase	15.09.2016	Monaghan County Council
Draft Plan Phase	15.09.2016	Rivers Agency
Draft Plan Phase	15.09.2016	Cavan County Council
Draft Plan Phase	15.09.2016	Inland Fisheries Ireland
Draft Plan Phase	15.09.2016	OPW
Draft Plan Phase	15.09.2016	Donegal County Council
Draft Plan Phase	15.09.2016	Irish Creamery Milk Suppliers Association
Draft Plan Phase	15.09.2016	Irish Farmers Association
Draft Plan Phase	15.09.2016	Monaghan Irish Farmers Association

APPENDIX D.5 Public Consultation Days Held at the Flood Mapping Stage in the Neagh Bann River Basin

Table D.5 Flood Mapping PCDs Held in the Neagh Bann River Basin

AFA	Date	Venue	No. Attendees
Annagassan	03.05.2015	Dillonstown Community Centre	34
Ardee	16.12.2014	OPW buildings	7
Carlingford and Greenore	17.02.2015	Carlingford Library	12
Carrickmacross and Inniskeen	19.03.2015	Carrickmacross Civic Offices	6
Dundalk & Blackrock South	05.03.2015	Louth County Council	39
Monaghan	18.02.2015	Four Seasons Hotel	26
Termonfeckin	16.03.2015	The Gatehouse Grill	27

APPENDIX D.6 Public Consultation Days Held at the Flood Risk Management Optioneering Stage in the Neagh Bann River Basin

Table D.6 Flood Risk Management Optioneering PCDs Held in the Neagh Bann River Basin

AFA	Date	Venue	No. Attendees
Annagassan	02.03.2016	Dillonstown Community Centre	16
Ardee	15.12.2015	OPW buildings	6
Carlingford and Greenore	18.02.2016	Foy Centre	19
Carrickmacross and Inniskeen	16.03.2016	Carrickmacross Civic Offices	14
Dundalk & Blackrock South	02.02.2016	Louth County Council	39
Monaghan	15.02.2016	Four Seasons Hotel	32
Termonfeckin	09.03.2016	The Gatehouse Grill	17

APPENDIX D.7 Public Consultation Days Held at the Draft Flood Risk Management Plan Stage in the Neagh Bann River Basin

Table D.7 Draft Flood Risk Management Plan PCDs Held in the Neagh Bann River Basin

AFA	Date	Venue	No. Attendees
Monaghan Town Ballybay	28.09.2016	Four Seasons Hotel Monaghan Town Co. Monaghan	25
Carrickmacross Inniskeen	29.09.2016	Civic Office Riverside Road Carrickmacross	22
Dundalk & Blackrock South Carlingford & Greenore Annagassan Ardee	20.10.2016	County Hall Saint Alphonsus Road Dundalk	55
Drogheda Termonfeckin Baltray	25.10.2016	Drogheda Library Stockwell Lane Drogheda.	14

APPENDIX E

DESCRIPTION OF THE FLOOD RISK IN EACH AFA

The numbers of properties at risk and the damage values set out herein are as understood under current conditions and at this stage of assessment. The numbers and values may change when the risk is assessed in more detail at the project-level of development of measures and/or due to the potential impacts climate change, future development and inflation. The numbers presented are determined independently for each source of flooding. For AFAs which are affected by more than one source of flooding, some properties may be at risk by more than one source, and as such properties may have been included in the numbers for both sources.

E.1 Flood Risk Analysis and Mapping - Annagassan AFA

During a 0.5% AEP coastal event inundation occurs due to an unimpeded flow path through low lying ground via a gap in the wall along Harbour Road. There is also a low point along the embankment on the right bank of the River Glyde approximately 200m upstream from Annagassan Bridge. Flooding also occurs during the 0.5% AEP wave overtopping events due to insufficient protection from existing defences.

There are a number of residential and business properties which are at flood risk within Annagassan during the 0.5% AEP coastal events. A few local roads and a regional road are also located within the floodplain.

Limited flood event data is available, however the model is shown to be a reasonable representation of the flood mechanisms described from the available flood event records and considered to be performing satisfactorily for design event simulation.

Properties are at risk in Annagassan during the present day 0.5% AEP coastal events (coastal 1) and 0.5% AEP wave overtopping (coastal 2) events. In the mid-range and high-end future scenarios, properties are also at risk from fluvial flooding.

Annagassan AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0 Fluvial 178,456.35 Coastal 1 567,172.48 Coastal 2	0 Fluvial 1,353,735 Coastal 1 2,550,195 Coastal 2	0 Fluvial 4,425,166.66 Coastal 1 4,041,624.72 Coastal 2
No. Residential Properties at Risk	0 Fluvial 3 Coastal 1 2 Coastal 2	0 Fluvial 9 Coastal 1 17 Coastal 2	0 Fluvial 33 Coastal 1 26 Coastal 2
No. Business Properties at Risk	0 Fluvial 1 Coastal 1 2 Coastal 2	0 Fluvial 4 Coastal 1 4 Coastal 2	0 Fluvial 7 Coastal 1 5 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	1 Fluvial 1 Coastal 1 2 Coastal 2	1 Fluvial 2 Coastal 1 3 Coastal 2	1 Fluvial 5 Coastal 1 4 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	2 Fluvial 5 Coastal 1 2 Coastal 2	2 Fluvial 6 Coastal 1 3 Coastal 2	2 Fluvial 6 Coastal 1 3 Coastal 2
No. Environmental Assets at Risk	3 Fluvial 3 Coastal 1 3 Coastal 2	3 Fluvial 3 Coastal 1 3 Coastal 2	3 Fluvial 3 Coastal 1 3 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
Mid-Range Future Scenario			
Event Damage (€)	665,190.43 Fluvial 4,879,530.05 Coastal 1 2,325,476.91 Coastal 2	665,190 Fluvial 17,595,322.46 Coastal 1 7,147,409.62 Coastal 2	867,443.61 Fluvial 23,235,482.73 Coastal 1 9,398,205.66 Coastal 2
No. Residential Properties at Risk	1 Fluvial 18 Coastal 1 15 Coastal 2	1 Fluvial 68 Coastal 1 42 Coastal 2	5 Fluvial 88 Coastal 1 68 Coastal 2
No. Business Properties at Risk	2 Fluvial 8 Coastal 1 3 Coastal 2	2 Fluvial 12 Coastal 1 10 Coastal 2	2 Fluvial 14 Coastal 1 10 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	2 Fluvial 3 Coastal 1 2 Coastal 2	2 Fluvial 6 Coastal 5 Coastal 2	4 Fluvial 7 Coastal 6 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	3 Fluvial 7 Coastal 1	3 Fluvial 7 Coastal 1	5 Fluvial 7 Coastal 1

	3 Coastal 2	7 Coastal 2	7 Coastal 2
No. Environmental Assets at Risk	3 Fluvial 3 Coastal 1 3 Coastal 2	3 Fluvial 3 Coastal 1 3 Coastal 2	3 Fluvial 3 Coastal 1 3 Coastal 2
No. Potential Pollution Sources at Risk	3 Fluvial 0 Coastal 1 0 Coastal 2	3 Fluvial 0 Coastal 1 0 Coastal 2	30 Fluvial 0 Coastal 1 0 Coastal 2
High-End Future Scenario			
Event Damage (€)	6,731,365.12 Fluvial 19,142,274.41 Coastal 1 7,411,730.98 Coastal 2	7,305,305.71 Fluvial 26,227,720.83 Coastal 1 14,425,537.19 Coastal 2	9,031,005.02 Fluvial 27,114,327.35 Coastal 1 17,393,385.18 Coastal 2
No. Residential Properties at Risk	45 Fluvial 74 Coastal 1 44 Coastal 2	46 Fluvial 97 Coastal 1 87 Coastal 2	57 Fluvial 97 Coastal 1 91 Coastal 2
No. Business Properties at Risk	7 Fluvial 12 Coastal 1 10 Coastal 2	7 Fluvial 14 Coastal 1 10 Coastal 2	8 Fluvial 14 Coastal 1 11 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	7 Fluvial 6 Coastal 1 5 Coastal 2	7 Fluvial 7 Coastal 1 7 Coastal 2	7 Fluvial 7 Coastal 1 7 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	7 Fluvial 7 Coastal 1 7 Coastal 2	7 Fluvial 7 Coastal 1 7 Coastal 2	7 Fluvial 7 Coastal 1 7 Coastal 2
No. Environmental Assets at Risk	3 Fluvial 3 Coastal 1 3 Coastal 2	3 Fluvial 3 Coastal 1 3 Coastal 2	3 Fluvial 3 Coastal 1 5 Coastal 2
No. Potential Pollution Sources at Risk	3 Fluvial 0 Coastal 1 0 Coastal 2	3 Fluvial 0 Coastal 1 0 Coastal 2	3 Fluvial 0 Coastal 1 0 Coastal 2

E.2 Flood Risk Analysis and Mapping - Ardee AFA

There are two main areas at risk of fluvial flooding during a 1% AEP event in Ardee. One area is at risk due to insufficient culvert capacities on the Mullameelan and Rathgory Rivers, resulting in out of bank flooding. Downstream, the second area is also at risk due to insufficient culvert capacity in the Mullameelan River, again causes flooding. Raised water levels along the Mullameelan result in water backing up into Rathgory Tributary 1. Out of bank flooding occurs, inundating the area. As these areas of flooding are reasonably close and may interact with one another, the flooding mechanisms are considered complex.

There are a number of residential and business properties at risk in Ardee with local urban roads and a couple of main roads also located within the floodplains.

An analysis of significant flood events at Burley gauging station 06025 was undertaken to quantify the flood events of August/September 2008 and November 2000. Although it is ideal to use several historical reports of flooding for robust model calibration, the limited information available has provided quantitative support for model results.

Properties are at risk in Ardee during the present day, and mid-range and high-end future scenarios from fluvial flooding.

Ardee AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	3,825,468.85	4,525,438.19	7,073,742.24
No. Residential Properties at Risk	1	6	28
No. Business Properties at Risk	1	1	8
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	0	3	11
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	10	10	10
No. Environmental Assets at Risk	2	3	3
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	4,170,035.77	6,159,291.55	9,317,534.69
No. Residential Properties at Risk	6	20	43
No. Business Properties at Risk	1	7	11
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	6	10	19
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	11	11	13
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	4,859,913.47	8,461,128.68	12,769,495
No. Residential Properties at Risk	10	41	67
No. Business Properties at Risk	4	8	15
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	6	13	19
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	11	13	17
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	0	0	0

E.3 Flood Risk Analysis and Mapping – Carlingford/Greenore AFA

Carlingford and Greenore are affected by flooding from 0.5% AEP coastal, 0.5% AEP wave overtopping and 1% AEP fluvial flood events. There are a number of different areas where receptors are at risk.

One area is affected by both 0.5% AEP coastal, 0.5% AEP wave overtopping events. Tidal inundation and wave overtopping would occur at Carlingford Harbour along the quays and adjacent to the Ghan Road to the east of the AFA. In a separate discrete area, flooding occurs in the Greenore AFA during a 0.5% tidally dominant flood event. This area is also affected during a 1% AEP flood event however receptors affected are downstream of the point of tidal influence with tidal inundation dominant.

There are a number of other areas which are affected by 1% AEP fluvial events. The Carlingford Commons watercourse flows into Carlingford AFA from the steep catchment of Carlingford Mountain. Low bank levels cause out of bank flooding whilst culverts with insufficient capacity to convey flood waters. This causes two areas of flooding which are considered complex due to their close proximity and their ability to influence one another. There is another discrete area of flooding where the Mullatee watercourse flows through the Greenore AFA. A culvert upstream does not have sufficient capacity to convey flood waters which results in out of bank flooding in the area.

There are a significant number of both residential and business properties at risk of flooding within the Carlingford and Greenore AFAs (also including cultural heritage assets and social amenities such as Surgery/Health Centre and a Community Centre). A few regional roads are also situated within the floodplain. As a result there are significant damages and risks in present day and future scenarios.

A limited verification exercise has been undertaken based on the data available, and the model is considered to be performing satisfactorily for design event simulation.

The present day, mid-range and high-end future scenarios flood risk associated with the three CFRAM flooding mechanisms applicable to Carlingford/Greenore; fluvial, coastal 1 (tidal inundation) and coastal 2 (wave overtopping), is summarized in the following table.

Carlingford/ Greenore AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	17,387,552 Fluvial 6,920,600 Coastal 1 143,312.24 Coastal 2	27,086,224 Fluvial 12,635,904 Coastal 1 3,361,849 Coastal 2	60,983,034 Fluvial 31,988,799 Coastal 1 11,453,901 Coastal 2
No. Residential Properties at Risk	89 Fluvial 14 Coastal 1 2 Coastal 2	136 Fluvial 117 Coastal 1 59 Coastal 2	351 Fluvial 183 Coastal 1 128 Coastal 2
No. Business Properties at Risk	48 Fluvial 30 Coastal 1 0 Coastal 2	54 Fluvial 34 Coastal 1 9 Coastal 2	65 Fluvial 47 Coastal 1 10 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	31 Fluvial 28 Coastal 4 Coastal 2	32 Fluvial 32 Coastal 15 Coastal 2	46 Fluvial 36 Coastal 15 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	1 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	31 Fluvial 20 Coastal 1 5 Coastal 2	36 Fluvial 24 Coastal 1 8 Coastal 2	41 Fluvial 28 Coastal 1 9 Coastal 2
No. Environmental Assets at Risk	4 Fluvial 4 Coastal 1 4 Coastal 2	5 Fluvial 4 Coastal 1 4 Coastal 2	5 Fluvial 4 Coastal 1 4 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2

Mid-Range Future Scenario			
Event Damage (€)	30,002,619 Fluvial 26,282,326 Coastal 1 3,580,358 Coastal 2	48,187,384 Fluvial 56,371,306 Coastal 1 30,744,860 Coastal 2	61,108,877 Fluvial 63,205,560 Coastal 1 34,966,175 Coastal 2
No. Residential Properties at Risk	147 Fluvial 173 Coastal 1 62 Coastal 2	263 Fluvial 320 Coastal 1 219 Coastal 2	344 Fluvial 330 Coastal 1 240 Coastal 2
No. Business Properties at Risk	60 Fluvial 55 Coastal 1 11 Coastal 2	64 Fluvial 59 Coastal 1 20 Coastal 2	68 Fluvial 60 Coastal 1 33 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	34 Fluvial 33 Coastal 1 18 Coastal 2	42 Fluvial 38 Coastal 1 21 Coastal 2	46 Fluvial 38 Coastal 1 23 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	40 Fluvial 36 Coastal 1 8 Coastal 2	40 Fluvial 38 Coastal 1 12 Coastal 2	41 Fluvial 41 Coastal 1 12 Coastal 2
No. Environmental Assets at Risk	5 Fluvial 4 Coastal 1 3 Coastal 2	5 Fluvial 4 Coastal 1 4 Coastal 2	5 Fluvial 4 Coastal 1 4 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2

High-End Future Scenario			
Event Damage (€)	57,018,320 Fluvial 59,944,712 Coastal 1 40,474,908 Coastal 2	63,903,024 Fluvial 69,656,693 Coastal 1 50,042,136 Coastal 2	71,515,188 Fluvial 73,502,988 Coastal 1 50,129,991 Coastal 2
No. Residential Properties at Risk	365 Fluvial 329 Coastal 1 265 Coastal 2	393 Fluvial 347 Coastal 1 270 Coastal 2	411 Fluvial 351 Coastal 1 268 Coastal 2
No. Business Properties at Risk	65 Fluvial 59 Coastal 1 27 Coastal 2	67 Fluvial 62 Coastal 1 29 Coastal 2	69 Fluvial 63 Coastal 1 30 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 1 Coastal 1 0 Coastal 2	0 Fluvial 1 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	40 Fluvial 37 Coastal 1 23 Coastal 2	43 Fluvial 38 Coastal 23 Coastal 2	46 Fluvial 39 Coastal 23 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	41 Fluvial 40 Coastal 1 12 Coastal 2	41 Fluvial 44 Coastal 1 13 Coastal 2	43 Fluvial 45 Coastal 1 13 Coastal 2
No. Environmental Assets at Risk	5 Fluvial 4 Coastal 1 4 Coastal 2	5 Fluvial 4 Coastal 1 4 Coastal 2	5 Fluvial 4 Coastal 1 8 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2

E.4 Flood Risk Analysis and Mapping – Carrickmacross AFA

Carrickmacross is affected by fluvial flooding during a 1% AEP event. There are two areas in close proximity which can interact. At one area the floodplain is inundated due to insufficient culvert capacity on the River Glyde. A further location downstream is affected due to raised water levels in the Glyde leading to out of bank flooding. In a discrete location during the 1% AEP flood event, the flow discharging into the lake from Tullynaskeagh River and Kilmactrasna Tributary 2 would be sufficiently high to cause water back up resulting in out of bank flooding.

There are a number of properties both residential and non-residential at risk of flooding during a 1% AEP fluvial event. A couple of social amenities and cultural heritage assets are also at risk along with a regional road.

Despite the lack of calibration and verification data, the model is considered to be performing satisfactorily for design event simulation.

Properties are at risk in Carrickmacross during the present day, and mid-range and high-end future scenarios from fluvial flooding.

Carrickmacross AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	2,539.27	271,757.24	7,780,549.34
No. Residential Properties at Risk	0	7	69
No. Business Properties at Risk	2	3	13
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	8	8	19
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	8	8	10
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	89,110.77	2,279,009.97	18,362,884.02
No. Residential Properties at Risk	5	24	98
No. Business Properties at Risk	4	9	23
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	8	13	27
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	8	9	13
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	277,167.97	13,420,666.78	31,689,024.75
No. Residential Properties at Risk	9	107	203
No. Business Properties at Risk	5	16	27
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	10	23	35
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	8	9	13
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

E.5 Flood Risk Analysis and Mapping – Dundalk and Blackrock South AFA

Dundalk and Blackrock South are affected by flooding from 0.5% AEP coastal, 0.5% AEP wave overtopping and 1% AEP fluvial flood events. There are a large number of different areas where receptors are at risk.

There are a few areas situated in the south of the AFA which flood due to coastal inundation. As they are in close proximity they can interact. There are other areas to the north of this which are also in close proximity and are affected by a combination of wave overtopping and tidal inundation. In an area to the south east of the AFA a flood defence wall is outflanked to the north during a 0.5% tidal event and also overtopped during a 0.5% wave event, affecting a large number of properties. Further, there is a large area to the east of the AFA which is affected by both 0.5% tidal and 1% fluvial flood mechanisms. The area features existing embankments and defence walls to the east and north respectively. The breach of these defences puts a large number of properties at risk of flooding.

Further, there are five discrete areas affected by fluvial flooding during a 1% AEP event. One of these events is in the south east of the AFA whilst the others are located further north. These areas of flooding are largely due to insufficient culvert capacity which leads to out of bank flooding. There are also areas affected by fluvial flooding in which there are high number of properties which are affected.

There are a substantial number of both residential and business properties which are at flood risk within Dundalk and Blackrock South. High numbers of receptors including social amenity sites and transport infrastructural assets are also located within these floodplains. As a result there are significant damages and risks in the AFA for present day and future scenarios.

There is good confidence in both the hydrology and hydraulics of the Dundalk and Blackrock South AFA. There is extensive historical flood information available (including photographs and flood outlines) for a verification exercise of the Dundalk and Blackrock model, with the model comparing well with the vast majority of evidence. It should be noted that as there are no active gauging stations with available flow data within the model extent, full fluvial model calibration was not possible. The 2-Dimensional coastal domain of the model has been calibrated well using Admiralty tidal information.

The present day, mid-range and high-end future scenarios flood risk associated with the three CFRAM flooding mechanisms applicable to Dundalk and Blackrock South; fluvial, coastal 1 (tidal inundation) and coastal 2 (wave overtopping), is summarized in the following table.

Dundalk and Blackrock South AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	15,616,671.13 Fluvial 11,657,779.91 Coastal 1 6,018,812.15 Coastal 2	27,694,989.05 Fluvial 117,017,514.36 Coastal 1 16,743,462.94 Coastal 2	59,770,416.31 Fluvial 400,016,271.17 Coastal 1 18,607,679.38 Coastal 2
No. Residential Properties at Risk	189 Fluvial 144 Coastal 1 30 Coastal 2	420 Fluvial 1,233 Coastal 1 52 Coastal 2	952 Fluvial 3,395 Coastal 1 60 Coastal 2
No. Business Properties at Risk	17 Fluvial 20 Coastal 1 27 Coastal 2	23 Fluvial 119 Coastal 1 33 Coastal 2	42 Fluvial 257 Coastal 1 33 Coastal 2
No. Utilities at Risk	2 Fluvial 4 Coastal 1 0 Coastal 2	2 Fluvial 4 Coastal 1 0 Coastal 2	2 Fluvial 4 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	33 Fluvial 37 Coastal 1 3 Coastal 2	54 Fluvial 88 Coastal 1 4 Coastal 2	94 Fluvial 202 Coastal 1 5 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 1 Coastal 1 0 Coastal 2	1 Fluvial 3 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	29 Fluvial 26 Coastal 1 2 Coastal 2	42 Fluvial 68 Coastal 1 2 Coastal 2	57 Fluvial 102 Coastal 1 2 Coastal 2
No. Environmental Assets at Risk	10 Fluvial 10 Coastal 1 4 Coastal 2	11 Fluvial 10 Coastal 1 5 Coastal 2	11 Fluvial 10 Coastal 1 5 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 1 Coastal 1 0 Coastal 2

Mid-Range Future Scenario			
Event Damage (€)	61,797,448.25 Fluvial 165,500,412.66 Coastal 1 12,453,676.59 Coastal 2	109,839,173.12 Fluvial 1,009,516,936.58 Coastal 1 28,041,339.8 Coastal 2	197,244,738.59 Fluvial 1,255,038,048.34 Coastal 1 32,515,015.42 Coastal 2
No. Residential Properties at Risk	685 Fluvial 1,833 Coastal 1 37 Coastal 2	1,388 Fluvial 6,254 Coastal 1 81 Coastal 2	1,994 Fluvial 7,011 Coastal 1 107 Coastal 2
No. Business Properties at Risk	73 Fluvial 154 Coastal 1 20 Coastal 2	117 Fluvial 432 Coastal 1 36 Coastal 2	175 Fluvial 500 Coastal 1 38 Coastal 2
No. Utilities at Risk	4 Fluvial 5 Coastal 1 0 Coastal 2	4 Fluvial 5 Coastal 1 0 Coastal 2	4 Fluvial 6 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	105 Fluvial 164 Coastal 1 4 Coastal 2	151 Fluvial 272 Coastal 1 8 Coastal 2	182 Fluvial 326 Coastal 1 9 Coastal 2
No. Highly Vulnerable Properties at Risk	1 Fluvial 2 Coastal 1 0 Coastal 2	2 Fluvial 13 Coastal 1 0 Coastal 2	2 Fluvial 23 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	55 Fluvial 83 Coastal 1 2 Coastal 2	67 Fluvial 173 Coastal 1 3 Coastal 2	75 Fluvial 198 Coastal 1 3 Coastal 2
No. Environmental Assets at Risk	11 Fluvial 10 Coastal 1 5 Coastal 2	11 Fluvial 10 Coastal 1 5 Coastal 2	11 Fluvial 10 Coastal 1 5 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 3 Coastal 1 0 Coastal 2

High-End Future Scenario			
Event Damage (€)	611,595,495.93 Fluvial 1,141,224,003.45 Coastal 1 25,665,179.61 Coastal 2	661,381,617.31 Fluvial 1,486,773,792.76 Coastal 1 63,597,921.34 Coastal 2	759,913,729.77 Fluvial 1,968,330,786.34 Coastal 1 77,345,265.53 Coastal 2
No. Residential Properties at Risk	5,189 Fluvial 6,865 Coastal 1 70 Coastal 2	5,606 Fluvial 7,697 Coastal 1 379 Coastal 2	6,036 Fluvial 8,897 Coastal 1 425 Coastal 2
No. Business Properties at Risk	342 Fluvial 480 Coastal 1 36 Coastal 2	358 Fluvial 566 Coastal 1 45 Coastal 2	409 Fluvial 734 Coastal 1 46 Coastal 1
No. Utilities at Risk	6 Fluvial 6 Coastal 1 0 Coastal 2	6 Fluvial 8 Coastal 1 0 Coastal 2	6 Fluvial 8 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	260 Fluvial 315 Coastal 1 7 Coastal 2	279 Fluvial 350 Coastal 1 21 Coastal 2	304 Fluvial 423 Coastal 1 21 Coastal 2
No. Highly Vulnerable Properties at Risk	6 Fluvial 24 Coastal 1 0 Coastal 2	7 Fluvial 27 Coastal 1 2 Coastal 2	10 Fluvial 31 Coastal 1 2 Coastal 2
No. of Social Infrastructure Assets at Risk	138 Fluvial 183 Coastal 1 2 Coastal 2	144 Fluvial 210 Coastal 1 9 Coastal 2	160 Fluvial 262 Coastal 1 10 Coastal 2
No. Environmental Assets at Risk	11 Fluvial 10 Coastal 1 5 Coastal 2	11 Fluvial 10 Coastal 1 5 Coastal 2	11 Fluvial 10 Coastal 1 8 Coastal 2
No. Potential Pollution Sources at Risk	1 Fluvial 2 Coastal 1 0 Coastal 2	1 Fluvial 3 Coastal 1 0 Coastal 2	1 Fluvial 4 Coastal 1 0 Coastal 2

E.6 Flood Risk Analysis and Mapping – Inniskeen AFA

Inniskeen is affected by fluvial flooding during a 1% AEP event. There are two areas where receptors are affected by flooding. In one area the Lannat River adjoins with the Fane River and during flood events high water levels in the Fane causes a backwater affect along the lower reaches of the Lannat. The combination of relatively low bank levels and the presence of a critical structure contribute to flooding on both the left and right banks of both watercourses. Further, another area of flooding is located downstream where several small tributaries connect with the River Fane. Flood waters that have originated upstream and flowed across Inniskeen Town Park contribute to flooding, with insufficient channel capacity being the main cause and several flooding sources within it.

There are a number of residential and non-residential properties at risk along with an electricity hereditament and a couple of local roads.

There is good confidence in both the hydrology and hydraulics of the Inniskeen AFA due to the presence of a gauging station at Moyles Mill (06011) and flood extent verification events.

Properties are at risk in Inniskeen during the present day, and mid-range and high-end future scenarios from fluvial flooding.

Inniskeen AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	592,495.04	1,246,179.05	4,448,594.13
No. Residential Properties at Risk	7	10	19
No. Business Properties at Risk	0	4	18
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	3	3	4
No. Highly Vulnerable Properties at Risk	0	2	2
No. of Social Infrastructure Assets at Risk	3	3	4
No. Environmental Assets at Risk	1	2	2
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	904,585.41	3,865,505	7,922,352.1
No. Residential Properties at Risk	8	18	24
No. Business Properties at Risk	3	16	20
No. Utilities at Risk	1	2	2
No. Major Transport Assets at Risk	3	4	4
No. Highly Vulnerable Properties at Risk	0	2	2
No. of Social Infrastructure Assets at Risk	3	4	6
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	3,546,965.26	5,214,030.36	10,069,144.47
No. Residential Properties at Risk	13	23	28
No. Business Properties at Risk	15	18	21
No. Utilities at Risk	2	2	2
No. Major Transport Assets at Risk	4	4	4
No. Highly Vulnerable Properties at Risk	2	2	2
No. of Social Infrastructure Assets at Risk	4	6	8
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

E.7 Flood Risk Analysis and Mapping – Monaghan AFA

Monaghan is affected by fluvial flooding during a 1% AEP event in a number of different locations within the AFA. There are three areas of discrete flooding, one in the south and two in the east. These areas are mainly at risk due to insufficient capacity of critical structures causing out of bank flooding.

There are a couple of instances where flooding occurs in areas which are in close proximity and can therefore interact. In one area high water levels in the Cor River propagate up the Monaghan River causing back water effects and putting properties at risk of flooding. Here insufficient capacity of critical structures also results in flooding. These locations experience a number of rivers contributing to the flood risk, back flow affects from the Cor River, and insufficient culvert capacity.

There are a number of residential and business properties at risk of flooding within Monaghan AFA including social infrastructure assets. Many roads are also located within the floodplains including five national roads, a couple of regional roads and some local roads.

There is good confidence in both the hydrology and hydraulics of the Monaghan AFA due to the presence of a gauging station. The model is validated by the most recent flood events and is confirmed with aerial photos. The model has been calibrated based on comment received during the local authority workshop.

Properties are at risk in Monaghan during the present day, and mid-range and high-end future scenarios from fluvial flooding.

Monaghan AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	2,703,718.77	15,928,570.05	59,760,213.08
No. Residential Properties at Risk	5	13	77
No. Business Properties at Risk	13	34	66
No. Utilities at Risk	0	0	1
No. Major Transport Assets at Risk	7	16	37
No. Highly Vulnerable Properties at Risk	1	1	3
No. of Social Infrastructure Assets at Risk	40	44	53
No. Environmental Assets at Risk	4	4	4
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	11,987,069.8	63,999,510.45	114,919,991.65
No. Residential Properties at Risk	10	61	108
No. Business Properties at Risk	27	66	123
No. Utilities at Risk	0	0	1
No. Major Transport Assets at Risk	23	42	62
No. Highly Vulnerable Properties at Risk	1	3	4
No. of Social Infrastructure Assets at Risk	42	51	57
No. Environmental Assets at Risk	4	4	4
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	37,917,816.12	90,306,176	161,738,364.6
No. Residential Properties at Risk	23	99	143
No. Business Properties at Risk	49	82	155
No. Utilities at Risk	0	1	1
No. Major Transport Assets at Risk	24	55	70
No. Highly Vulnerable Properties at Risk	3	3	6
No. of Social Infrastructure Assets at Risk	45	55	59
No. Environmental Assets at Risk	4	4	4
No. Potential Pollution Sources at Risk	0	0	0

E.8 Flood Risk Analysis and Mapping – Termonfeckin AFA

Termonfeckin is affected by both 1% AEP fluvial and 0.5% AEP coastal flood events, however there are no receptors subject to coastal risk up to and including the 0.5% AEP event. There are two discrete areas at risk of flooding, one of which is subject to out of bank flooding due to insufficient channel capacity caused by a weir structure. Downstream of this on the Termonfeckin watercourse flooding occurs due to low bank levels and high water levels again associated with insufficient channel capacity. This instance is exacerbated by a restriction of flow associated with bridge structures.

There are a few residential and business properties at risk of flooding within Termonfeckin along with a couple of regional and local roads.

Despite a shortage of fluvial calibration data, the model is considered to be performing satisfactorily for design event simulation.

The present day, and mid-range and high-end future scenarios flood risk associated with the two CFRAM flooding mechanisms applicable to Termonfeckin; fluvial and coastal 1 (tidal inundation), is summarized in the following table.

Termonfeckin AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	11,607.78 Fluvial 0 Coastal 1	624,067.88 Fluvial 0 Coastal 1	2,688,906.32 Fluvial 0 Coastal 1
No. Residential Properties at Risk	0 Fluvial 0 Coastal 1	5 Fluvial 0 Coastal 1	12 Fluvial 0 Coastal 1
No. Business Properties at Risk	2 Fluvial 0 Coastal 1	2 Fluvial 0 Coastal 1	4 Fluvial 0 Coastal 1
No. Utilities at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Major Transport Assets at Risk	2 Fluvial 0 Coastal 1	3 Fluvial 0 Coastal 1	4 Fluvial 0 Coastal 1
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. of Social Infrastructure Assets at Risk	1 Fluvial 0 Coastal 1	1 Fluvial 0 Coastal 1	5 Fluvial 0 Coastal 1
No. Environmental Assets at Risk	4 Fluvial 4 Coastal 1	6 Fluvial 4 Coastal 1	6 Fluvial 4 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
Mid-Range Future Scenario			
Event Damage (€)	180,939.4 Fluvial 0 Coastal 1	2,020,873.3 Fluvial 0 Coastal 1	3,117,772.04 Fluvial 0 Coastal 1
No. Residential Properties at Risk	2 Fluvial 0 Coastal 1	11 Fluvial 0 Coastal 1	12 Fluvial 0 Coastal 1
No. Business Properties at Risk	3 Fluvial 0 Coastal 1	3 Fluvial 0 Coastal 1	4 Fluvial 0 Coastal 1
No. Utilities at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Major Transport Assets at Risk	2 Fluvial 0 Coastal	3 Fluvial 0 Coastal	5 Fluvial 0 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. of Social Infrastructure Assets at Risk	1 Fluvial 0 Coastal 1	4 Fluvial 0 Coastal 1	6 Fluvial 0 Coastal 1
No. Environmental Assets at Risk	4 Fluvial 4 Coastal 1	6 Fluvial 4 Coastal 1	6 Fluvial 4 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1

High-End Future Scenario			
Event Damage (€)	544,143.94 Fluvial 0 Coastal 1	2,541,852.31 Fluvial 0 Coastal 1	3,361,560.09 Fluvial 0 Coastal 1
No. Residential Properties at Risk	4 Fluvial 0 Coastal 1	12 Fluvial 0 Coastal 1	14 Fluvial 0 Coastal 1
No. Business Properties at Risk	3 Fluvial 0 Coastal 1	3 Fluvial 0 Coastal 1	4 Fluvial 0 Coastal 1
No. Utilities at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	1 Fluvial 0 Coastal 1
No. Major Transport Assets at Risk	3 Fluvial 2 Coastal	5 Fluvial 2 Coastal	6 Fluvial 2 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. of Social Infrastructure Assets at Risk	2 Fluvial 0 Coastal 1	5 Fluvial 0 Coastal 1	7 Fluvial 0 Coastal 1
No. Environmental Assets at Risk	4 Fluvial 4 Coastal 1	6 Fluvial 4 Coastal 1	6 Fluvial 4 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1

APPENDIX F

METHODS OF FLOOD RISK MANAGEMENT

There are a wide range of different approaches, or methods, that can be taken to reduce or manage flood risk. These can range from non-structural methods, that do not involve any physical works to prevent flooding but rather comprise actions typically aimed at reducing the impacts of flooding, to structural works that reduce flood flows or levels in the area at risk or that protect the area against flooding.

The range of methods for managing flood risk that are considered include those outlined below.

F.1 FLOOD RISK PREVENTION METHODS

Flood risk prevention measures are aimed at avoiding or eliminating a flood risk. This can be done by not creating new assets that could be vulnerable to flood damage in areas prone to flooding, or removing such assets that already exist. Alternatively, prevention can be achieved by completely removing the potential for flooding in a given area, although in practice this is rarely possible (the frequency or magnitude of flooding can be reduced by flood protection measures, but it is generally not possible to remove the risk of flooding entirely).

Flood prevention is hence generally focussed on sustainable planning and / or the re-location of existing assets, such as properties or infrastructure.

F.1.1 Sustainable Planning and Development Management

In November 2009, the Guidelines on the Planning System and Flood Risk Management, jointly developed by DHPLG and the OPW, were published under Section 28 of the Planning Acts. These Guidelines provide a systematic and transparent framework for the consideration of flood risk in the planning and development management processes, whereby:

- A sequential approach should be adopted to planning and development based on avoidance, reduction and mitigation of flood risk.
- A flood risk assessment should be undertaken that should inform the process of decision-making within the planning and development management processes at an early stage.
- Development should be avoided in floodplains unless there are demonstrable, wider sustainability and proper planning objectives that justify appropriate development and where the flood risk to such development can be reduced and managed to an acceptable level without increasing flood risk elsewhere (as set out through the Justification test).

The proper application of the Guidelines by the planning authorities is essential to avoid inappropriate development in flood prone areas, and hence avoid unnecessary increases in flood risk into the future, and to take a precautionary approach in regards to the potential impacts of climate change on flood risk that should be addressed in spatial plans, planning decisions and through Local Adaptation Plans. The flood mapping produced through the CFRAM Programme and parallel projects provided as part of the Plan will facilitate the application of the Guidelines.

In flood-prone areas where development can be justified (i.e., re-development, infill development or new development that has passed the Justification Test), the planning authorities can manage the risk by setting suitable objectives or conditions, such as minimum floor levels or flood resistant or resilient building methods.

F.1.2 Sustainable Urban Drainage Systems (SUDS)

Development of previously 'green', or permeable, land within an urban area increases the impermeable area, reducing infiltration and increasing runoff rates and volumes. Traditional urban storm water drainage systems are effective at transferring surface water quickly, but they provide only limited attenuation causing the volume of water in the receiving watercourse to increase more rapidly and increasing flood risk. Sustainable Drainage Systems (SUDS) can play a role in reducing and managing run-off to surface water drainage systems as well as improving water quality and contributing to local amenity. SUDS comprise a wide range of techniques, including swales, basins, ponds and infiltration systems.

In accordance with the Guidelines (see Section 7.2.1.1), planning authorities should seek to reduce the extent of hard surfacing and paving and require the use of sustainable drainage techniques to reduce the potential impact of development on flood risk downstream.

F.1.3 Voluntary Home Relocation

In extreme circumstances, the flood risk to a home may be such that the home owner may consider that continuing to live in the property is not sustainable and would choose to relocate.

F.1.4 Preparation of Local Adaptation Planning

It is likely that climate change will have a considerable impact on flood risk in Ireland, such as through rising mean sea levels and the potential increases in winter rainfall and intense rainfall events. For example, it is known that sea levels are rising at a rate of more than 3mm/yr at present, and the Fifth Assessment Report (AR5) of the Inter-Governmental Panel on Climate Change (IPCC) projects that mean sea level is likely to rise between 0.52m and 0.98m by the end of the century. The flood risk assessment for the future scenarios, described in Section 5 herein, highlight the potential impacts of such changes. More recent research (Jevrejeva et al. 2014) indicates that it is plausible that mean sea level may rise by up to approximately 2m by the end of the century.

The Climate Action and Low Carbon Development Act, 2015, required that the Minister for Communications, Climate Action and Environment prepare a National Climate Change Adaptation Framework (NCCAF) that shall specify the national strategy for the application of adaptation measures in different sectors and by a local authority in its administrative area in order to reduce the vulnerability of the State to the negative effects of climate change. The consultation document on the NCCAF (DCCAE, March 2016) noted that as the impacts of climate change vary by region, adaptation requires locally specific, place-based responses, and that Building resilience to the impacts of the climate change at local level for communities and businesses can be achieved in an effective manner if it is integrated into existing planning frameworks and policies under the remit of the local government sector. The NCCAF was published in January 2018 and sets out that local level adaptation measures will be identified in Local Adaptation Strategies prepared by the relevant local authority and implemented through inclusion in relevant plans and policies under the local authority's remit. To this end, local authorities should take into account the potential impacts of climate change on flooding and flood risk in their planning for local adaptation, in particular in the areas of spatial planning and the planning and design of infrastructure.

F.1.5 Land Use Management and Natural Flood Risk Management Measures

Flood flows depend on how much rain falls in the catchment and the pattern of rainfall, and also on how much and how rapidly the rain runs off the land into the river. The volume and rate of runoff can be reduced by changing land use practices, such as by reducing stocking rates, changing the way ploughing is undertaken (e.g., along contours rather than perpendicular to contours), the retention, protection and/or rewetting of peatlands and bogs and by planting hedgerows across hillsides.

Similarly, excess runoff can be stored in wetlands, micro-detention basins, or be attenuated in small streams and channels through the use of obstructions to flow, such as large woody-debris dams. While such measures have been shown to reduce flood peaks in small catchments and frequent, less severe flood events, they may be less effective for more severe floods and in larger catchments and often require very significant land owner engagement for implementation (EU, 2014).

These types of measures will often not be able to solve severe flood problems on their own, but they have the potential to form part of the solution and can also help to achieve the goals in a range of areas, including water quality, nature conservation / biodiversity, agriculture and forestry, green growth and climate change mitigation and adaptation (EU, 2014), and as such would be best addressed on a multi-sectoral level in partnership with all relevant agencies, to promote integrated catchment management.

F.2 FLOOD PROTECTION METHODS

Flood protection measures are aimed at reducing the likelihood and/or the severity of flood events. These measures, typically requiring physical works, can reduce risk in a range of ways, such as by reducing or diverting the peak flood flows, reducing flood levels or holding back flood waters. The preferred Standard of Protection offered by such measures in Ireland is the current scenario 1% Annual Exceedance Probability (AEP) flood for fluvial flooding and 0.5 % AEP flood for tidal flooding (also referred to as the 100-year and 200-year floods respectively), although these standards can increase or decrease depending on local circumstances.

A description of the protection measures typically considered is provided below.

F.2.1 Enhance Existing Protection Works

Flood protection works will provide flood protection up to a certain 'Standard of Protection' and, depending on the type of protection measure, may reduce the severity of flooding above this Standard. The Standard of Protection is the magnitude of flood, often defined by the annual probability of that flood occurring being exceeded (the Annual Exceedance Probability, or 'AEP'), that the measure is designed to protect the area at risk against.

In some locations where existing flood protection works exist, measures can be taken, in addition to the necessary ongoing maintenance, to improve the condition of the works to reduce the likelihood of failure, and/or increase the Standard of Protection to further reduce the risk in, and extend, the protected area. This can apply to both structures that were deliberately built as flood protection works, and also other structures (e.g., quay walls, road embankments) that provide some flood protection as a secondary function.

Some natural features can provide defences against floods, or form part of a defence in depth. For example sand dunes and flood marshes often form effective barriers against flooding in coastal areas. These features may be vulnerable to rapid erosion and some enhancement may be useful to retain the feature and their effectiveness in providing a defence function.

F.2.2. Flood Defences

Solid structures built between the source of flood waters (rivers, estuaries or the sea) and an area vulnerable to flooding (people, properties, land and other assets) can prevent flooding up to the Standard of Protection of the structure, hence reducing the flood risk in the area being protected by the structure. Such structures typically include walls (generally in urban areas with limited space) or embankments (generally in rural areas and in urban areas where space is available, such as parks), but can also include other built or natural structures, such as sand dunes. However, the residual risk of flooding which remains after a defence is constructed, which arises as a flood in excess of the design standard of the defence may occur, also needs to be carefully considered during design.

Figure F.1: Flood Defence Wall

Figure F.2: Flood Defence Embankment (During Construction / Maintenance)

F.2.3 Increasing Channel Conveyance

The water level of a river is determined by the flow and the hydraulic characteristics of the river, any structures (e.g., bridges, weirs, walls) in, alongside and over the river and, when in flood, of the floodplain. The hydraulic characteristics determine the conveyance of the river, and changing these characteristics can reduce the water level for a given flow. This can be achieved by works such as dredging to deepen and/or widen the river, reducing the roughness of the rivers, its banks and floodplain to allow more flow to pass, or removing or altering structures to reduce the build up of water upstream of the structure.

Figure F.3: River Widening (During Construction)

Figure F.4: River Widening (After Construction)

By increasing channel (and floodplain) conveyance, river levels during a flood can be lowered, hence reducing the likelihood and severity of flooding. This can be to the point that flooding during events up to the design Standard of Protection is avoided, but this type of measure has the advantage that it also reduces the risk for floods greater than the design Standard of Protection.

This type of measure is typically only applicable for river flooding,

F.2.4 Diverting Flood Flows

Flooding of an area from a river occurs because the quantity of flow flowing through an area exceeds the conveyance capacity of the channel and so the river spills out on to its floodplain. Reducing the flow through an area in the event of a flood can reduce the likelihood of flooding for that area, and this can be achieved by diverting some of the flows around the area of risk through a flood diversion channel or across a designated area of land.

F.2.5 Storing Flood Waters

Instead of diverting excess flood waters to reduce the flow through an area at risk, the flow can also be reduced by storing flood waters upstream of the area.

This can be in large, single flood attenuation structures, in wash-lands on the floodplain or in multiple, smaller storage areas dispersed around the catchment. Storage using soft measures, such as wetlands or micro-detention basins, or through attenuation in small channels, is generally considered to be part of land use management, or natural flood risk management (see Section 7.2.2.7).

Floods can also be attenuated (i.e., the flood slowed down, the peak flow reduced and the flood volume spread over a longer period of time) by measures along the river and floodplain, e.g., increasing channel and floodplain roughness (introducing impediments to flow in the river, or on floodplains, such as by increasing riparian vegetation or planting hedgerows) or by restoring meanders.

Such measures are often referred to as natural water retention measures or natural flood management. While these have been shown to reduce flood flows in smaller, more common floods, it is understood that their impact in larger, more extreme or rare floods, is reduced. Further research is required on this matter. However, such measures can have significant benefits for environmental enhancement, such as contributing to the objectives of the Water Framework Directive or increasing biodiversity.

F.2.6 Implementing Channel Maintenance Programmes

Excess silt and gravels deposited in watercourses and vegetation in and on the banks of river channels, or the blockage of channels by discarded rubbish or bulky objects in urban areas, can reduce the conveyance of a channel, increasing flood levels in the event of a flood and hence increasing the flood risk in the surrounding area. The blockage of culvert screens by debris and rubbish can also increase flood risk.

A regular maintenance programme to remove excess inorganic material, vegetation and/or remove debris and rubbish from river channels, and ensure that culvert screens are kept clear, can help reduce flood levels during flood events.

F.2.7 Maintenance of Drainage Schemes

Following the passing of the Arterial Drainage Act, 1945, the OPW began investigations to determine where Arterial Drainage Schemes would be suitable and economically viable. The implementation of the Schemes began in the late-1940s and continued into the early-1990s, and a total of 11,500kms of river channel now form part of the Arterial Drainage Schemes, that also include 800km of embankments.

The purpose of the Arterial Drainage Schemes was primarily to improve the drainage of agricultural lands to enhance production. This typically involved lowering or widening river beds and removal of weirs to facilitate the drainage and discharge of neighbouring lands and drainage channels. While not the primary focus of the Schemes, they did also provide enhanced conveyance capacity where they passed through towns, villages and dispersed rural communities that in turn has reduced the flood risk to properties in these areas.

While new Arterial Drainage Schemes are no longer being undertaken, the OPW has a statutory duty to maintain the completed schemes in proper repair and in an effective condition. The annual maintenance programme is published by the OPW on the OPW website, and typically involves some clearance of vegetation and removal of silt build-up on a five-yearly cycle.

Drainage Districts are areas where drainage schemes to improve land for agricultural purposes were constructed under a number of Acts of Parliament and Acts of the Oireachtas prior to 1945. 170 Drainage District Schemes were established, covering 4,600km of channel. The statutory duty of maintenance for these schemes lies with the local authorities concerned. The standard of this maintenance varies widely from county to county.

F.2.8 Land Commission Embankments

The Land Commission was created in 1881 as a rent fixing commission by the Land Law (Ireland) Act 1881, and was reconstituted in the Irish Free State by section 2 of the Land Law (Commission) Act, 1923, backdated to the state's creation. With very few exceptions, lands acquired through the Land Commission are now in private ownership. Trusts were established in some cases for the maintenance of flood defences on acquired lands. The Commission was dissolved on 31 March 1999 by the Irish Land Commission (Dissolution) Act, 1992 and the trusts held by the Land Commission were transferred to the Dept. of Agriculture, Food and the Marine - DAFM, with retained funds entrusted to the Public Trustee, who is an officer of the DAFM.

While the Public Trustee administers these funds that may be used for repairs of the embankments, this is applied only in very exceptional circumstances, as the amount of such funds is generally small and wholly inadequate to maintain the various embankments. The DAFM does not however have a general responsibility for the maintenance, repair or restoration of the embankments, which rests with the land owner in most cases (Section 10 of the Land Act, 1965).

F.3 FLOOD PREPAREDNESS (RESILIENCE) METHODS

In some instances, it may not be possible to reduce the likelihood or severity of flooding to an area at risk. However, actions and measures can be taken to reduce the consequences of flooding, i.e., reduce the risk to people and of damage to properties and other assets, and make sure that people and communities are resilient to flood events. This can be achieved by being aware of and preparing for the risk of flooding, knowing when floods are going to occur, taking actions immediately before, during and after a flood. The actions and measures of this type are described below.

F.3.1 Flood Forecasting and Warning

Knowing that a flood event is imminent allows people, communities and local authorities to prepare for the flood by, for example, erecting temporary defences or moving people and assets out of harm's way.

It is possible to forecast floods under certain conditions using weather predictions, observed rainfall and river levels and flows, and with the aid of computer models. Flood forecasts based on predicted weather are generally less certain than those based on observed rainfall or river levels or flows. The forecast period achievable generally depends on the catchment size and characteristics, and, while in larger catchments it may be possible to provide a number of hours or even days of advance warning of a flood event, in small, flashy catchments this period can be extremely short and therefore of less or potentially no real benefit. Flood forecasting also involves significant uncertainty, as it entails trying to simulate very complex systems in real time with limited data.

The OPW, on behalf of Ireland, signed a partner agreement in 2010 with the European Flood Awareness System (EFAS), which was developed by the EU Joint Research Centre for use by partner organisations. EFAS was developed to help improve and increase preparedness for fluvial floods and is intended to provide early warning or notification of potential flood events under specified criteria. These EFAS flood notifications are disseminated by the OPW to local authorities and other relevant stakeholders. During the floods of winter 2015/16, EFAS provided a number of valuable flood notifications and forecasts which informed and supported the management of these floods. The OPW also provides national tidal and storm surge forecasts for local authorities and other relevant stakeholders and disseminates high tide advisory notices to local authorities when tide, weather and atmospheric conditions are such that coastal flooding may arise.

A number of other project specific flood forecasting systems are in place as part of OPW funded flood relief schemes that include demountable flood defence systems.

Appendix F6 of the Major Emergency Management (MEM) Framework (2006) sets out the arrangements put in place by Met Éireann to issue public service weather warnings to the local authorities. Met Éireann operates a weather warning system that aligns with the EU Meteoalarm system (www.meteoalarm.eu). Met Éireann also issues weather warnings to the public. Warnings for very heavy rainfall may indicate a threat of widespread flooding or flooding for a specific area.

Local warnings are also issued by the local authority. Warnings may be circulated to national and/or local broadcast media, as appropriate, which can be supplemented, in the case of specific local areas identified as being at risk, with emergency vehicles and personnel to deliver the warnings in very exceptional cases.

A Government decision was taken on the 5th January 2016 to establish a National Flood Forecasting and Warning Service (refer Section 7.4.1.10 for further details).

F.3.2 Emergency Response Planning

Well prepared and executed emergency response plans can significantly reduce the impact of flood events, particularly for human health and welfare. The MEM Framework designates the local authority as the lead agency for co-ordinating a response to a flooding emergency. "A Guide to Flood Emergencies (2013)" sets out the sequence of steps required to prepare for and respond to flood emergencies. The Department of Housing, Planning and Local Government is designated as the Lead Government Department for co-ordinating a national response to large scale flood emergencies.

Local authorities develop and review flood plans. Flood plans detail how local authorities receive, assess and respond to weather and flood warnings that can be received from the OPW, Met Éireann, EFAS or other sources, taking into account other relevant information available to them, such as real-time gauge information (e.g., www.waterlevel.ie) and local knowledge of river systems, roads, infrastructure and vulnerable communities.

Local authorities, as part of their planning for flood emergencies, appoint a Severe Weather Assessment Team. This team monitors weather alerts and provides an analysis of the flood risk before and during an event, as well as providing specialist advice to the operational services deployed to a flood event.

It is the responsibility of the Severe Weather Assessment Team to determine the scale of response that is required, i.e. further action required, the activation of an internal operational response, or the requirement for increased levels of inter-agency co-ordination, up to the declaration of a major emergency and activation of the Major Emergency Plan.

During a flood emergency, where a national response is required to support the local response, the Lead Government Department activate and chair the National Co-ordination Group. Once the National Co-ordination Group is activated, the Lead Government Department establishes links with all Regional / Local Co-ordination Groups. The National Co-ordination Group sets key response objectives, prioritising life safety and protection of property/ critical infrastructure. The National Co-ordination Group works with the Principal Response Agencies to ensure that resources are allocated where needed and can provide optimum benefits. The National Co-ordination Group also develops key public safety messages and provides a single point for information to media and public sector organisations.

F.3.3 Promotion of Individual and Community Resilience

Individuals and communities that are aware of any prevalent flood risk are able to prepare for flood events such that if and when such events occur, people are able to take appropriate actions in advance of, during and after a flood to reduce the harm and damages a flood can cause. This could include short-term preparation and action such as elevating valuables to above likely flood levels, helping neighbours who may have mobility difficulties to prepare and if necessary evacuate, moving vehicles to high ground and evacuating themselves if necessary. Longer-term preparations can involve making homes and properties flood resilient or flood resistant, such as through new floor and wall coverings chosen to be durable in a flood or moving electrical sockets above likely flood levels.

In 2005, the OPW launched the Plan, Prepare, Protect campaign that provides general, practical advice to homeowners, businesses and farmers on what they can do to prepare for flood events and make themselves resilient. This advice has recently been updated and is available to view and download from: www.flooding.ie.

While the Plan, Prepare, Protect campaign provides useful information, as a national campaign it is generic. Resilience also has a strong local dimension involving consultation with the local community, the dissemination of site-specific advice, and the provision of assistance with preparedness at a local level for individuals and businesses known to be at risk. The Report of the Flood Policy Review Group (OPW, 2004) recommends that local authorities should assume responsibility for the local dimension of the flood risk education programme, including raising awareness of individuals and business interests considered to be at risk, and to assist individuals and business interests considered to be at risk with preparations for minimising damages in the event of a flood event

While the State, through the OPW, local authorities and other public bodies can take certain actions to reduce and manage the risk of flooding, individual home-owners, businesses and farmers also have a responsibility to manage the flood risk to themselves, their property and other assets to reduce damages and the risk to personal health in the event of a flood.

All people at flood risk within the Neagh Bann River Basin should:

- Make themselves aware of the potential for flooding in their area, including the likely extents, depths and risk-to-people.
- Consider what long-term preparatory actions they might take to reduce the potential damage, such as implementing property resilience or resistance measures.
- Prepare a flood event plan to set out the actions they should take before, during and after a flood event.
- Discuss the issue of flooding and flood risk with other people in their communities, and consider forming a local Flood Action Group.

Advice on what steps can be taken is provided in the Plan, Prepare, Protect booklet available through www.flooding.ie.

F.3.4 Individual Property Protection

Individual Property Protection includes generally low-cost and small-scale measures that can be applied to individual properties to help make them more resistant to flood waters. Examples might include flood-gates to go across doorways, water-proof doors, air-vent covers, non-return valves for pipe-work and sewerage, etc. These measures can be effective in reducing the damage to the contents, furniture and fittings in a house or business, but are not applicable in all situations (for example, they may not be suitable in areas of deep or prolonged flooding, or for some types of property with pervious foundations and flooring).

F.3.5 Flood-Related Data Collection

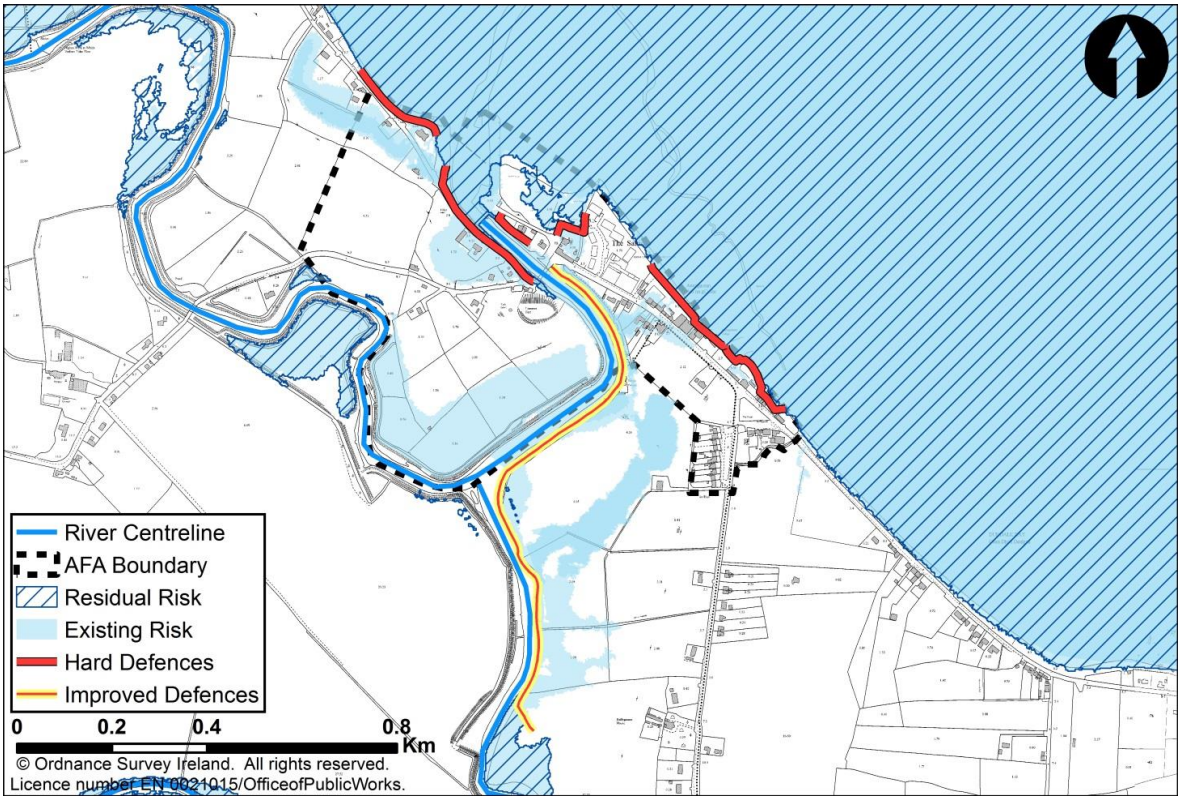
Data on flood flows and levels, as collected through the hydrometric networks of the OPW, EPA / local authorities, the Marine Institute and other organisations, are essential to understand what extreme river flows and levels and sea levels might occur, and hence to enable the appropriate design of structural and non-structural flood risk management measures. Similarly, recording details on flood events that happen are extremely useful to build up our knowledge of flood risk throughout the country and also to understand how the flooding occurs in the affected area to calibrate the computer models used to predict potential future flooding. The ongoing collection and, where appropriate, publication of such data is a measure that will help us to continually improve our preparation for, and response, to flooding.

APPENDIX G

DESCRIPTION OF POTENTIALLY VIABLE FLOOD RELIEF WORKS

G.1 Annagassan AFA

River Basin	Neagh Bann	**AFA**	Annagassan AFA
Measure	Undertake a Detailed Assessment of the Costs of the Potential Measure for Annagassan AFA		
Code	GBNIIENB-IE-AFA-060013-0106-M25		
Description	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes			
Objective	**Un-Weighted Score**	**Local Weighting**	**Comment**
1.a.i	4.75	2.4	*There are 26 ground floor properties and there are no additional upper floor properties benefiting with this option in place.*
1.a.ii	0.0	1.0	*There are no additional highly vulnerable properties benefiting with this option in place.*

1.b.i	4.97	5.0	*There are 3 social infrastructure/amenity sites benefiting with this option in place.*
1.b.ii	4.83	1.8	*There are 8 commercial properties benefiting with this option in place.*
2.a	4.70	2.0	*With this option in place the annual average damages have been reduced from €149803.27 to €8847.*
2.b	4.98	5.0	*There are 4 transport links benefiting with this option in place.*
2.c	4.98	5.0	*There is 1 utility benefiting with this option in place.*
2.d	1.00	4.0	*Reduction in rural land flooded*
3.a	-2.00	5.0	*Construction phase impacts with potential for excavation and restoration of banks adjacent to and set back from sensitive and non-sensitive waterbodies. Potential for in-stream and on-bank construction impacts in areas which are already impacted by infrastructure and FRM methods.*
3.b	-3.00	5.0	*Potential for direct construction phase impacts on the periphery of and adjacent to the Donegal Bay SAC, SPA and Ramsar site from the construction of walls and embankments, set back from the waterbody where possible. Potential for direct temporary loss of habitat and displacement of species from works area. Potential for short term, indirect, downstream impacts from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.*
3.c	-3.00	4.0	*Potential for direct construction phase impacts on the periphery of and adjacent to the Donegal pNHA and MPA from the construction of walls and embankments, set back from the waterbody where possible. Potential for direct temporary loss of habitat and displacement of species from works area. Potential for short term, indirect, downstream impacts from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.*
3.d	-3.00	4.0	*Potential for direct construction phase impacts from construction and augmentation of walls and embankments adjacent to waterbodies known for sensitive species. Potential for short term, indirect, downstream impacts to fisheries from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.*
3.e	-1.00	3.0	*Short term construction phase impacts on local sensitivity landscape. Construction and rehabilitation of walls and embankments in areas already impacted by infrastructure and FRM methods. Impacts mainly on those to be protected.*
3.f.i	-1.00	3.0	*Slight potential for physical impacts to and on the setting of Annagassan Bridge NIAH structure from the construction and tie in of defences.*

3.f.ii	1.00	4.0	*Increased protection from severe flooding to one monument.*
4.a	2.00	5.0	*Low risk*
4.b	3.00	5.0	*The following hazards have been identified: working near water, heavy plant machinery*
4.c	3.00	5.0	*Option is adaptable at moderate cost*

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
919	3.70	248.34

No Properties Benefitting	**10% AEP Event**	**1%/0.5% AEP Event**	**0.1% AEP Event**
Residential	0 (Fluvial) 3(Coastal 1) 2 (Coastal 2)	0 (Fluvial) 9 (Coastal 1) 17 (Coastal 2)	N/A
Commercial	0 (Fluvial) 1 (Coastal 1) 2 (Coastal 2)	0 (Fluvial) 4 (Coastal 1) 4 (Coastal 2)	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions

Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
6.6	3.70	3.13	0.85

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, a monument, a utility, rural land, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, disturbance of protected bird species, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located adjacent to and upstream of Dundalk Bay SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences, and disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase. Should water levels or flow be altered by the hard defences there is potential for impacts on qualifying habitat.

The specific mitigation measures will be identified in detail at project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

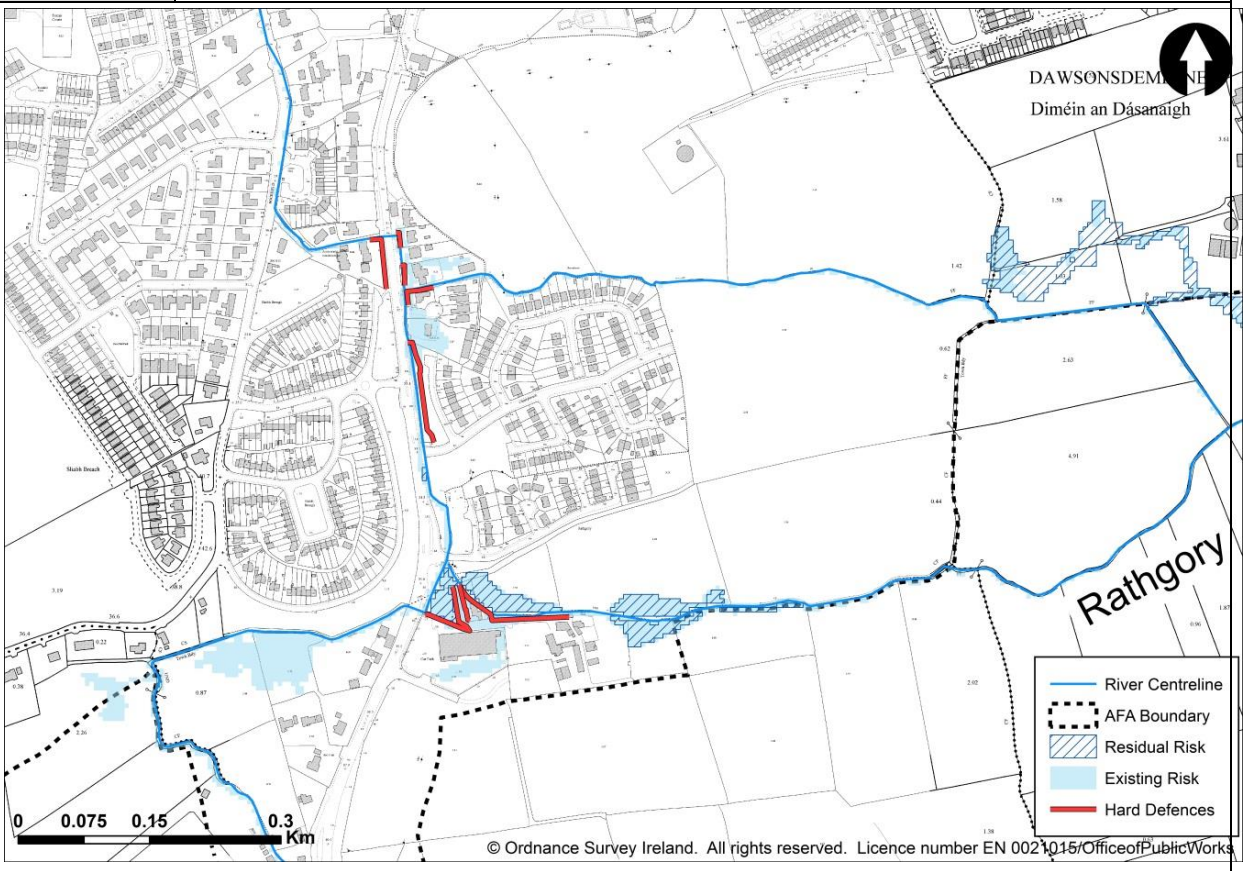
- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality, and
- appropriate surveys of habitats, species and hydrological processes.

(see Section 6.6.3: timing to avoid overwintering of designated bird species, specific sediment control measures for sensitive areas, surveys).

Adaptability to Potential Future Changes
Annagassan AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation would require increasing the height of existing and proposed walls and embankments to provide the required SoP, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. Note that the cyclical FD process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.
Public Consultation Outcomes
A public consultation for Annagassan Options was held on 02/03/16, 16 members of the public attended. A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the Draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions. There was a concern there may not be enough space for embankments alongside roads at some locations and if the embankments will cause a significant effect on the hydrodynamics around the harbour or elsewhere along the coast. If there is an increase in velocities resulting from the proposed embankments this may compromise the existing coastal erosion defences in the area. A condition survey of existing embankments along the River Dee and the River Glyde during low tide was recommended. There was a suggestion to tier the river where it discharges at the harbour and divert it to the right at the harbour wall, in order to increase velocities and desilt the outfall. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.
Other Issues / Conclusions
One measure was identified for Annagassan AFA, consequently this is the preferred measure. Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score and the benefit – cost ratio is below unity. Therefore it is recommended that a detailed assessment of the costs of the potential measure for Annagassan AFA should be undertaken. Consultations and submissions provided additional information which has been noted for project-level assessment however none resulted in a change of the preferred measure. Migratory fish species (salmon, sea trout, lamprey and eels) use both the Glyde and Dee and so the construction phase of any works should comply with IFI's Guidance document on the protection of fisheries during construction works.

G.2 Ardee AFA

River Basin	Neagh Bann	**AFA**	Ardee AFA
Measure	Progress the development of a Flood Relief Scheme for Ardee AFA		
Code	GBNIIENB-IE-AFA-060014-0206-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Ardee, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	3.66	1.0	*There are 6 ground floor properties and there is 1 upper floor property benefiting with this option in place.*
1.a.ii	0.0	1.0	*There are no additional highly vulnerable properties benefiting with this option in place.*
1.b.i	0.00	5.0	*There are no additional social infrastructure/amenity sites benefiting with this option in place.*
1.b.ii	3.99	1.0	*There is 1 commercial property benefiting with this option in place.*
2.a	4.71	5.0	*With this option in place the annual average damages have been reduced from €505785.37 to €29818.48.*
2.b	0.47	4.0	*There is 1 road benefiting with this option in place.*

2.c	0.00	1.0	*There are no additional utilities benefiting with this option in place.*
2.d	-1.00	4.0	*Flood extents slightly larger*
3.a	-1.00	5.0	*Short term negative impacts from construction of hard defences set back from non-sensitive watercourse. Potential for on bank and in stream works. Reduced flood risk for the 1% AEP fluvial event. Potential for indirect sedimentation impacts to downstream sensitive waterbodies during construction. Construction impacts could be mostly mitigated for with good site practice, effective planning and timing of works.*
3.b	0.00	2.0	*The River Dee discharges to the River Glyde at Dundalk Bay SAC, SPA, OSPAR MPA, Ramsar Site c.15km downstream of Ardee. No impact on existing SAC, SPA or Ramsar sites as a result of flood risk management measures.*
3.c	-1.00	3.0	*Localised construction impacts are anticipated in the vicinity of the proposed walls but these will be mitigated by the already modified nature of the banks and should not affect any protected areas. Potential for indirect sedimentation impacts to downstream habitats during construction. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.*
3.d	-1.00	4.0	*Short term negative impacts from construction of hard defences set back from non-sensitive watercourse. Potential for on bank and in stream works. Potential for indirect sedimentation impacts to downstream sensitive River Dee during construction. Construction impacts could be mostly mitigated for with good site practice, effective planning and timing of works. waterbody treated as sensitive.*
3.e	0.00	2.0	*Louth Landscape Character Assessment of 2002 classifies the general area as the Muirhevna Plain and is looking to conserve the agricultural land and hedgerows, the small broadleaf woodlands throughout the area and within the town of Ardee, and the four pNHAs in the area. The walls are proposed in an existing built up /suburban area and will have no impact on these objectives.*
3.f.i	0.00	4.0	*There are over 70 NIAH recorded buildings of local and regional importance within the AFA, as well as one monument (Medieval Building) with a preservation order that is classified as being more vulnerable to flooding. Proposed measures will not have any impact nor will result in increased flood risk on any of these sites.*
3.f.ii	0.00	2.0	*No effects on archaeological features - no protected features in AFA or influenced area.*
4.a	4.00	5.0	*Negligible operational risk*
4.b	2.00	5.0	*The following hazards have been identified: Working near Water, Working near Water, Heavy Plant Machinery*
4.c	3.00	5.0	*Option is adaptable at moderate cost*

Total MCA-Benefit Score	Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
738	0.84	875.19

No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	1 (Fluvial)	6 (Fluvial)	N/A
Commercial	1 (Fluvial)	1 (Fluvial)	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions

Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
12.96	0.84	2.66	3.16

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and a commercial property, a road and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community and fisheries during construction of the hard defences, and short term sedimentation and water quality impacts. There is potential for medium to long term impacts on the Ardee-Newtown Bedform Field IGH site. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located upstream of Dundalk Bay SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. No significant impacts on these European sites are expected, owing to their distance from the preferred measure.

The specific mitigation measures will be identified in detail at project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- and appropriate surveys of habitats and species.

(See Section 6.6.3: timing to avoid overwintering of designated bird species, specific sediment control measures for sensitive areas, surveys).

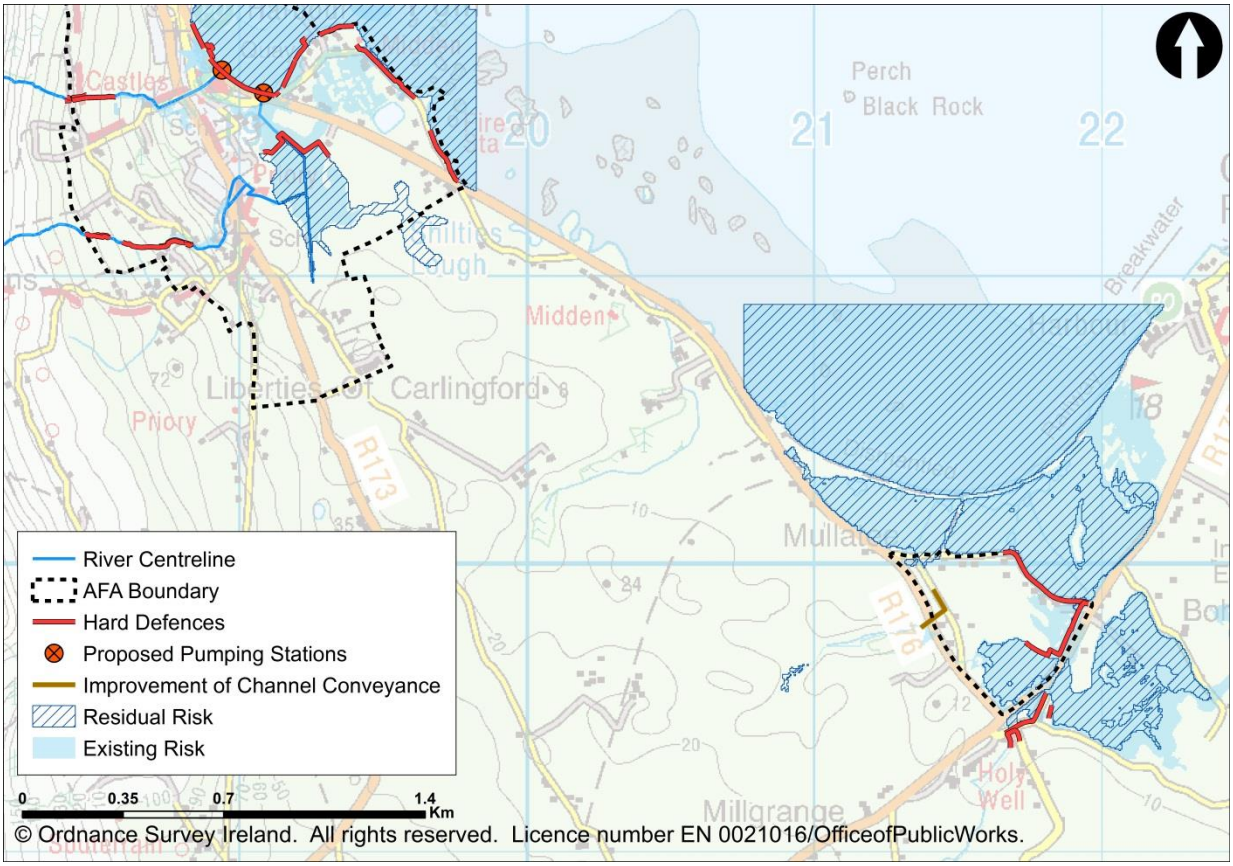
Adaptability to Potential Future Changes

Ardee AFA is considered to be at moderate vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require increasing the height of the walls and embankments and extending their length to provide the required SoP, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes
A public consultation for Ardee Options was held on 15/12/2015, 6 members of the public attended were informed of the proposed options. A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the Draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions. It was queried if culvert upgrade would provide an alternative potential option however this had been investigated and found to be economically unviable due to the costs of upgrading a series of culverts and the associated channel capacity improvements. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.
Other Issues / Conclusions
Of the three potentially viable measures presented in the Preliminary Options Report the preferred measure as described above scored better technically, environmentally and economically and therefore has a significantly higher benefit cost ratio than the other potential measures. Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity. Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure. The River Dee contains a salmonid nursery and adult habitat and supports stocks of salmon, sea trout and brown trout. The river also supports lamprey and European eel amongst other species. Game angling is also popular in Ardee. The construction phase of any works should comply with IFI's Guidance document on protection of fisheries during construction works.

G.3 Carlingford/Greenore AFA

River Basin	Neagh Bann	**AFA**	Carlingford/Greenore AFA
Measure	Progress the development of a Flood Relief Scheme for Carlingford and Greenore AFA		
Code	GBNIIENB-IE-AFA-060016-0306-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Carlingford and Greenore, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.86	5.0	*There is a combined number of 383 ground floor properties and there are 52 upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.*
1.a.ii	0.00	1.0	*There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.*
1.b.i	4.91	5.0	*There is a combined number of 38 social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.*

1.b.ii	4.98	5.0	*There is a combined number of 61 commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.*
2.a	4.84	5.0	*With this option in place the annual average damages have been reduced from €5688882 to €184153.13.*
2.b	4.91	5.0	*There is a combined number of 64 transport links benefiting from the option's SoP from fluvial and coastal flood sources.*
2.c	0.00	1.0	*There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.*
2.d	2.00	2.0	*All flood water is kept in channel with option in place therefore flood extents on agricultural land are minimised*
3.a	-2.00	5.0	*Construction of flood walls, embankments, pumping stations and a culvert replacement adjacent to and upstream of a sensitive waterbody on mainly already modified areas. Potential for in-stream and on-bank works in non-sensitive waterbodies. Potential for short term, indirect, downstream impacts from sedimentation during works. Reduced flood risk for the 1% AEP fluvial event and the 0.5% AEP tidal and overtopping events.*
3.b	-2.00	4.0	*Potential for direct construction phase disturbance impacts to the adjacent Carlingford Shore SAC and Carlingford Lough SPA from the construction of walls, embankments and pumping stations on existing modified areas, set back from the waterbodies and designated sites.* *Potential for short term, indirect, downstream impacts to Carlingford Shore SAC and Carlingford Lough SPA from sedimentation during works in Greenore. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Unlikely to be any permanent or recurring impacts.*
3.c	-2.00	2.0	*Potential for direct construction phase disturbance impacts to the adjacent Carlingford Lough pNHA from the construction of walls, embankments and pumping stations on existing modified areas, set back from the waterbodies and designated site.* *Potential for short term, indirect, downstream impacts to Carlingford Lough pNHA from sedimentation during works in Greenore. Potential for direct temporary loss of habitat and displacement of species from works area, with impacts limited by already modified channel / shoreline. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Unlikely to be any permanent or recurring impacts.*

3.d	-4.00	5.0	*Potential for direct construction phase impacts from construction and augmentation of walls, embankments and pumping stations adjacent to sensitive shellfish designated waterbody. Potential for short term, indirect, downstream impacts to shellfisheries from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Unlikely to be any permanent or recurring impacts on fisheries following construction.*
3.e	-3.00	5.0	*Carlingford town is rated of high is a major tourist attraction and visual amenity is important to the AFA. Northernmost fluvial flood walls would be partially in "green belt" area in LAP, southernmost fluvial flood walls are in land zoned for residential development. Both appear to require the removal of some natural trees or hedgerows. Measures may have permanent impact on medium sensitivity landscape character (sensitivity termed as medium, as walls will be well outside the town centre/heritage area.*
3.f.i	2.00	4.0	*Potential for physical impacts on and on the setting of the boathouse and Carlingford pier NIAH structures from construction / augmentation of coastal defences and pumping stations. Increased protection to 9 NIAH buildings from severe flooding.*
3.f.ii	1.00	3.0	*Potential for physical impacts on a midden in the area of Carlingford Sailing Club from construction of coastal defences, however archaeological material may be discovered in excavation work in this area. Potential for impacts on the setting of and increased flood risk to the site of Muchgrange church and St James holy well. Increased protection to Taaffe's Castle and Paid na Farrell's Castle from severe flooding.*
4.a	3.00	5.0	*Very low operational risk*
4.b	1.00	5.0	*The following hazards have been identified: working near water (construction), working near water (O&M), heavy plant and machinery (construction), work on wells*
4.c	3.00	5.0	*Option is readily adaptable at limited cost*

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
1329	23.41	56.80

No Properties Benefitting	**10% AEP Event**	**1%/0.5% AEP Event**	**0.1% AEP Event**
Residential	89 (Fluvial) 14 (Coastal 1) 2 (Coastal 2)	136 (Fluvial) 117 (Coastal 1) 59 (Coastal 2)	N/A
Commercial	48 (Fluvial) 30 (Coastal 1) 0 (Coastal 2)	54 (Fluvial) 34 (Coastal 1) 9 (Coastal 2)	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
231.73	23.41	63.12	2.70

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, transport links, agricultural land and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, disturbance of birds, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and moderate visual impacts in the medium to long term.

As the proposed works will be located adjacent to and upstream of Carlingford Shore SAC and Carlingford Lough SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to disturbance of protected bird species in Carlingford Lough SPA, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase. Should water levels or flow be altered by the hard defences there is potential for impacts on qualifying habitat of Carlingford Shore SAC.

The specific mitigation measures will be identified in detail at project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality, and
- appropriate surveys of habitats, species and hydrological processes.

(See Section 6.6.3: timing to avoid overwintering of designated bird species, specific sediment control measures for sensitive areas, surveys).

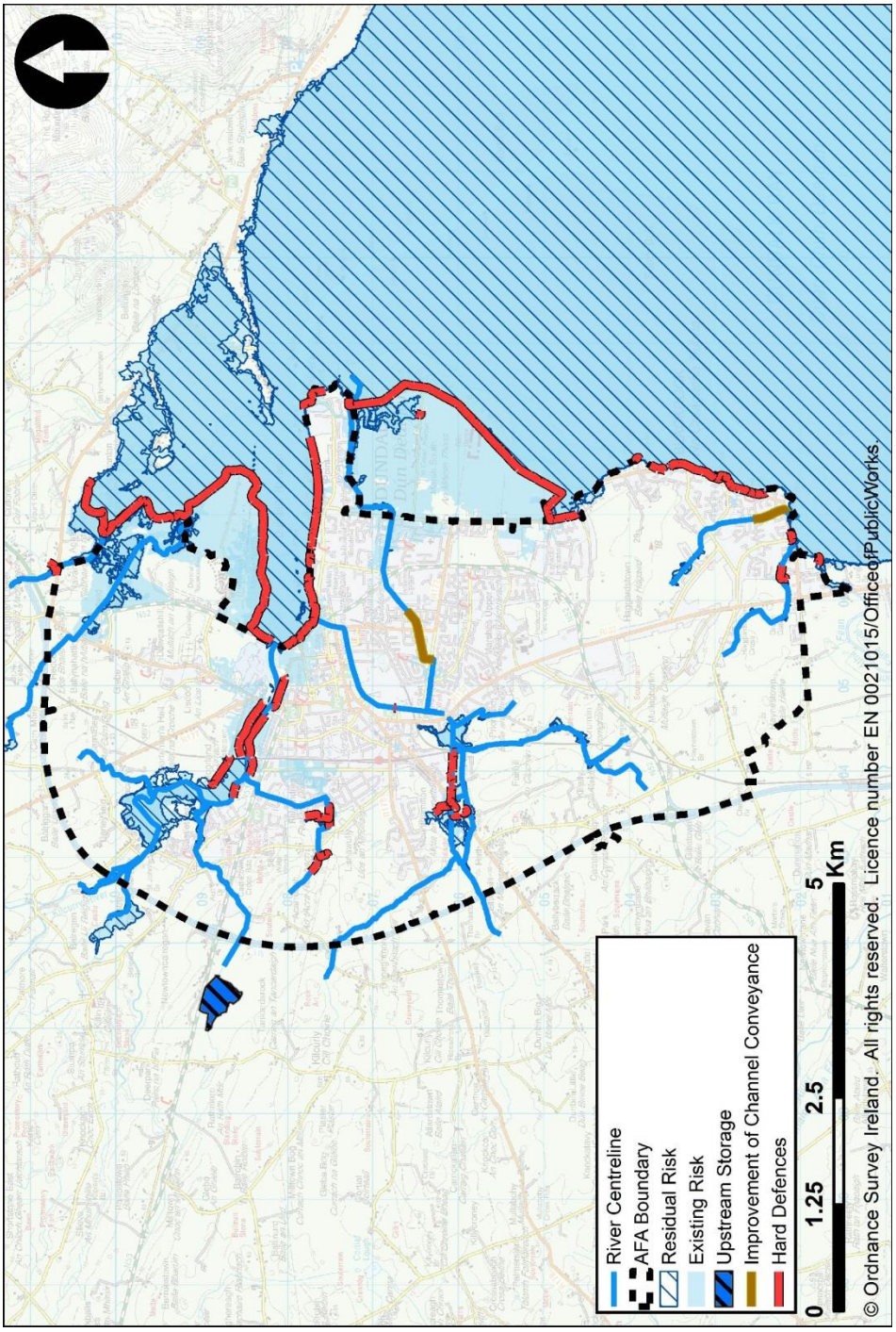
Adaptability to Potential Future Changes

Carlingford and Greenore AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Regarding adaptability of the preferred measure there are a number of FRM methods which make up the preferred measure that need to be considered. The hard defences method could be adapted by increasing the height of the retaining structure and extending its length, additional lengths of embankment would also be required upstream. There is no opportunity to adapt the flap valve method, this should continue to function regardless of the water levels in the Carlingford and Carlingford Commons watercourses. The pumping station method is adaptable by either installing a pump which is large enough to cope with future flows or leaving room within the pumping house for additional pumps to be installed at a later date. The improvement of channel conveyance method could be adapted by increasing channel capacity size and culvert sizes. Other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. Note that the cyclical FD process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes
A public consultation for Carlingford and Greenore AFA Options was held on 18/02/16, 19 members of the public attended. A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the Draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions. The height and aesthetics of the wall at the harbour should be considered at project-level assessment stage. An alternative option was discussed relating to the harbour walls and installation of a lock gate. This was found to be unfeasible and therefore was not identified as the preferred measure at this stage in the optioneering process of Carlingford and Greenore, however this alternative may be evaluated further during the project-level assessment stage of the scheme. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.
Other Issues / Conclusions
One measure was identified for Carlingford and Greenore AFA, consequently this is the preferred measure. Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity. Consultations and submissions provided additional information which has been noted for project-level assessment. • If the proposed pumping stations require any storage/holding tanks, consideration should be given at project-level assessment as to how best to integrate these either into the harbour front or alternatively to assess if the temporal tidal nature of the harbour could be harnessed, in combination with some kind of a control barrier, to provide attenuation. None of the submissions resulted in a change of the preferred measure.

G.4 Dundalk and Blackrock South AFA

River Basin	Neagh Bann	AFA	Dundalk and Blackrock South AFA
Measure	Preferred Measure 1 - Progress the development of a Flood Relief Scheme for Dundalk and Blackrock South AFA		
Code	GBNIIENB-IE-AFA-060019-0406-M61		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Dundalk and Blackrock South, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes			
Objective	**Un-Weighted Score**	**Local Weighting**	**Comment**
1.a.i	4.93	5.0	*There are 1285 ground floor properties and there are 21 upper floor properties benefiting with this option in place.*
1.a.ii	4.62	2.7	*There is 1 highly vulnerable property benefiting with this option in place.*
1.b.i	4.96	5.0	*There are 127 social infrastructure/amenity sites benefiting with this option in place.*
1.b.ii	4.92	5.0	*There are 155 commercial properties benefiting with this option in place.*
2.a	4.55	5.0	*With this option in place the annual average damages have been reduced from €7011212 to €636221.*
2.b	3.25	5.0	*There are 107 transport links benefiting with this option in place.*
2.c	2.11	4.8	*There is 1 utility benefiting with this option in place.*
2.d	1.00	4.0	*The proposed option has an overall slight improvement on the impact on agricultural land.*
3.a	-5.00	5.0	*Excavation and restoration of banks adjacent to and set back from sensitive waterbodies. Potential for in-stream and on-bank construction impacts. Creation of online storage on undesignated tributary of the Castletown River, which would be operational during floods, however required culvert and weir. Improvement of channel conveyance in Blackwater River and Blackrock River with construction phase impacts of culvert replacements and construction phase dredging / lowering. Receiving waterbodies listed in WFD Register of Protected Areas.*
3.b	-5.00	5.0	*Potential for direct impacts to Dundalk Bay SAC, SPA and Ramsar site from construction and restoration of embankments, in particular in Ballymascanlan / Racecourse area where defences may bisect designated areas. Potential for indirect downstream impacts during construction of all walls and embankments and from dredging / culvert works at Blackwater and Blackrock Rivers. Direct loss of natural and semi natural habitats in the footprint of works. Potential for defences to be set further back from designated sites.*
3.c	-5.00	5.0	*Potential for direct impacts to Dundalk Bay pNHA and OSPAR Marine Protected Area from construction and restoration of embankments, in particular in Ballymascanlan / Racecourse area where defences may bisect designated areas. Potential for indirect downstream impacts during construction of all walls and embankments and from dredging / culvert works at Blackwater and Blackrock Rivers. Potential for defences to be set further back from designated sites.*

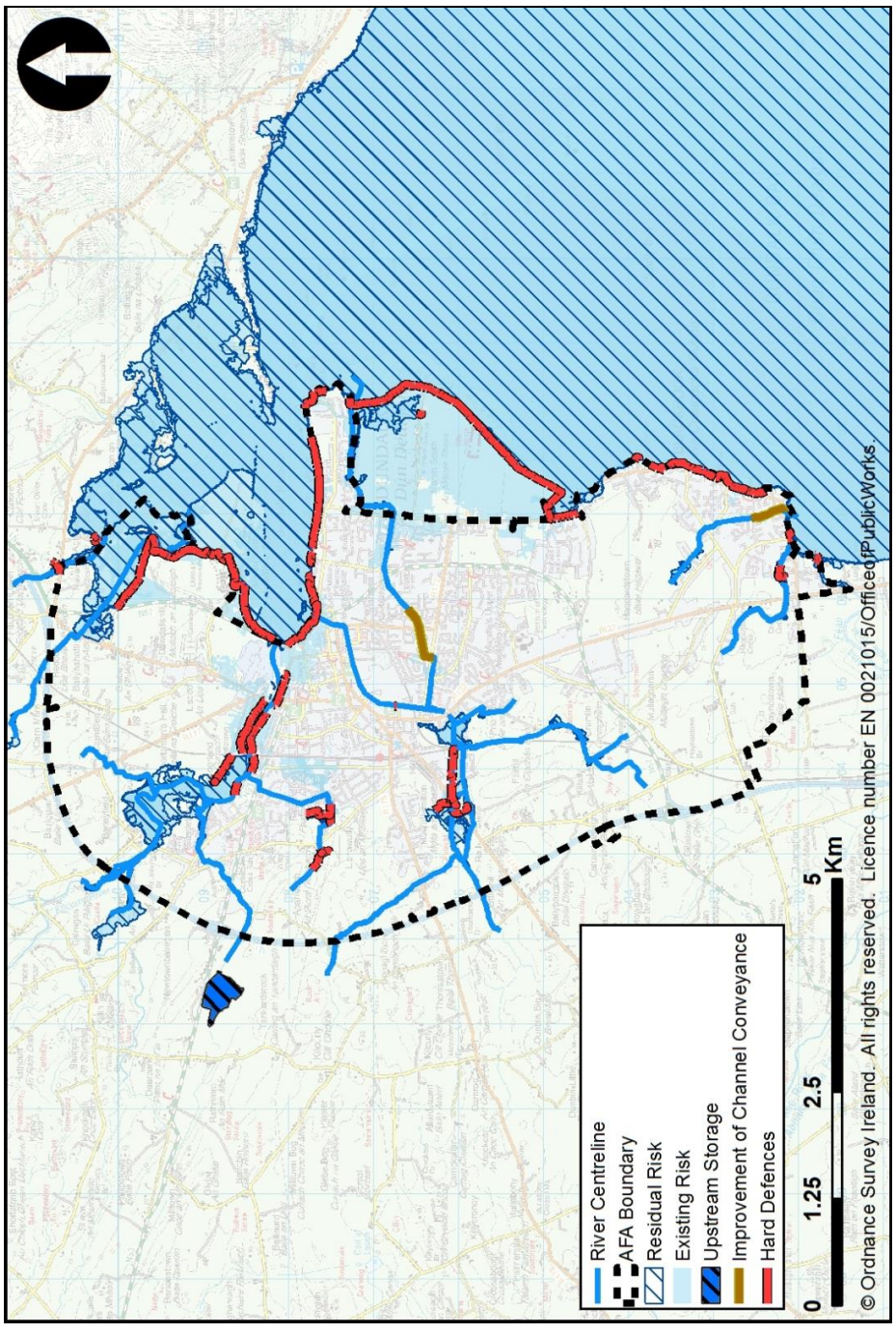
3.d	-4.00	4.0	*Generally direct construction phase impacts from excavation and restoration of banks, and rehabilitation of existing in-stream and on-bank defences, in and adjacent to sensitive waterbodies. Potential for indirect downstream impacts to sensitive waterbodies (salmon and shellfish) during construction of defences and dredging works. Potential for mitigation measures to minimise impacts on fisheries.*
3.e	-4.00	4.0	*Permanent impacts on moderate value landscape. Embankments may have negative impacts on setting of Dundalk Bay and on local views of the Bay. Potential for some localised negative impacts on views in Dundalk.*
3.f.i	3.00	5.0	*Increase in the level of protection for several NIAH buildings in Dundalk. Embankments may however have slight negative impacts on the setting of some NIAH buildings.*
3.f.ii	1.00	5.0	*Increase in the level of protection for a few recorded monuments.*
4.a	0.00	5.0	*Moderate, but manageable risk*
4.b	2.00	5.0	*The following hazards have been identified: Working near water, Maintenance near water, Heavy plant and machinery*
4.c	0.00	5.0	*Option is not adaptable*

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
1134	40.54	27.98

No Properties Benefitting	**10% AEP Event**	**1%/0.5% AEP Event**	**0.1% AEP Event**
Residential	189 (Fluvial) 144 (Coastal 1) 30 (Coastal 2)	420 (Fluvial) 1,233 (Coastal 1) 52 (Coastal 2)	N/A
Commercial	17 (Fluvial) 20 (Coastal 1) 27 (Coastal 2)	23 (Fluvial) 119 (Coastal 1) 33 (Coastal 2)	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
258.77	40.54	134.94	3.33

River Basin	Neagh Bann	AFA	Dundalk and Blackrock South AFA
Measure	Preferred Measure 2 Progress the development of a Flood Relief Scheme for Dundalk and Blackrock South AFA		
Code	GBNIIENB-IE-AFA-060019-0506-M61		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Dundalk and Blackrock South, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes			
Objective	**Score**	**Local Weighting**	**Comment**
1.a.i	4.93	5.0	*There are 1285 ground floor properties and there are 21 upper floor properties benefiting with this option in place.*
1.a.ii	4.62	2.7	*There is 1 highly vulnerable property benefiting with this option in place.*
1.b.i	4.96	5.0	*There are 127 social infrastructure/amenity sites benefiting with this option in place.*
1.b.ii	4.92	5.0	*There are 155 commercial properties benefiting with this option in place.*
2.a	4.55	5.0	*With this option in place the annual average damages have been reduced from €7011212 to €636221.*
2.b	3.25	5.0	*There are 107 transport links benefiting with this option in place.*
2.c	2.11	4.8	*There is 1 utility benefiting with this option in place.*
2.d	-4.00	4.0	*The proposed option has an overall loss of agricultural land, when considering the relocation of the embankment at Marsh North. A significant area of land would become frequently inundated.*
3.a	-4.00	5.0	*Excavation and restoration of banks adjacent to and set back from sensitive waterbodies. Potential for in-stream and on-bank construction impacts. Creation of online storage on undesignated tributary of the Castletown River, which would be operational during floods, however required culvert and weir. Improvement of channel conveyance in Blackwater River and Blackrock River with construction phase impacts of culvert replacements and construction phase dredging / lowering. Receiving waterbodies listed in WFD Register of Protected Areas. Defences set back further from Dundalk Bay with this Option.*
3.b	1.00	5.0	*Potential for indirect impacts to adjacent and downstream Dundalk Bay SAC, SPA and Ramsar site from construction and restoration of embankments. Potential for indirect downstream impacts during construction of all walls and embankments and from dredging / culvert works at Blackwater and Blackrock Rivers. Potential for positive impacts on improvement of wetland habitat in Ballymascanlan / Racecourse area of Dundalk Bay SAC, SPA and Ramsar site. Potential for creation of new habitat at Marsh North.*
3.c	1.00	5.0	*Potential for indirect impacts to adjacent and downstream Dundalk Bay pNHA and OSPAR Marine Protected Area from construction and restoration of embankments. Potential for indirect downstream impacts during construction of all walls and embankments and from dredging / culvert works at Blackwater and Blackrock Rivers. Potential for positive impacts on improvement of wetland habitat in Ballymascanlan / Racecourse area of Dundalk Bay pNHA and OSPAR Marine Protected Area. Potential for creation of new habitat at Marsh North.*

3.d	-3.00	4.0	*Generally direct construction phase impacts from excavation and restoration of banks, and rehabilitation of existing in-stream and on-bank defences, in and adjacent to sensitive waterbodies. Potential for indirect downstream impacts to sensitive waterbodies (salmon and shellfish) during construction of defences and dredging works. Potential for mitigation measures to minimise impacts on fisheries.*
3.e	-2.00	4.0	*Permanent impacts on moderate value landscape. Embankments may have negative impacts on setting of Dundalk Bay and on local views of the Bay, however are more set back from the water in this Option. Potential for some localised negative impacts on views in Dundalk.*
3.f.i	3.00	5.0	*Increase in the level of protection for several NIAH buildings in Dundalk. Embankments may however have slight negative impacts on the setting of some NIAH buildings.*
3.f.ii	1.00	5.0	*Increase in the level of protection for a few recorded monuments.*
4.a	3.00	5.0	*Moderate, but manageable risk*
4.b	2.00	5.0	*The following hazards have been identified: Working near water, Maintenance near water, Heavy plant and machinery*
4.c	0.00	5.0	*Option is not adaptable*

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
1540.32	40.58	37.96

No Properties Benefitting	**10% AEP Event**	**1%/0.5% AEP Event**	**0.1% AEP Event**
Residential	189 (Fluvial) 144 (Coastal 1) 30 (Coastal 2)	420 (Fluvial) 1,233 (Coastal 1) 52 (Coastal 2)	N/A
Commercial	17 (Fluvial) 20 (Coastal 1) 27 (Coastal 2)	23 (Fluvial) 119 (Coastal 1) 33 (Coastal 2)	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
258.77	40.58	134.94	3.33

Environmental Assessments

The preferred measures will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, monuments, utilities, transport links, agricultural land and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures. They include the potential for short term disturbance of the local community and fisheries during construction of the hard defences, direct morphological impacts during construction, disturbance or loss of habitats and/or species in the direct footprint of the hard defences, disturbance of bird species, and construction phase and potentially recurring sedimentation and water quality impacts. There is also potential for moderate visual impacts in the medium to long term.

As the preferred measures will be located adjacent to and upstream of Dundalk Bay SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences (particularly in the Marsh North / Ballymascanlan area, where defences may bisect designated areas) and disturbance of protected bird species of Dundalk Bay SPA, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction of hard defences and from dredging and culvert works in Blackrock River, which may include recurring sedimentation impacts during flood events or maintenance works. Should water levels or flow be altered by the hard defences there is potential for impacts on qualifying habitat.

The specific mitigation measures will be identified in detail at project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- incorporation of measures to avoid scouring into the detailed channel conveyance design, and
- appropriate surveys of habitats, species and hydrological processes to inform a detailed Stage 2 Appropriate Assessment.

(See Section 6.6.3: timing to avoid overwintering of designated bird species, specific sediment control measures for sensitive areas, surveys).

One option positions the defences at Marsh North / Ballymascanlan further inland, to avoid bisecting the designated areas; however this does not protect one currently uninhabited property. This may be a viable if the impacts on the European sites are deemed to be unacceptable, and includes potential positive impacts, as repositioning of coastal hard defences at Marsh North / Ballymascanlan will allow inundation of the land currently behind hard defences and potentially lead to an increase in the extent of wetland coastal habitats.

Adaptability to Potential Future Changes

Dundalk and Blackrock South AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Regarding adaptability of the preferred measure there are a number of FRM methods which make up the preferred measure that need to be considered. The hard defences method could be adapted by increasing the height of the walls, embankments, demountables and road raises along with extending the lengths. Existing defences would need to be altered, with rock armour needing widened and sea walls requiring additional length. Additional lengths of hard defences would also be required where properties were not at risk under the present day. A sluice would need to be replaced. The storage area does not have any more capacity to store water for future scenarios. The improvement of channel conveyance method could be adapted by increasing channel capacity size and upgrading culverts. Other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes
A public consultation for Dundalk and Blackrock South AFA Options was held on 02/02/16, 39 members of the public attended plus an elected representative. A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the Draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions. People who attended the public consultation were informed of the alternative options, those who commented were in favour of either preferred measure however there is an overall concern for the time it will take for the final option to be put in place. The public and elected representatives would be very keen for interim measures and as such Louth CoCo is progressing the extension of a 1350mm diameter pipe in the Balmers Bog area, which has been investigated as an interim flood relief measure. The line of the coastal embankments along the North Marshes is the difference between the alternative options; nearby residents prefer seaward line based on use of agricultural land and property drainage, others are open to a new set back line which involves relocation of one property. Likewise there were comments about the Lord Limerick embankment, many commented that the reuse of the existing line was the preferred solution and would allow some parts of the existing structure to be incorporated into the new scheme. Residents in the area expressed supported improved channel conveyance on fluvial flood risk areas as this would reduce any impact on back drainage. In the Mounthamilton /Cambrooke areas concern for sewage works was raised (with back drainage to be provided for in design). Some concern was raised for defences at Blackrock (demountable defences suggested in the overtopping zone due to visual amenity) other residents were concerned to have overtopping protection in place. One submission recommended the second preferred measure as it does not bisect designated areas. This should be borne in mind at project-level assessment stage in this area of the AFA where the two measures still exist. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions

Of the four potentially viable measures presented in the Preliminary Options Report the preferred measures as described above scored better than other potential measures which were investigated.

Overall the alternative preferred measures have positive technical, social and economic scores with negative environmental/cultural scores but the benefit – cost ratios are above unity.

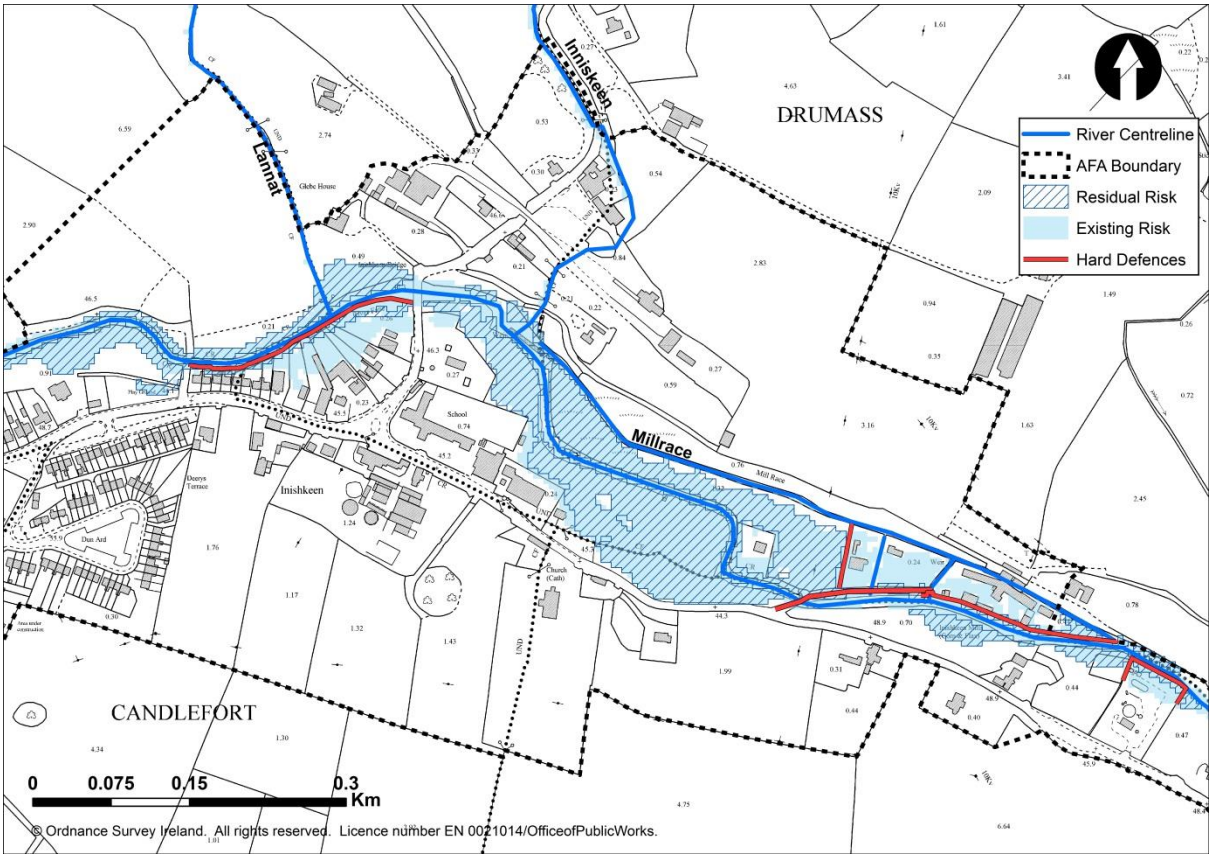
Consultations and submissions provided additional information which has been noted for project-level assessment.

- A submission was received regarding Blackrock South proposing an amendment to all options for Dundalk and Blackrock South. It noted that the carpark area to the north of the protected promenade in Blackrock South was not shown as protected within a figure in the Preliminary Options Report. This comment was further assessed and an error in the figure was identified. The protection of this carpark was costed at preliminary options stage and has been provided coincidentally in the protection of the Main Street. The corrected figure is provided in the final Plan.
- Concerns were raised regarding planning Issues in the Mounthamilton area on the Ardee Road and a Local Authority led scheme in the Balmers Bog area. Both of these issues were referred to Louth County Council by letter.
- There is a temporary Local Authority led interim solution involving the proposed extension of an existing 1350mm surface drainage pipe as an interim flood relief method in the Balmers Bog area. This pipe was assessed under the CFRAM study (as a sealed culvert with a positive outlet). The pipe provides additional flow capacity which may be significant during high frequency events and affords partial protection upstream flood mitigation during a 1% AEP event, however alternative FRM methods would still require to be added to provide the preferred SoP under CFRAM for Dundalk AFA.
- The Castletown River and Ramparts rivers both contain numerous fish populations. Any construction should comply with IFI guidance in such a way as to not impede the passage of fish and to aid protection of fisheries during construction.
- While not for consideration at this early stage, it should be noted that there is strong local support for the possibility of the creation of a cycleway / walkway as part of any works on the Lord Limerick Embankment.

None of the submissions resulted in a change of the preferred measure.

G.5 Inniskeen AFA

River Basin	Neagh Bann	AFA	Inniskeen AFA
Measure	Progress the development of a Flood Relief Scheme for Inniskeen AFA		
Code	GBNIIENB-IE-AFA-060020-0606-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Inniskeen, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.88	5.0	*There are 10 ground floor properties and there are no additional upper floor properties benefiting with this option in place.*
1.a.ii	0.0	1.0	*There are no additional highly vulnerable properties benefiting with this option in place.*
1.b.i	0.00	5.0	*There are no additional social infrastructure/amenity sites benefiting with this option in place.*
1.b.ii	4.64	5.0	*There are 10 commercial properties benefiting with this option in place.*
2.a	1.04	5.0	*With this option in place the annual average damages have been reduced from €397818.05 to €314749.94.*

2.b	0.00	2.4	*There are no additional transport links benefiting with this option in place.*
2.c	4.67	5.0	*There is 1 utility benefiting with this option in place.*
2.d	0.00	4.0	*Agriculture very important to the Inniskeen area, with the AFA surrounded by pasture and grazing land. Production of this pasture land is interlinked with the local hydrology and hydrogeology, given the drumlin hill landscape. Further downstream of Inniskeen towards Knockbridge and Blackrock the land use is mainly arable in the flat floodplain of the Fane River*
3.a	0.00	5.0	*Construction phase impacts in non-sensitive waterbody. Excavation and restoration of banks and walls, set back from waterbody. Reduced flooding in 1% AEP extent to Inniskeen waste water treatment plant.*
3.b	0.00	1.0	*The Fane River discharges to Dundalk Bay SAC, SPA, OSPAR MPA, Ramsar Site and pNHA ~15km downstream of Inniskeen. The Drumcah, Toprass and Cortial Lough pNHA is just over 1km from the AFA, off the Fane River, however is not hydraulically linked to the AFA. IWeBS key site in the vicinity.*
3.c	0.00	1.0	*No impact on existing national, regional and local sites as a result of FRM measures. Potential for localised loss of or disturbance to undesignated flora/fauna in semi-natural and urban habitat during construction, prior to re-establishment.*
3.d	-4.00	4.0	*Short term minor impacts from construction in the vicinity of local fishing areas, such as Lough Major and White Lough. Not sensitive species*
3.e	-1.00	2.0	*Construction of hard defences adjacent to LAP conservation / amenity areas and lough shores has the potential for permanent negative impacts on visual amenity.*
3.f.i	0.00	2.0	*No effects on architectural features.*
3.f.ii	0.00	1.0	*No effects on architectural features.*
4.a	4.00	5.0	*Negligible operational risk*
4.b	1.00	5.0	*The following hazards have been identified: Risk of burial from earthfall, working near water (construction), work with heavy plant and components, working near water (O&M)*
4.c	3.00	5.0	*Option is adaptable at moderate cost*

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
1049	2.10	499.9

No Properties Benefitting	**10% AEP Event**	**1%/0.5% AEP Event**	**0.1% AEP Event**
Residential	7	10	N/A
Commercial	0	4	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
5.92	2.10	2.67	1.27

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, and Inniskeen WWTP in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located upstream of Dundalk Bay SAC and SPA, with the potential for indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. No significant impacts on these European sites are expected, owing to their distance from the proposed measure.

The specific mitigation measures will be identified in detail at project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality, and
- appropriate surveys of habitats and species.

(See Section 6.6.3: timing to avoid overwintering of designated bird species, specific sediment control measures for sensitive areas, surveys).

Adaptability to Potential Future Changes

Inniskeen AFA is considered to be at low vulnerability from the mid-range future scenario and moderate vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the walls, embankments and road raises along with extending the lengths. Other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes

A public consultation for Inniskeen Options was held on 16/03/16 (combined with Carrickmacross), 14 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the Draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

A single property, identified through public consultation experienced basement flooding most likely due to a perched water table. This flooding mechanism is beyond the scope of the CFRAM remit.

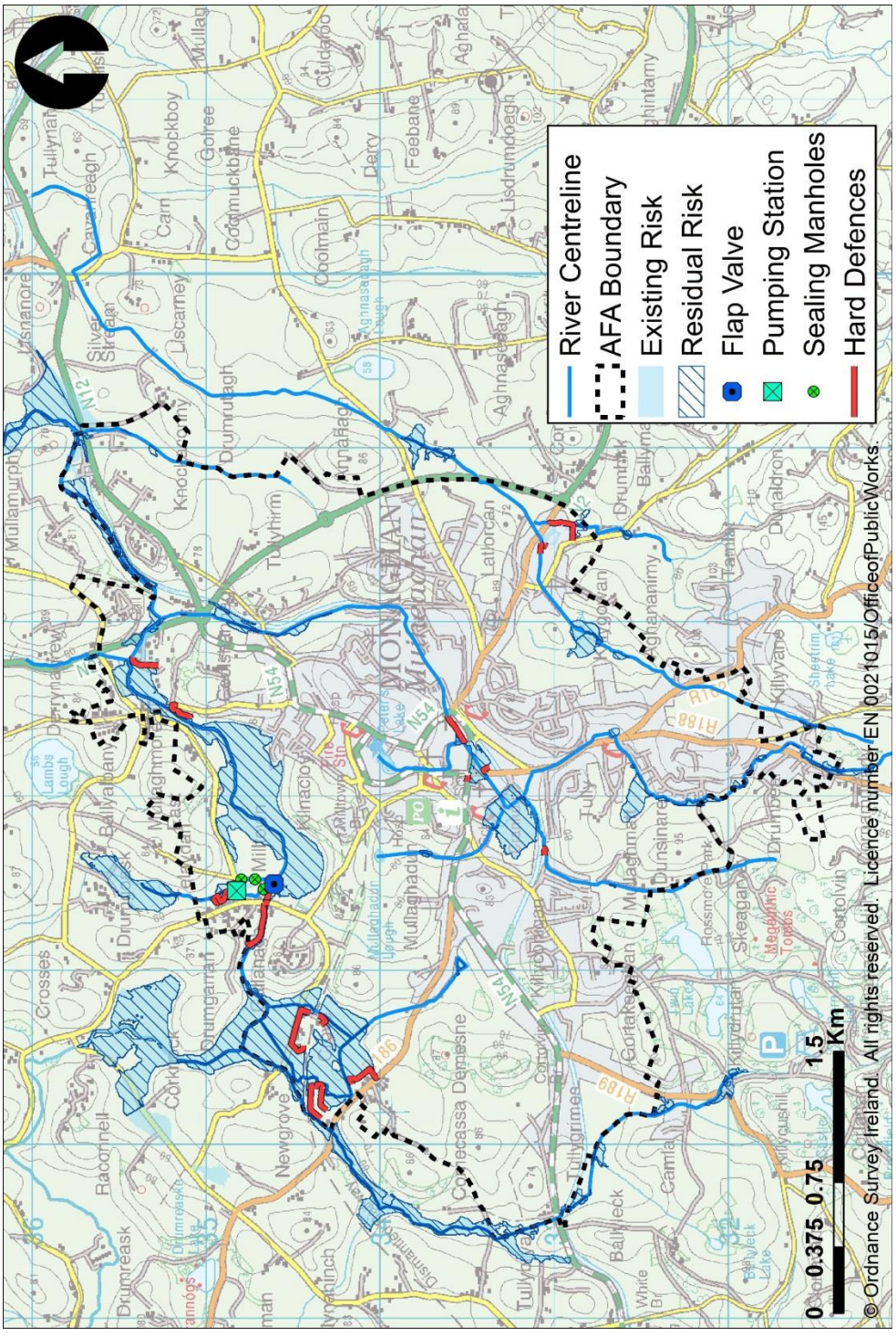
Works have been carried out on the Fane to improve the habitat for fish. Work has also been carried out to limit scour and erosion.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions
Of the three potentially viable measures presented in the Preliminary Options Report the preferred measure has a slightly higher benefit cost ratio compared to other potential measures which were investigated. Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity. Consultations and submissions provided additional information which has been noted for project-level assessment. This includes risk of flooding to local recreational areas and walkways. None of the submissions resulted in a change of the preferred measure.

G.6 Monaghan AFA

River Basin	Neagh Bann	AFA	Monaghan AFA
Measure	Progress the development of a Flood Relief Scheme for Monaghan AFA		
Code	GBNIIENB-IE-AFA-030011-0706-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Monaghan, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes			
Objective	**Un-Weighted Score**	**Local Weighting**	**Comment**
1.a.i	4.82	5.0	*There are 13 ground floor properties and there are 18 upper floor properties benefiting with this option in place.*
1.a.ii	0.0	1.0	*There are no additional highly vulnerable properties benefiting with this option in place.*
1.b.i	0.00	5.0	*There are no additional social infrastructure/amenity sites benefiting with this option in place.*
1.b.ii	4.76	5.0	*There are 36 commercial properties benefiting with this option in place.*
2.a	4.12	5.0	*With this option in place the annual average damages have been reduced from €872454.07 to €152794.05.*
2.b	0.61	5.0	*There are 5 transport links benefiting with this option in place.*
2.c	0.00	1.0	*There are no additional utilities benefiting with this option in place.*
2.d	0.00	3.0	*Agricultural production. No increase in the negative impact of flooding on agricultural production*
3.a	-3.00	5.0	*Construction phase impacts in non-sensitive waterbody. Excavation and restoration of banks and walls, set back from waterbody.*
3.b	0.00	4.0	*No impact on existing SAC, SPA or Ramsar sites as a result of flood risk management measures.*
3.c	0.00	3.0	*No impact on existing national, regional and local sites as a result of FRM measures. Potential for localised loss of or disturbance to undesignated flora/fauna in semi-natural and urban habitat during construction prior to re-establishment.*
3.d	-3.00	3.0	*Construction phase impacts in non-sensitive waterbody. Excavation and restoration of banks and walls, set back from waterbody.*
3.e	-1.00	2.0	*Short term construction phase impacts of local flood embankments prior to establishment of screening. Localised impacts on those to be defended. Unlikely to be impacts on the wider landscape.*
3.f.i	-1.00	4.0	*Potential for slight negative impacts on the setting of Ballyalbany Bridge NIAH structure from hard defences / embankments.*
3.f.ii	0.00	2.0	*No effects on archaeological features.*
4.a	3.00	5.0	*Very low operational risk - Pumping station in flood cell 5 would require intervention, monitoring and maintenance*
4.b	1.00	5.0	*The following hazards have been identified: working near water (construction), working near water (O&M), heavy plant and machinery (construction), work on wells*
4.c	1.00	5.0	*Option is adaptable only at significant cost*

Total MCA-Benefit Score	Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
954	12.50	76.33

No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	5	13	N/A
Commercial	13	34	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
26.95	12.50	12.61	1.01

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, and transport links in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will not be located in the vicinity of any European site, and there are not considered to be any potential pathways by which impacts could occur on designated habitats and/or species, Appropriate Assessment was not required.

The specific mitigation measures will be identified in detail at project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality, and
- appropriate surveys of habitats and species.

(See Section 6.6.3: timing to avoid overwintering of designated bird species, specific sediment control measures for sensitive areas, surveys).

Adaptability to Potential Future Changes

Monaghan AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require increasing the height of the walls, embankments and road raises along with extending the lengths. There is no opportunity to adapt the flap valve method; this should continue to function regardless of the water levels in the Monaghan watercourses. The pumping station method is adaptable by either installing a pump which is large enough to cope with future flows or leaving room within the pumping house for additional pumps to be installed at a later date. Other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes

A public consultation for Monaghan Options was held on 15/02/16, 32 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the Draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

People who attended the public consultation were informed of the options, those who commented were in favour of the preferred measure including protection of the roadway. However there was interest in methods involving dredging and land use management (peat extraction in Brager). There is a fear that in some locations hard defences will put properties at risk of pluvial flooding. In one location Monaghan County Council have carried out minor works, therefore no further optioneering was required. This was noted in the preliminary option report. HSE houses are also noted within the area.

A submission received from Monaghan County Council resulted in a change of the preferred measure as the local authority are currently progressing a scheme, independent of the CFRAM process, to protect the road junction in the town centre. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage

Other Issues / Conclusions

Of the two potentially viable measures presented in the Preliminary Options Report the preferred measure has a higher benefit cost ratio than other than the other potential measure.

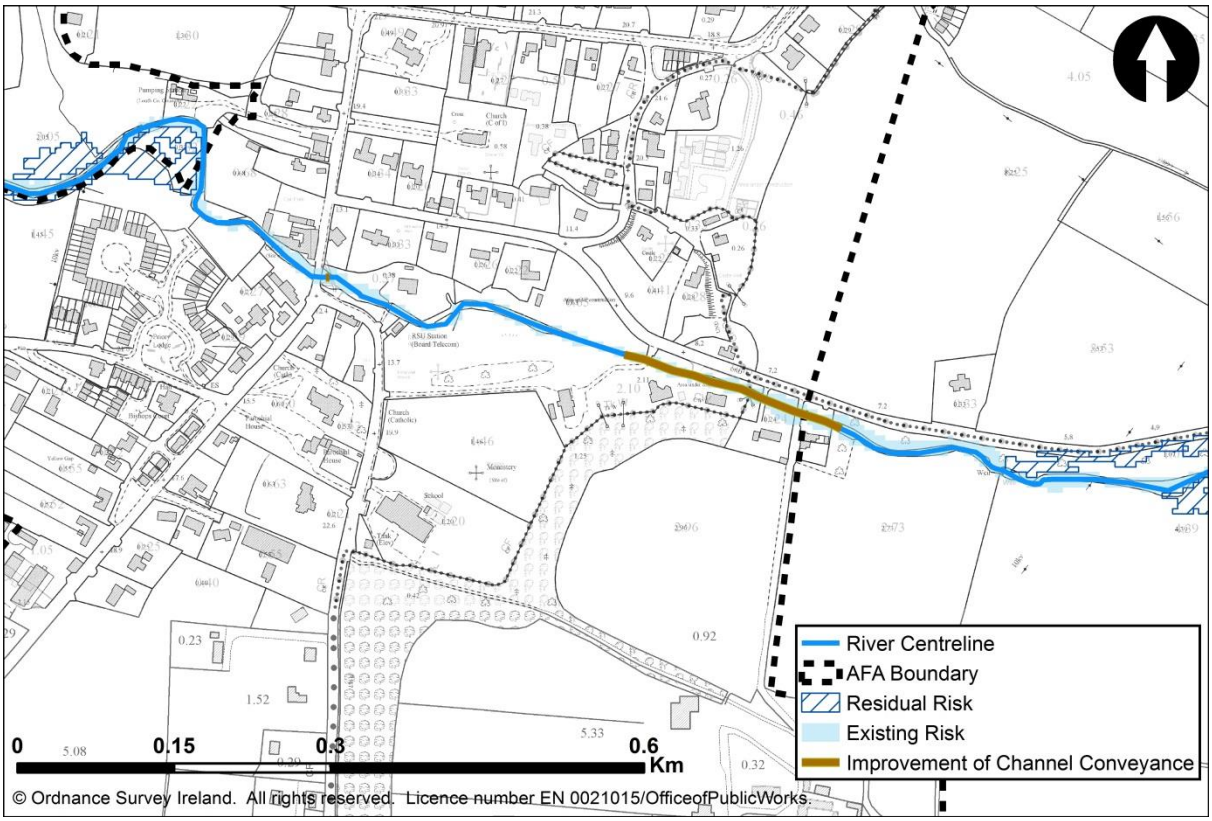
Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.

Consultations and submissions provided additional information which has been noted for project-level assessment. A submission received from the Monaghan County Council resulted in a change of the preferred measure. The local authority are currently progressing a scheme independent of the CFRAM process to protect the road junction in the town centre.

- A submission made the point that the river names within the report are not the names known locally and requested that the maps are amended to detail these names for any future design work. Crove, Newgrove, Newgrove 2, Tullybran collectively are known locally as Conawary River Lower. Monaghan Mullaghdun, Patena Lake, Tenderagees collectively are known locally as Shamble's River and Peter's Lake. Corr River, Derrynagrew, Knockaconny, Teladyan are collectively known locally as Monaghan Blackwater. Killygowan, Ballymacforban are collectively known as Conawary River Upper.
- A culvert (0642M00060J) exists under the Glen Road between a shop and car park has a grating cover at the upstream face which is prone to blockage. This resulted in flooding in October 2011. Flood mapping in the area shows no flooding as all culverts were assumed to be clear during hydraulic modelling.

G.7 Termonfeckin AFA

River Basin	Neagh Bann	AFA	Termonfeckin AFA
Measure	Undertake a Detailed Assessment of the Costs of the Potential Measure for Termonfeckin AFA		
Code	GBNIIENB-IE-AFA-060024-0806-M25		
Description	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	3.64	1.0	*There are 5 ground floor properties and there is 1 upper floor property benefiting with this option in place.*
1.a.ii	0.0	1.0	*There are no additional highly vulnerable properties benefiting with this option in place.*
1.b.i	0.00	5.0	*There are no additional social infrastructure/amenity sites benefiting with this option in place.*
1.b.ii	4.23	1.0	*There are 2 commercial properties benefiting with this option in place.*
2.a	2.33	1.0	*With this option in place the annual average damages have been reduced from €15125.89 to €8086.67.*
2.b	4.89	5.0	*There are 3 transport links benefiting with this option in place.*

2.c	0.00	1.0	*There are no additional utilities benefiting with this option in place.*
2.d	0.00	4.0	*No Change.*
3.a	-5.00	5.0	*Improvement of channel conveyance in a non-sensitive waterbody, upstream of the Louth Coast sensitive coastal waterbody. Reduced risk of flooding. Potential for sedimentation impacts downstream during conveyance works.*
3.b	-2.00	3.0	*No direct impacts to any SAC, SPA or Ramsar sites, however potential for increased sedimentation to downstream Boyne Coast and Estuary SAC during conveyance works. Potential for increased flows and increased erosion and sedimentation downstream of Termonfeckin following works that may have increased sedimentation impacts on Boyne Coast and Estuary SAC.*
3.c	-2.00	3.0	*Direct loss of local, undesignated, flora and fauna from conveyance works. May re-establish following works. Potential for increased sedimentation to downstream Boyne Coast and Estuary pNHA during conveyance works. Potential for increased flows and increased erosion and sedimentation downstream of Termonfeckin following works that may have increased sedimentation impacts on Boyne Coast and Estuary pNHA.*
3.d	-5.00	3.0	*Improvement of channel conveyance in a non-sensitive waterbody. Potential for indirect impacts on downstream fishing activity.*
3.e	-1.00	4.0	*Short term construction phase impacts on views from those to be protected. Unlikely to be any impacts on the wider landscape.*
3.f.i	-1.00	4.0	*Potential for short term construction phase impacts on the setting of the Termonfeckin Bridge NIAH structure.*
3.f.ii	1.00	4.0	*Increased protection from flooding to one monument - burial ground.*
4.a	4.00	5.0	*No reliance on systems of intervention, with more regular monitoring and intermittent, but potentially substantial, maintenance requirements*
4.b	2.00	5.0	*The following hazards have been identified: Working near water (construction), Working near water (O&M), Heavy plant and machinery (construction)*
4.c	2.00	5.0	*Option is adaptable at moderate to significant cost*

Total MCA-Benefit Score	Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
-289	0.35	-815.32

No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	0 (Fluvial) 0 (Coastal 1)	5 (Fluvial) 0 (Coastal 1)	N/A
Commercial	2 (Fluvial) 0 (Coastal 1)	2 (Fluvial) 0 (Coastal 1)	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
0.68	0.35	0.32	0.9

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, a monument and transport links in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures. They include the potential for short term disturbance of the local community during construction, direct morphological impacts, and short term sedimentation and water quality impacts during conveyance works, with potential for recurring sedimentation impacts during maintenance of the conveyance works. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the works.

As the proposed works will be located immediately upstream of Boyne Coast and Estuary SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during conveyance works. Recurrent sedimentation impacts are also possible during flood events or maintenance of channel conveyance. Should water levels or flow be altered, there is potential for impacts on qualifying habitat.

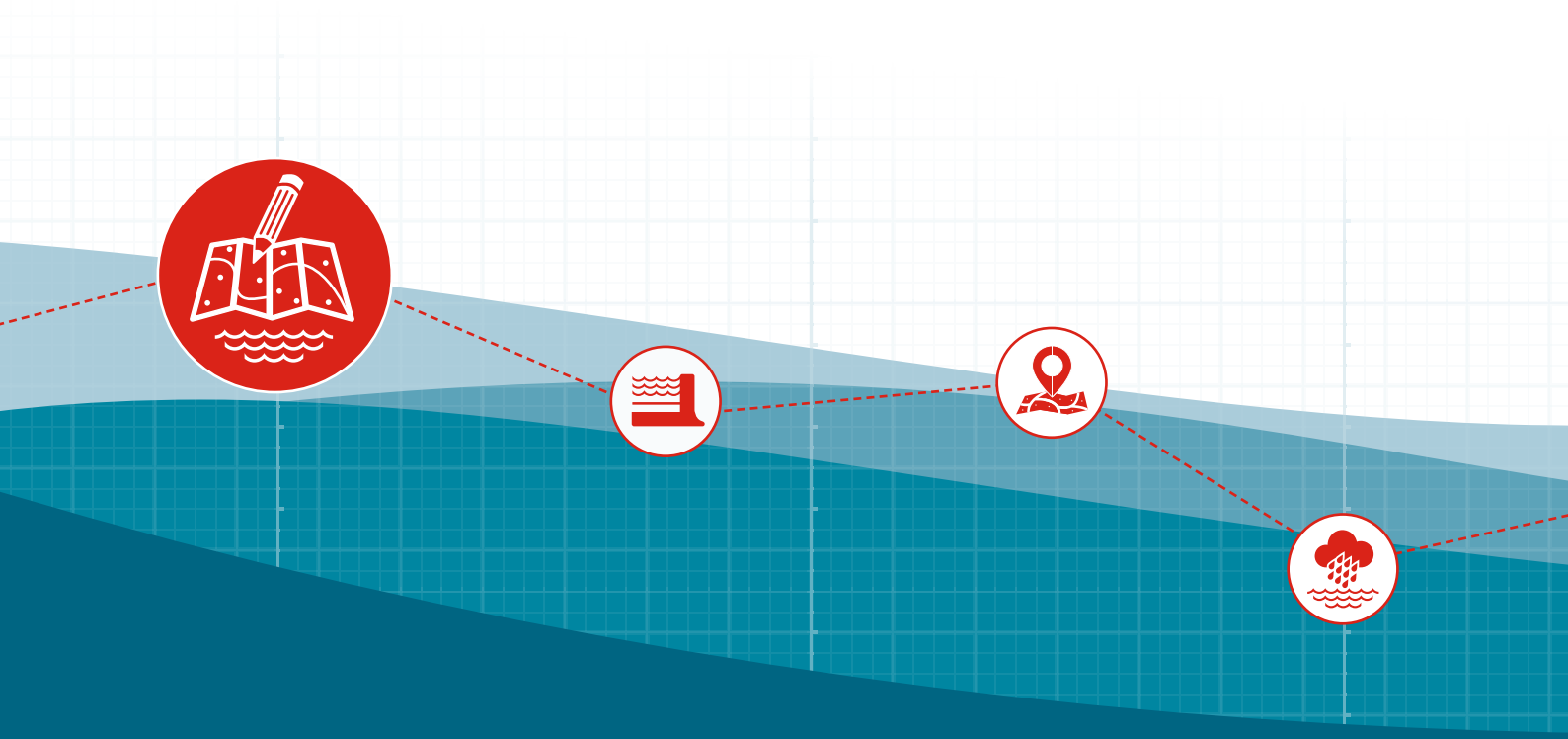
In relation to the preferred measure for Termonfeckin AFA, the measure may cause detrimental impacts in relation to the environment / cultural heritage, resulting in an overall multi-criteria assessment (MCA) score of below zero. At the project-level development and assessment of the measure for Termonfeckin the potential detrimental impacts of the measure will need to be carefully considered to determine whether, and how, the potential impacts can be mitigated, such that the measure can be progressed without detrimental impacts to the community and its surrounding environment.

The specific mitigation measures will be identified in detail at project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the appropriate timing of construction work to minimise disturbance of species,
- incorporation of measures to avoid scouring into the detailed channel conveyance design,
- effective sediment control measures to protect water quality, and
- appropriate surveys of habitats, species and hydrological processes to inform a detailed Stage 2 Appropriate Assessment.

(See Section 6.6.3: timing to avoid overwintering of designated bird species, specific sediment control measures for sensitive areas, surveys).

Adaptability to Potential Future Changes
Termonfeckin AFA is considered to be at moderate vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require further dredging/widening the river channel and increasing conveyance through restrictive structures to provide the required SoP, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.
Public Consultation Outcomes
A public consultation for Termonfeckin Options was held on 09/03/16, 17 members of the public attended. A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the Draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage. Any further assessment in this location should bear in mind the outcome of public consultation which reported that there have been some in channel modifications within the Termonfeckin AFA.
Other Issues / Conclusions
Of the two potentially viable measures presented in the Preliminary Options Report the preferred measure as described above scored better environmentally and has a higher benefit cost ratio than the other potential measure. Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity. Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.



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