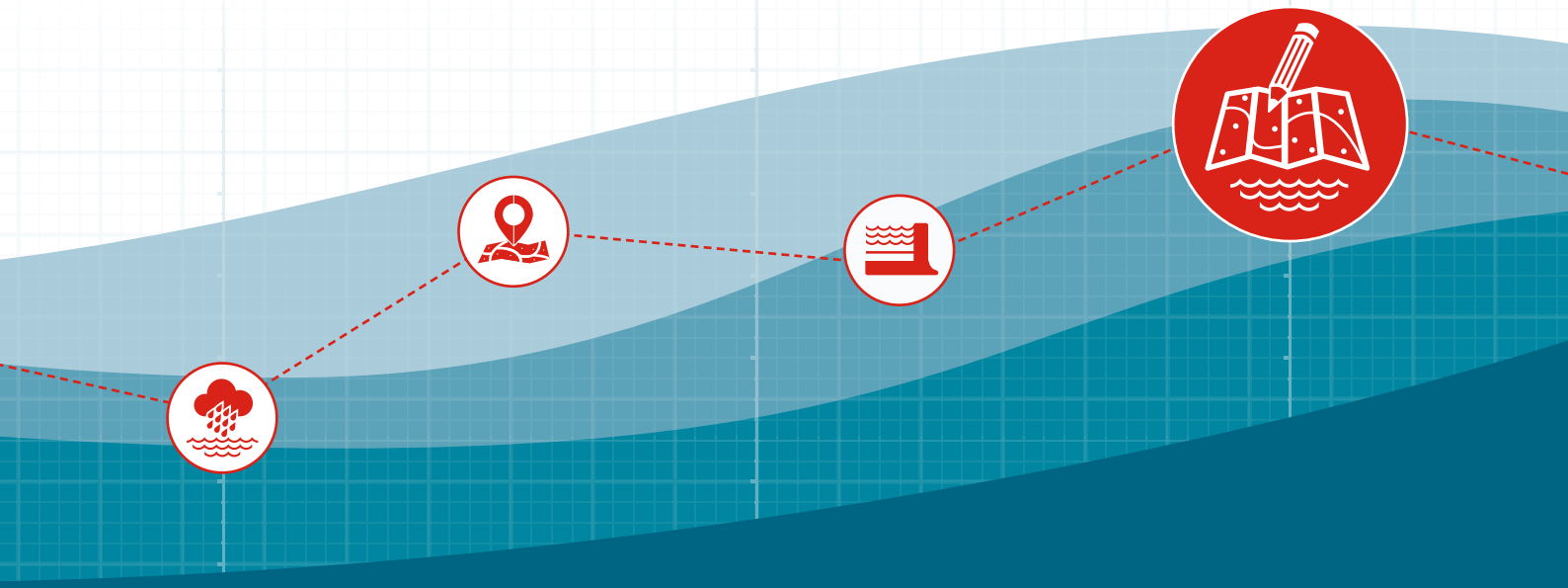
OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

Abhantrach
23
River Basin



Plean um Bainistiú Priacal Tuile

Flood Risk Management Plan

Bá Thrá Lí – An Fhéil

Tralee Bay – Feale

2018

Plean um Bainistiú Priacal Tuile
Flood Risk Management Plan

Amhantrach (23) Bá Thrá Lí - An Fhéil
River Basin (23) Tralee Bay - Feale

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

Mainistir Ó dTorna	*Abbeydorney*
Mainistir na Féile	*Abbeyfeale*
Áth an tSléibhe	*Athea*
An Bheannach	*Banna*
Lios Tuathail	*Listowel*
Muine Caisean	*Moneycashen*
Trá Lí	*Tralee*

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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ACHOIMRE FHEIDHMEACH

RÉAMHRÁ

Is é seo an Plean um Bainistiú Priacal Tuile (an 'Plean') d'Abhantrach Bá Thrá Lí - An Fhéil. 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 Bá Thrá Lí - An Fhéil 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 Bá Thrá Lí - An Fhéil

CONTAE	AINM an PHOBAIL	FOINSÍ PRIACAL TUILE
Luimneach	Mainistir na Féile	Abhann
Luimneach	Áth an tSléibhe	Abhann
Ciarraí	Lios Tuathail	Abhann
Ciarraí	Mainistir Ó dTorna	Abhann
Ciarraí	Muine Caisean	Abhann/Cósta
Ciarraí	An Bheannach	Abhann/Cósta
Ciarraí	Trá Lí	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:

- Mainistir Ó dTorna
- Áth an tSléibhe
- An Bheannach
- Lios Tuathail
- Trá Lí

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

Níl aon scéimeanna nó oibreacha eile um Fhaoiseamh Tuile tugtha chun cinn nó molta trí thionscadail nó trí phleananna eile.

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 Tralee Bay - Feale 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 Tralee Bay - Feale 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 Tralee Bay - Feale River Basin

COUNTY	COMMUNITY NAME	SOURCE(S) OF FLOOD RISK
Limerick	Abbeyfeale	Fluvial
Limerick	Athea	Fluvial
Kerry	Listowel	Fluvial
Kerry	Abbeydorney	Fluvial
Kerry	Moneycashen	Fluvial/Coastal
Kerry	Banna	Fluvial/Coastal
Kerry	Tralee	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:

- Abbeydorney
- Athea
- Banna
- Listowel
- Tralee

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

There are no other flood relief schemes or works progressed or proposed through other projects or plans.

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.

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1. INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

This is the Flood Risk Management Plan (the 'Plan') for the Tralee Bay – Feale 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 Tralee Bay – Feale 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.

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).

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

- Fluvial flooding (from rivers of 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 sources 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.
- 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].

[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)

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 Jacobs for the Tralee Bay – Feale 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.
- 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 River Basins 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 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:

- Listowel (Clievragh) Flood Risk Assessment and Preliminary Flood Relief Option Assessment.

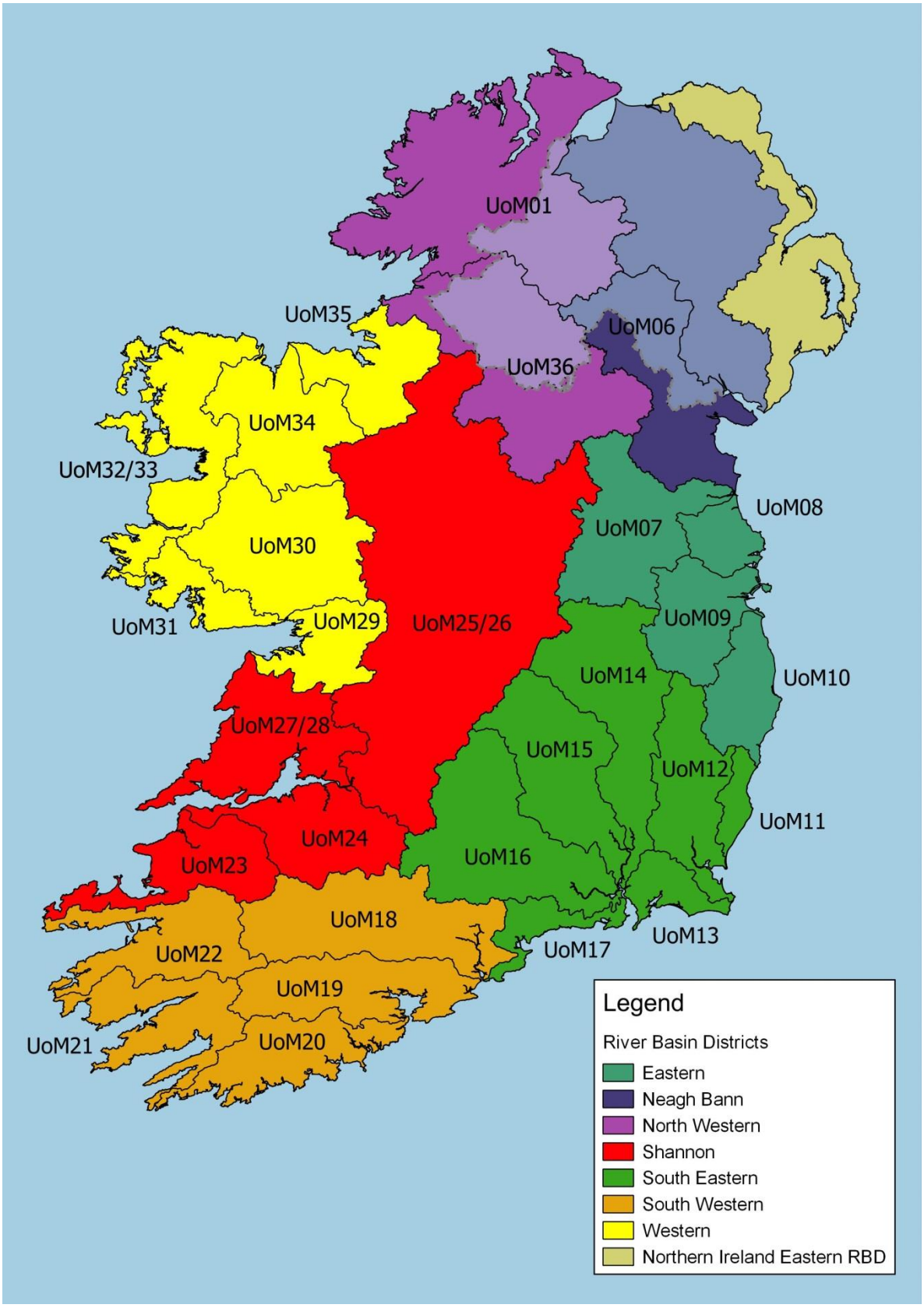
Following several flood events within the AFA boundary of Listowel in the Clievragh Area (which was not modelled as part of the CFRAM Study), Kerry County Council appointed consulting engineers to undertake a preliminary options study and to recommend solutions to mitigate flooding in this area. The Final 'Listowel Flood Risk Assessment and Preliminary Flood Relief Option Assessment Report (May 2016)', presents a flood risk assessment for the area, and a number of recommendations, including the construction of an offline storage area between Clievragh Road (R552) and Ballybunion Road to attenuate peak flows.

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 on the OPW website[5:]

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

[5] http://www.opw.ie/en/flood-risk-management/operations/flooddefenceschemes/#d.en.23394

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



1.3.5 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.
River Basin Management Plan, 2010 Draft River Basin Management Plan, 2017	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. An updated version of the national RBMP has been published in Draft format.
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.
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.
Kerry County Development Plan (2015-2021)	The County Development Plan for County Kerry 2015-2021.
Limerick County Development Plan (2010-2016)	The County Development Plan for County Limerick 2010-2016.
Cork County Development Plan (2014-2020)	The County Development Plan for County Cork 2014-2020.
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.
Abbeydorney LAP (2013-2019)	The Abbeydorney Local Area Plan (LAP) 2013-2019
Listowel LAP (2009 - 2015)	The Listowel Local Area Plan (LAP) 2009 - 2015
Tralee LAP (2013-2019)	The Tralee Local Area Plan (LAP) 2013-2019
Abbeyfeale LAP (2014 - 2020)	The Abbeyfeale Local Area Plan (LAP) 2014 - 2020
Other Spatial / Development Plans for River Basin	No other Spatial / Development Plans were used for this River Basin.

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 know 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 Tralee Bay – Feale 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 Tralee Bay - Feale River Basin addresses fluvial, coastal and tidal 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 Tralee Bay – Feale 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 detailed design 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 can not 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 TRALEE BAY - FEALE RIVER BASIN

The Tralee Bay – Feale River Basin is shown in its wider context within the Shannon RBD in Figure 2.1 and in more detail in Figure 2.2. It is located almost entirely in County Kerry, with only a very small area extending into counties Limerick and Cork. The total area of The Tralee Bay – Feale River Basin is approximately 1800 km². There are 7 Areas for Further Assessments (AFAs) and no Individual Risk Receptors (IRR) within the River Basin.

The sources of flood risk considered in this study, are fluvial and coastal. The Tralee Bay – Feale River Basin is dominated by the Feale sub-catchment which contains 5 of the 7 AFAs. Coastal flood risk dominates these 5 AFAs, with only the Moneycashen AFA also at fluvial flood risk. There are two other smaller sub-catchments within the River Bain; Lee sub-catchment and the Tyshe sub-catchment, both of which contain a single AFA.

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Figure 2.1: The Tralee Bay – Feale River Basin in wider context within the Shannon RBD

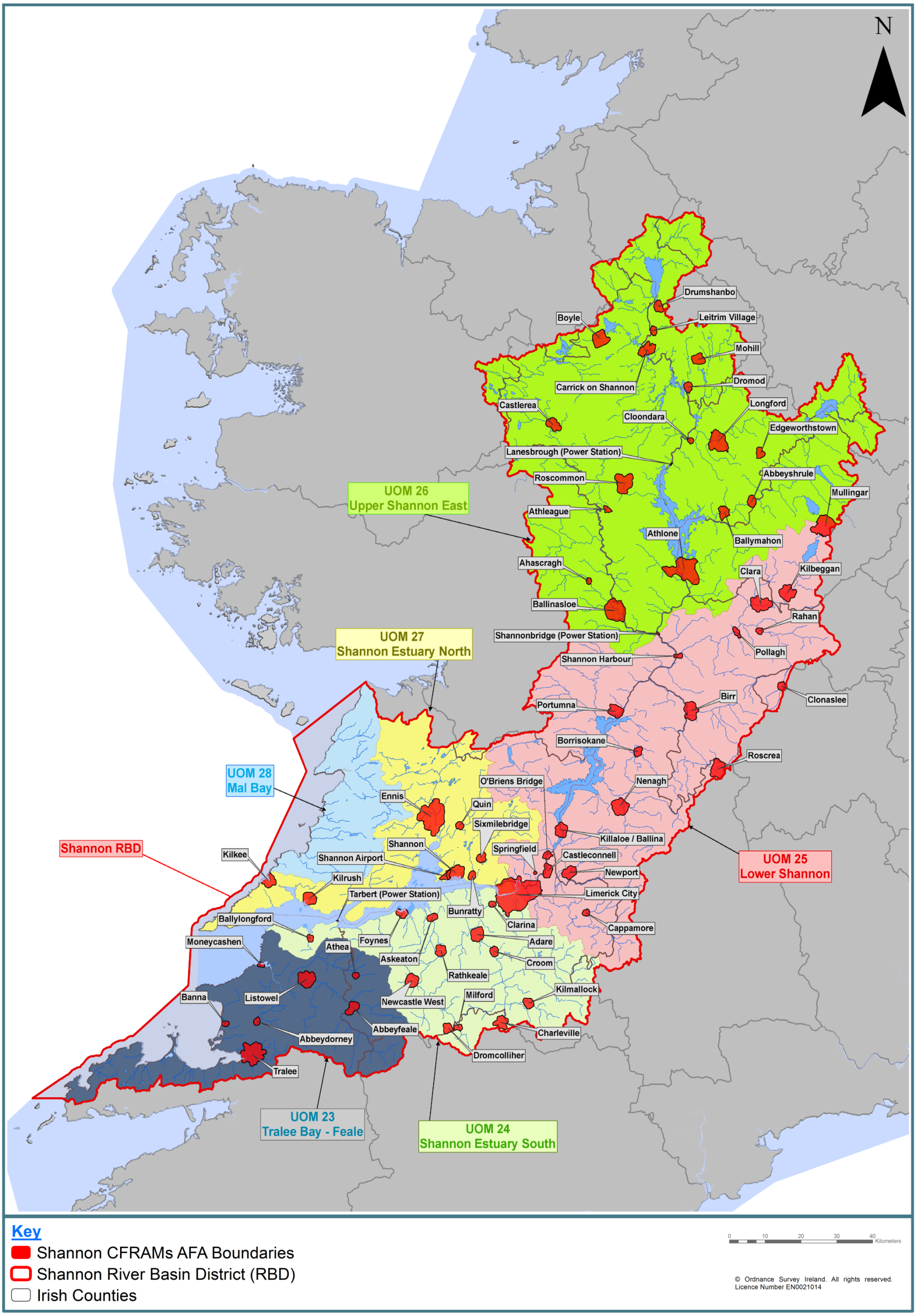

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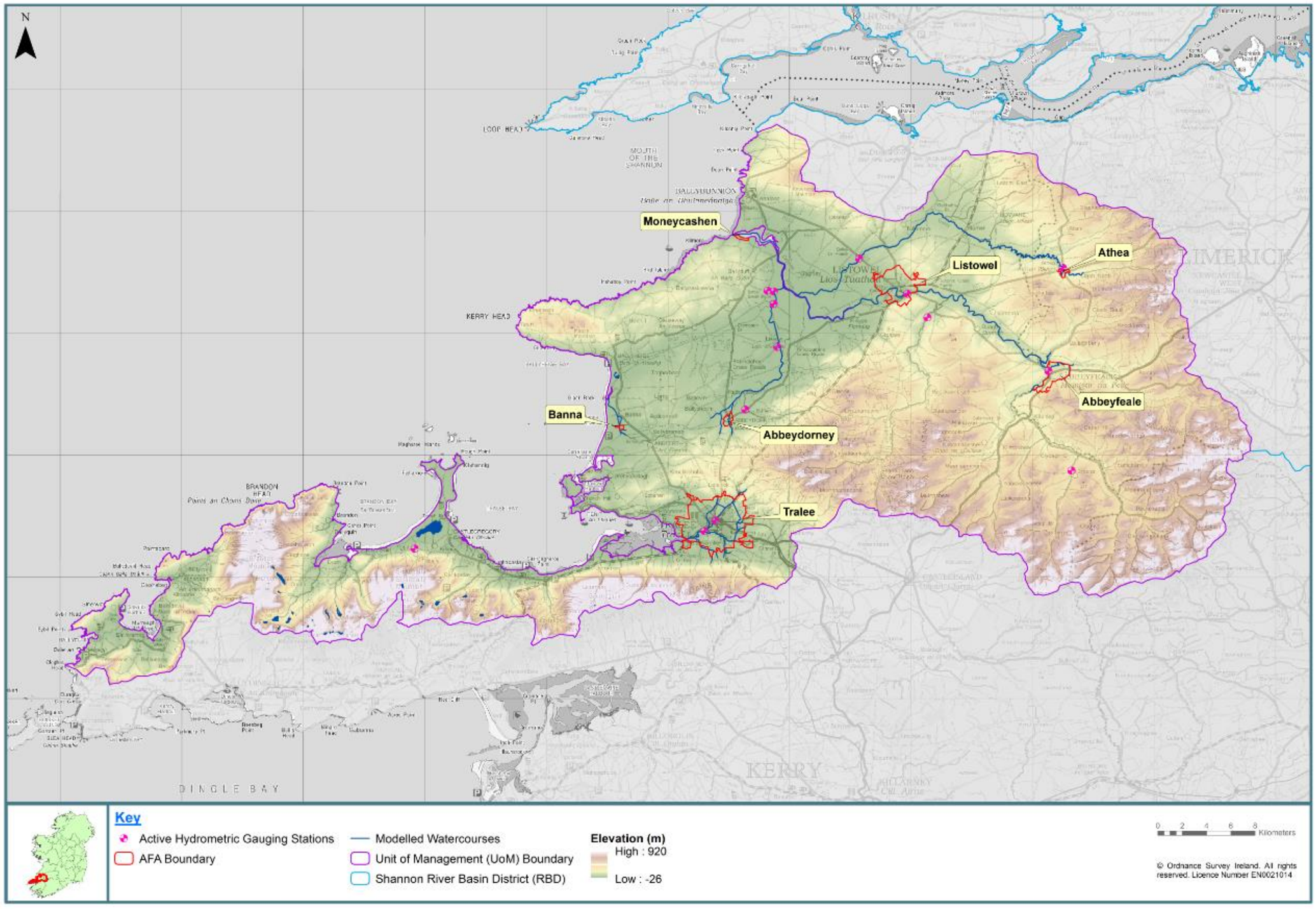
Figure 2.2: The Tralee Bay – Feale River Basin



2.2 TOPOGRAPHY, GEOLOGY, SOILS AND GROUNDWATER

2.2.1 Topography

The Tralee Bay – Feale River Basin is bounded on the northwest by the mouth of the Shannon Estuary and on the east and southeast by the Mullaghareirk Mountains. Along the southern boundary from east to west are the Glanaruddery Mountains and the Slieve Mish Mountains which extend into the Dingle Peninsula.

The Slieve Mish Mountains and Stack's Mountains surround the River Basin's largest AFA, Tralee. The main rivers flowing through Tralee are the River Lee and the Big River.

The Feale sub-catchment dominates this River Basin. Its main watercourse is the River Feale which rises in the Mullaghareirk Mountains and flows in a north-westerly direction before flowing into the River Cashen and then the Shannon Estuary.

The western area along the Atlantic coast (Ballyheige Bay) is a mainly low lying area which is protected by an extensive coastal dune system; the Akeragh Lough Drainage District which discharges into the Atlantic at an outfall in Blackrock approximately 3km north of Banna.

A visual representation of the topography across the River Basin is provided in Figure 2.2.

2.2.2 Geology, Soils and Groundwater

The Tralee Bay – Feale River Basin comprises a variation of poorly drained soil, alluvium and peat.

The dominant aquifer group in the River Basin is the 'locally important aquifer' group. The lower Feale sub-catchment consists of locally and regionally karstified aquifers. Some scattered poor aquifers are also observed near the periphery of the River Basin.

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

2.3 LAND USE AND LAND MANAGEMENT

2.3.1 Urban areas (population and distribution)

As outlined in section 2.1 there are 7 AFAs within The Tralee Bay – Feale River Basin which are summarised in Table 2.1 and Figure 2.2. AFAs (and IRRs) are the towns, villages and significant infrastructure appraised by the CFRAM Study and reported upon within this Plan. The population for each AFA is also provided in Table 2.1. This information was obtained from the 2011 census data.

Table 2.2: Areas for Further Assessment in the Tralee Bay - Feale River Basin (2011 Census)

Sub-Catchment	Areas for Further Assessment (AFAs)	Town Population in 2011
Tyshe Sub-Catchment	Banna	732
Feale Sub-Catchment	Abbeydorney	244
	Abbeyfeale	1940
	Athea	377
	Listowel	4338
	Moneycashen	-
Lee (Kerry) Sub-Catchment	Tralee	25,744

2.3.2 Land cover and land use

Agriculture is the primary land use in the Tralee Bay – Feale River Basin and this is reflected in the area's settlement patterns. The Tralee Bay – Feale River Basin is split into 3 sub-catchments.

The Feale sub-catchment is predominantly rural. The Tyshe sub-catchment is also almost completely rural with the village of Banna located on the River Tyshe. Finally, the Lee sub-catchment varies from rural at the upstream extent, to urban on the downstream extent with the significant urban development of Tralee.

Further details on land use and land use management in the Tralee Bay – Feale River Basin is provided in Appendix B.

2.3.3 Potential Future Land Use Changes

The County Development Plans for Kerry, Limerick and Cork outline the town population allocation growth, the number of houses required and the town area required for population growth for the AFAs located in the Tralee Bay – Feale River Basin.

The Local Area Plans identify different development zones for the various AFAs. These zones include retail, conservation, industrial, mixed use, open space and strategic residential reserve.

The County Development Plans and the Local Area Plans can be viewed on the County Council Homepage.

Further details on land use and land use management in the Tralee Bay – Feale River Basin is provided in Appendix B.

2.4 HYDROLOGY

2.4.1 Sub-catchments and river networks, estuarine areas and coastlines

Tralee Bay – Feale River Basin is dominated by the Feale sub-catchment which covers 65% of the total River Basin area. The main watercourse in this sub-catchment is the River Feale, along with the minor tributaries of the rivers Brick and Galey.

The Tyshe sub-catchment is the smallest sub-catchment, draining west along the River Tyshe before discharging into the Atlantic Ocean.

The Lee sub-catchment is dominated by the Tralee AFA. There are a number of flashy watercourses draining into Tralee, including the River Lee, with their sources being surrounding Slieve Mish and Stack's Mountain.

Further details on the hydrology of the Tralee Bay – Feale River Basin is provided in Appendix B.

2.4.2 Land Drainage (Inc. Arterial Drainage Schemes, Drainage Districts)

In the low-lying areas of the Cashen sub-catchment there are significant areas of land protected by arterial drainage defences. Some of this protected land is below the peak mean spring tide level. Therefore, these lands are at significant risk of flooding, with a greater than 1 in 2 chance of flooding in any given year, and without these defences would likely not be available for agricultural uses.

In the upstream reaches of the River Galey, works were carried out as part of the arterial drainage scheme. The relevant arterial drainage schemes within the Tralee Bay – Feale River Basin are detailed in Section 2.6.1.

2.4.3 Rainfall Distribution

Annual precipitation within the Tralee Bay – Feale River Basin varies with topography. Rainfall can vary between 1460mm per annum in the upland areas to 1035mm per annum in the low lying areas.

The dearth of sub-daily rainfall records for the catchment severely limited the application of traditional rainfall runoff techniques, when undertaking the River Basin hydrology. Rainfall runoff modelling has therefore been discounted for the Tralee Bay – Feale River Basin.

2.4.4 Hydrometric data availability

The design hydrology approach adopted for the Tralee Bay – Feale River Basin focuses on the use of gauged flow data, supplemented by the Flood Studies Update (FSU) techniques where no flow data is available. There were 24 gauges identified in the River Basin, however, only 4 of these were considered suitable for use in the Shannon CFRAM study. Hydraulic modelling was undertaken at these 4 gauges to produce a revised rating.

A detailed study on the Hydrology of the Tralee Bay – Feale River Basin can be downloaded at the following URL: www.floodinfo.ie/.

Further details on the hydrology of the Tralee Bay – Feale River Basin is provided in Appendix B.

2.5 FLOOD HISTORY

Flooding within the Tralee Bay – Feale River Basin District dating back to the early 20th century is documented in available records. Although gauging station and rainfall data isn't available for this period, anecdotal evidence exists of a major flood event that occurred in November 1916 which resulted in major roads and numerous houses being flooded within the River Lee Sub-catchment. A severe flood event in the same area occurred on the 5th August 1986, with the entire business centre of Tralee being submerged and many roads in the Ballymullen and Castlecountess areas being rendered impassable. A more recent event in the region, occurring from excessive rainfall in September 2015 which resulted in a member of the public being evacuated from their home. Similarly, in September and December 2016, Tralee again experienced significant flooding with properties and roads throughout the town adversely impacted.

Similar events have occurred throughout the River Feale Sub-catchment, with extreme rainfall levels resulting in the flooding of houses, roads, agricultural lands, septic tanks and wastewater treatment plants. The most notable of these occurred in the area of Athea on the 6th August 2008, which impacted at least 12 properties, the R523 roadway and a Wastewater Treatment Plant.

The Tralee Bay – Feale River Basin District is also affected by tidal flooding with a major tidal flood event occurring in Moneycashen in February 2002, where water levels were recorded as their highest in over 80 years.

The Tralee Bay – Feale River Basin hydrological study was undertaken in December 2013. A full outline of the flood history in the River Basin is provided in Appendix B, Section B 3.5, up to December 2013.

Since 2013 there has been significant flooding to Tralee in 2015 and 2016, which are noted above.

2.6 EXISTING FLOOD RISK MANAGEMENT MEASURES

There are no existing flood risk management arrangements for the AFAs/IRRs within this River Basin.

2.6.1 Arterial Drainage Schemes and Drainage Districts

The following Arterial Drainage (AD) Schemes and Drainage Districts (DD) have been completed, and are maintained by the OPW or Local Authority respectively, in the Tralee Bay – Feale River Basin.

- River Feale Catchment Drainage Scheme (AD): Completed 1959, 294 km of Channel and 143 km of Embankment, Benefiting Land Area of 86 km^2.
- Akeragh Lough DD: Kerry County Council.
- Banna DD: Kerry County Council.
- Lough Gill DD: Kerry County Council.

2.6.2 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 and IRRs within the Tralee Bay – Feale River Basin

ID No.	County	Name	Source(s) of flood risk
232632	Limerick	Abbeyfeale	Fluvial
232630	Limerick	Athea	Fluvial
230357	Kerry	Listowel	Fluvial
230341	Kerry	Abbeydorney	Fluvial
232679	Kerry	Moneycashen	Fluvial/Coastal
230345	Kerry	Banna	Fluvial/Coastal
230361	Kerry	Tralee	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:

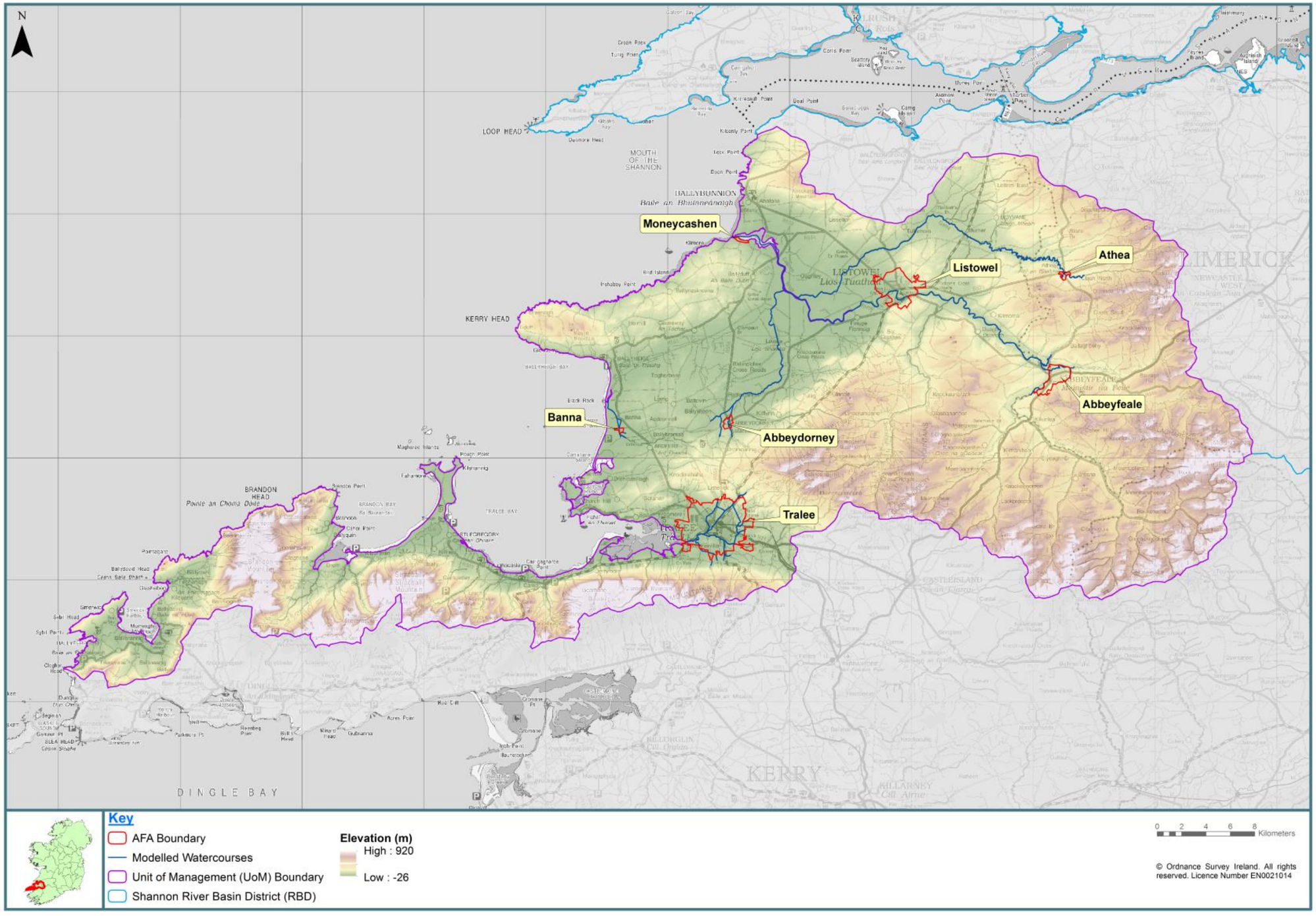
- Rural and dispersed flood risk: The CFRAM Programme has focused on communities at potentially significant flood risk (the AFAs) where the risk was understood to be concentrated and where it is more likely that viable measures could be identified. In the second cycle, it is foreseen that there will 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 Tralee Bay – Feale 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 Tralee Bay – Feale River Basin in the development of this Plan. An overview of the CFRAM consultation stages and structures is provided diagrammatically in Figure 4.1.

Stakeholder and Public Consultation was undertaken at the following stages during the Shannon CFRAM Study.

- Strategic Environmental Assessment (SEA) Scoping Stage.
- Draft Flood Map Preparation Stage.
- Flood Risk Management Objective Stage.
- Draft Flood Map Preparation Stage; Preliminary Option Report Stage; and
- Draft FRMP Stage.

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 Shannon CFRAM Study. 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 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

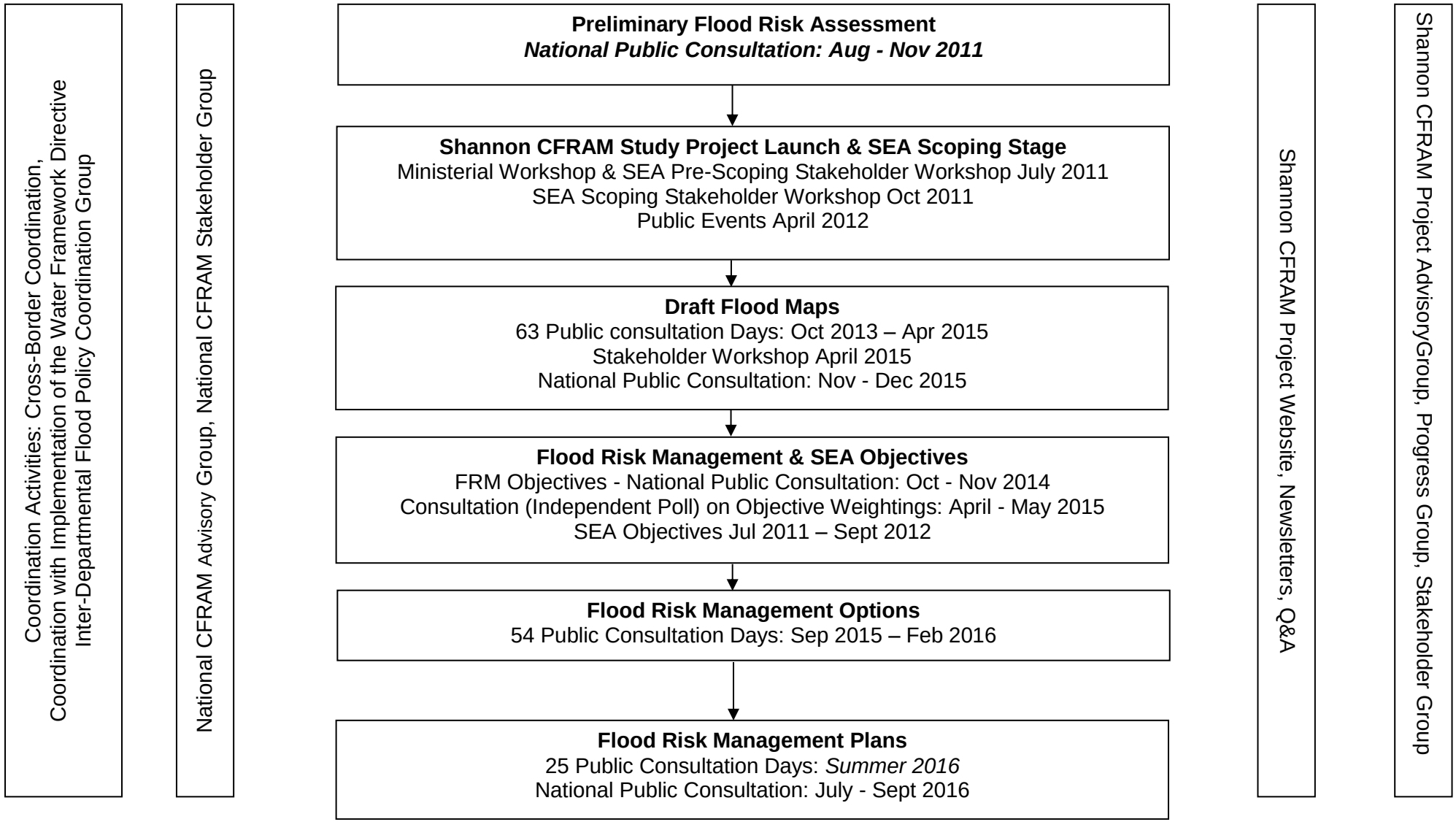
4.3.1 The CFRAM Steering and Progress Groups

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 Programme. 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).

Figure 4.1: Overview of the Shannon CFRAM Consultation Stages and Structures



4.3.1.2 Shannon CFRAM Project Advisory Group

A Project Advisory Group was established for the Shannon CFRAM Project, that includes the Tralee Bay – Feale 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 Advisory Group typically met twice a year.

The membership of this Group is provided in Appendix D.2.

4.3.1.3 Shannon CFRAM Project Progress Group

A Project Progress Group was established for the Shannon CFRAM Project in 2011. This group is a working group that supports the Project Advisory 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 is predominately the same as for the Shannon CFRAM Project Advisory 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 Shannon CFRAM Stakeholder Group was established in 2011, and met on six 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 Shannon CFRAM Project. Members of 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 Shannon CFRAM Project

The Shannon CFRAM Study commenced in January 2011. After the initial data gathering, inception and confirmation of the AFA/IRR phases, a series of public events were held in Athlone on 27th and 28th April 2012. The purpose of the events was firstly to inform the public of progress which had taken place and to outline what the next steps were. Secondly, the events were used to identify what the public's priorities were with regards to flood risk management.

The following three events took place over these two days:

- 27th April: 11am to 2pm at Radisson Blu Hotel. Political Briefing.
- 27th April: 3pm to 7pm at Radisson Blue Hotel. Public Consultation, and
- 28th April: 3pm to 7pm at Athlone Town Centre Shopping Centre.

The Political Briefing was tailored towards political representatives and Teachta Dála's (TD's), and ensured that the attendees were given the opportunity to understand and be informed about the CFRAM Study, ask any questions which they or the communities they represent may have, and receive answers from the Shannon CFRAM Study team. During the Political Briefing attendees were asked to sign in, and one TD and eight elected members attended.

The public events were intentionally held at accessible town centre locations and were open to all members of the public. These public open days allowed participants to gain an understanding of the Study and to speak to members of the Shannon CFRAM Study team. The events aimed to explain what the Shannon CFRAM Study is, the wider CFRAM initiative covering all Ireland, and to demonstrate the Areas of Further Assessment (AFAs) and the Individual Risk Receptors (IRRs).

As the public events were open days, it was not compulsory to sign-in, however the events were attended by community representatives, members of the farming/agricultural community and members of the public.

All participants of the public events were asked to complete a questionnaire in order to identify their prioritisation of flood-related issues as well as how they were informed of the event. 43 questionnaires were completed.

The questionnaire asked respondents whether they lived in an area prone to flooding and whether they had been affected by flooding in the past. 88% of respondents of both the public events had previously been affected by flooding.

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 Shannon CFRAM Project 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 Jacobs 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 Tralee Bay – Feale River Basin were held for consultation on the flood maps at the venues listed in Appendix D.5.

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[6]. 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[7], 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.

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 Tralee Bay – Feale River Basin were held during the option development stage at the venues listed in Appendix D.6.

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

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

4.4.6 Consultation on Draft Plans

The Draft Plan for the Tralee Bay - Feale River Basin was published for the purposes of public consultation on the 15th July 2016. Observations from the public and from relevant Councils were to be submitted to the OPW by the 23rd September and the 17th October 2016 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. The PCDs in the Tralee Bay - Feale 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), the 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).

The River Shannon rises in the Shannon Pot, which is in Northern Ireland, and part of the Shannon Catchment (2.5km^2) is within Northern Ireland. There are however no AFAs within this 2.5km^2 catchment.

As there is only a very small area of the Shannon River catchment within Northern Ireland, and no significant flood risk issues within this area in the River Basin in the Republic of Ireland near the border, then there is limited need and scope for coordination. Notwithstanding this, the Rivers Agency are corresponding members of the Shannon Steering Group, and coordination is maintained on progress and activities through the Cross-Border Coordination Group and the Cross-Border Technical Coordination Group.

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 Programme to determine the extent and nature of flooding in the AFAs within the Tralee Bay – Feale 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

5.1.1 Background to hydrological analysis

Hydrology is the study of available information to determine the volume of flow within a defined river. This process is referred to as the hydrological analysis.

Immediately after project commencement, the hydrological data collection phase started. This was an extensive exercise including requests from OPW, Local Authorities, ESB, Met Éireann, EPA and other stakeholders.

The objective of the data collection was to search, locate and register all potentially relevant information in the following fields;

- Flood Relief / Risk Management.
- Historical Flooding.
- Hydrometry.
- Meteorology.
- Land Uses.
- Soils and Geology.
- Planning and Development.
- Defence and Coastal Protection Assets.
- Existing Survey and Geotechnical Information.
- Environmental, and
- Flood Risk Receptor Information.

During this phase a review of historic flooding within the AFAs/IRRs was also undertaken. The outcomes of this review are presented in Section 2.5.

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.

5.1.2 Design hydrology approach

Gauging stations contain instrumentation which are installed along rivers to record observed water levels. At most gauging stations' rating curves are used to calculate the passing flow from the observed water levels. Calculating flood flows from rating curves, particularly those that represent out-of-bank conditions is often challenging as often there has not been an observed or recorded flood along the river. In these instances, an extrapolation using available observation is needed. Rating curve reviews were undertaken for 4 stations in this River Basin. For these gauging stations hydraulic modelling was undertaken to develop a (revised) rating curve.

Due to a dearth of sub-daily rainfall data, Jacobs' approach to peak design flow estimation in the Shannon River Basin District (RBD) avoids the use of rainfall data and instead uses observations at the gauging stations, the rating curve flows and, supplemented Flood Studies Update (FSU) techniques where no flow data is available.

The peak design flows along the rivers were determined by obtaining an estimation of QMED (the median of the annual maxima flow series). These calculated QMED flows were then adjusted using observations from gauging stations in the vicinity to extrapolate to give peak design flows. The design flows calculated for this study are the 50% (1 in 2), 20% (1 in 5), 10% (1 in 10), 5% (1 in 20), 2% (1 in 50), 1% (1 in 100), 0.5% (1 in 200) and 0.1% (1 in 1000) Annual Exceedance Probability(AEP) events.

If there were no gauging stations within the catchment, the hydrograph shapes were calculated using observations from gauging stations from hydrologically similar catchments.

The calculated flows from the hydrological assessment were calibrated against historic flood information, where available. This was achieved by using the hydraulic models developed for the rivers (reference Section 5.2) to determine the expected extent of flooding for calculated flows. Where necessary, the calculated flows were adjusted through this calibration process.

For more detailed information on the hydrology approach please refer to the Shannon CFRAM Final Hydrology Report: www.floodinfo.ie/.

5.2 HYDRAULIC MODELLING

Hydraulic modelling is a computational process for estimating river water levels and flood extents, using the flows through the hydrological analysis.

Within the Tralee Bay – Feale River Basin there are 145km of river forming the study extents for the 7 AFAs. To maintain accuracy and ensure consistency, 6 hydraulic models were developed to determine the river water levels throughout these study extents. The hydraulic models have the capacity to assess fluvial and tidal flood risk. Table 5.1 provides a summary of the fluvial and coastal models developed for this the Tralee Bay – Feale River Basin. The location and extent of these models can be observed in Figures 5.1 and 5.2.

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.

Table 5.1: List of Hydraulic Fluvial & Coastal Models in The Tralee Bay – Feale River Basin

Model Reference	Model Length (kms)	AFA/IRR Reference	Flood Risk
S14-a	34	Abbeyfeale Listowel	Fluvial
S14-b	35	Moneycashen	Fluvial and Coastal
S14-c	32	Athea	Fluvial
S15	10	Abbeydorney	Fluvial
S16	29	Tralee	Fluvial and Coastal
S17	5	Banna	Fluvial and Coastal

For each hydraulic model outlined in Table 5.1, the watercourses were split into the following types:

- High Priority watercourses (HPW) - Watercourses that could give rise to existing or potential future fluvial or coastal flooding within an AFA.
- Medium priority watercourses (MPW) - Watercourses that could give rise to existing or potential future fluvial or coastal flooding outside of AFAs. River reaches between AFAs, or between an AFA and the sea are also defined as MPWs.

As references in Table 5.1, all of the hydraulic models developed for the Tralee Bay – Feale River Basin were to estimate current and future fluvial design flood levels, depths, velocities and extents. Where possible, the fluvial hydraulic models were calibrated and verified against observed flood events. The models have been run for fluvial design flood events with the following range of annual exceedance probabilities (AEPs):

- 50%, 20%, 10%, 4%, 2%, 1%, 0.5% and 0.1% for existing conditions and for the Mid-Range Future Scenario (MRFS);
- 10%, 1% and 0.1% for the High End Future Scenario (HEFS).

Section 2.5 of this Report details the flood history for The Tralee Bay – Feale River Basin. Using suitable information gathered through this, the variable coefficients and river flows applied to the hydraulic models have been adjusted so that predicted river levels match the historically observed events. Wherever possible, a range of in bank and out of bank events were used for calibration and verification. HPW reaches were verified using this historical data to vertical accuracies of 0.2m while MPW reaches were verified to vertical accuracies of 0.4m. Calibration of the models in some locations was unfeasible due to the lack of gauged data. Under these circumstances photographs and anecdotal evidence of past events was used to verify flood extents generated by the hydraulic models.

Table 5.1 confirms that 3 of the 6 hydraulic models developed for the Tralee Bay – Feale River Basin, were to estimate coastal flood risk which comprises a combination of high tide and surge and/or wave overtopping. The information used to determine these peak tidal levels is from the Irish Coastal Protection Strategy Study (ICPSS). These peak levels along with tidal gauge level data (2003-2007) collected from the Shannon Foynes Port Company at Foynes, Carrigaholt and Limerick along the Shannon Estuary were used to produce design tidal hydrographs. The design tidal hydrographs were used to inform downstream boundary conditions for the relevant hydraulic models.

The Irish Coastal Wave & Water Level Modelling Study (ICWWS) was also used to highlight coastal locations potentially vulnerable to wave overtopping for the South Western coast and the Shannon estuary.

For detailed hydraulic information please refer to the Hydraulic report which can be downloaded at: www.floodinfo.ie.

Figure 5.1: The Tralee Bay – Feale River Basin including all AFAs and all HPWs/MPWs

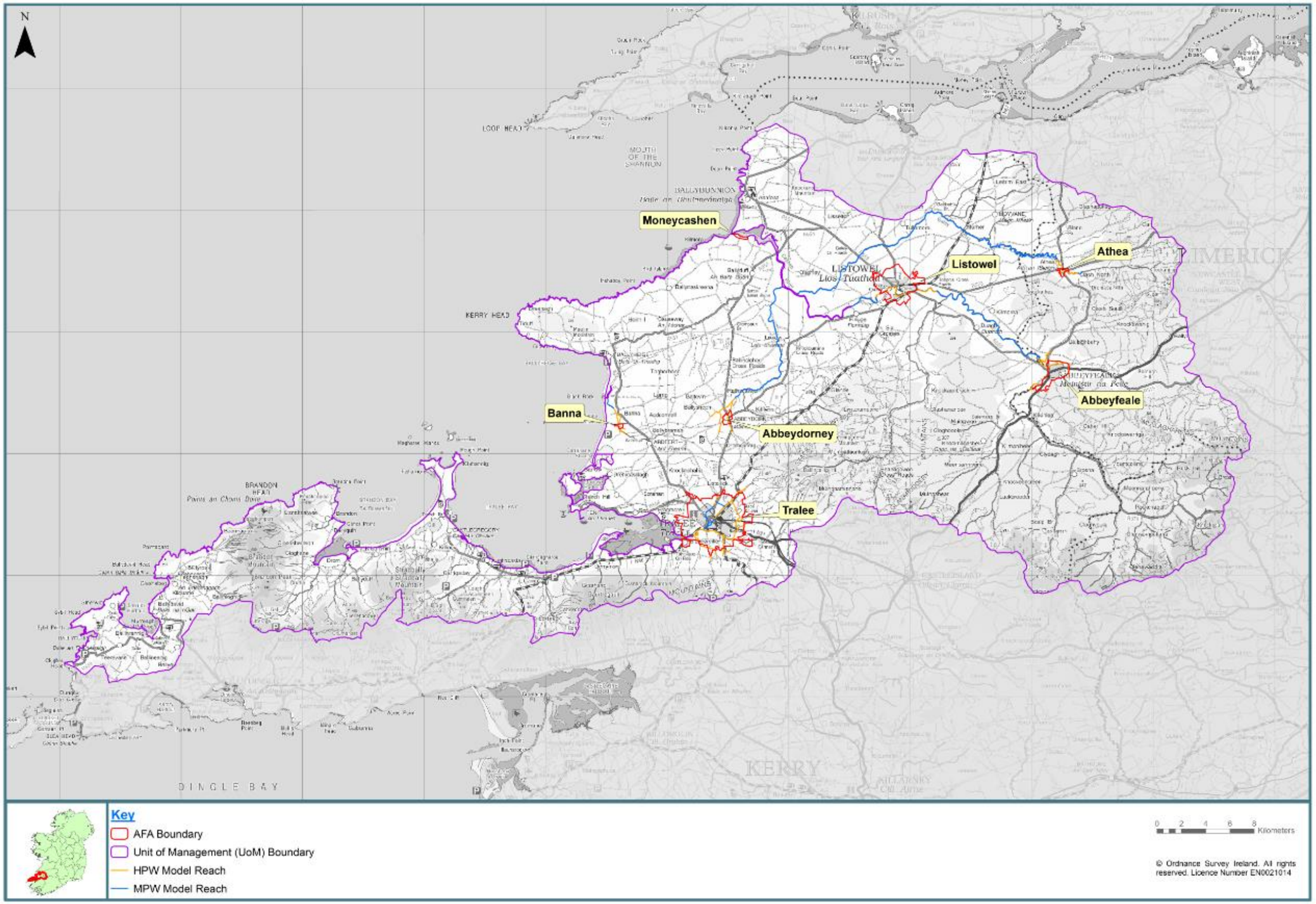
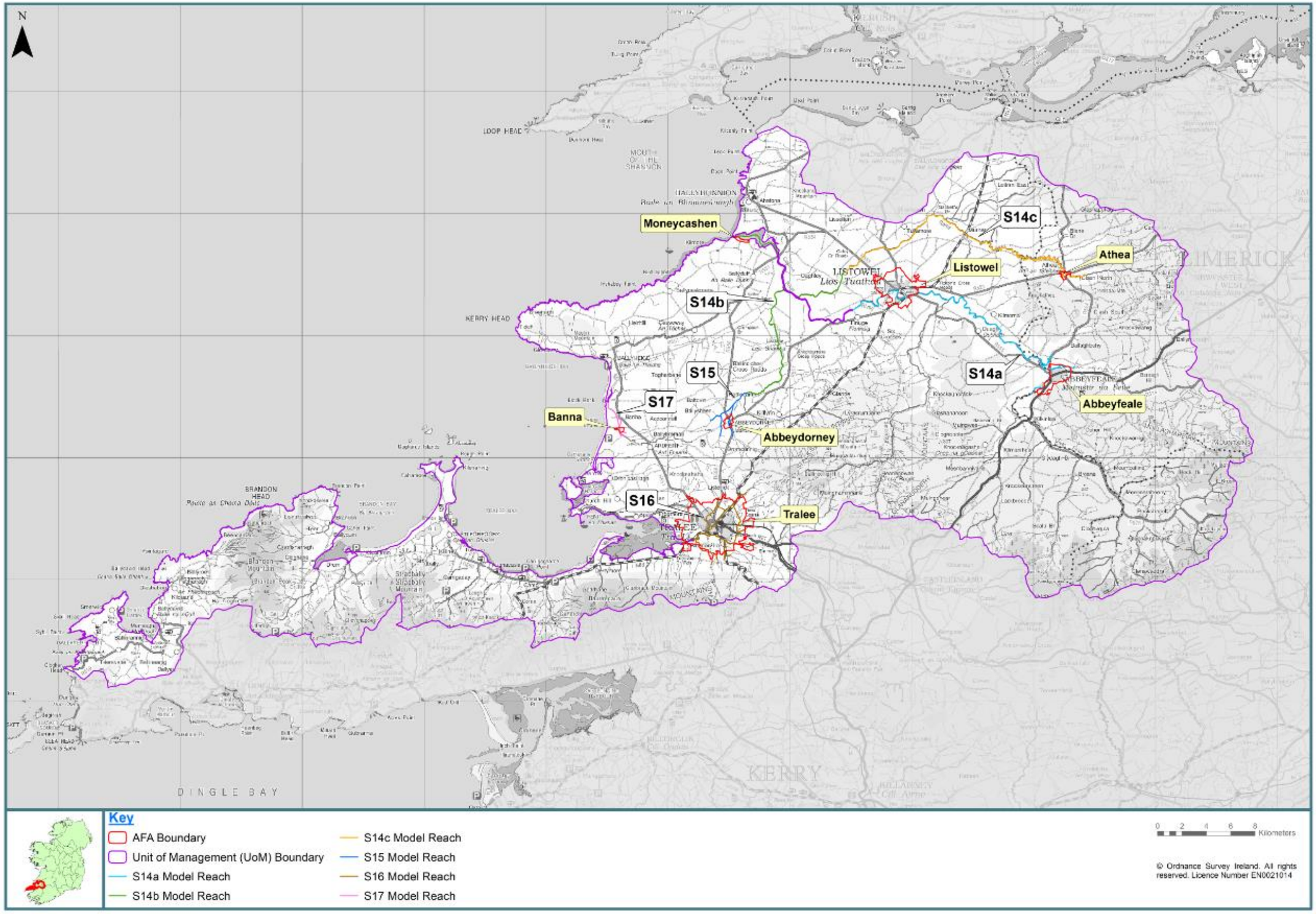


Figure 5.2: The Tralee Bay – Feale River Basin including the Model Areas



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 to 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[8].

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.

The maps produced fall into one of the following five types:

- Flood extent: These maps show the extent of flooding associated with a design flood event for a given annual probability. Additional information such as tabulated peak flows and water levels are also shown.
- Flood zone: These maps show flood zones A and B as defined by the Guidelines on the Planning System and Flood Risk Management (DoEHLG/OPW, 2009).
- Flood depth: These maps show the depths of flooding associated with a design flood event for a given annual probability.
- Flood velocity: These maps show the velocities of floodplain flows associated with a design flood event for a given annual probability, and
- Flood hazard: These maps show the hazard (or 'risk to people') associated with a design flood event for a given annual probability of as a function of the depth and velocity.

As outlined in Section 5.2 hydraulic models have been run for eight AEPs. Extent and depth outlines for all eight AEPs were developed, however, only selected AEPs were displayed on the maps. The AEPs presented on each map, described above, are outlined in section 5.3.1 to 5.3.5 below.

5.3.1 Flood Extent Maps

Fluvial flood extent maps show the 10%, 1% and 0.1% Annual Exceedance Probability (AEPs), and are coloured respectively using a transparent fill from dark blue to light blue. Also shown on the maps are points along the river centreline, with a table of water level and flows for 10%, 1% and 0.1% AEP.

[8] DoEHLG/OPW 2009: Guidelines on The Planning System and Flood Risk Management

Areas benefiting from defences are shown by a grey hatched area. The flows represent the modelled flow and not those calculated by the hydrological analysis.

Tidal flood extent maps show the 10%, 0.5% and 0.1% AEP events and are coloured respectively using a transparent fill from dark green to light green. Water levels are given at points on the maps for the 10%, 0.5% and 0.1% AEP respectively.

A separate set of wave overtopping maps were produced for those areas identified as being vulnerable from wave overtopping. These areas included the 10%, 0.5% and 0.1% AEP and are coloured using a transparent fill with dark green to light green with an arrow hatch.

5.3.2 Flood Zone Maps

Flood zone maps show flood zones A and B to facilitate implementation of the Guidelines on the Planning System and Flood Risk Management (DoEHLG & OPW, November 2009). These maps are based on the undefended scenario runs for the flood events as mentioned above. The flood zone maps are generated using the outer flood extent associated with undefended runs.

5.3.3 Flood Depth Maps

Flood depth maps show the resulting peak depths predicted for a specified AEP.

The map borders, features and general components of the depth maps are the same as the flood extent maps. The key features particular to the depth maps are:

- The 10%, 1% and 0.1% AEPs are shown on individual maps.
- Flood depths are shown on the map in six graduated classes, coloured light blue to purple for low to high depths respectively.

5.3.4 Velocity Maps

Flood velocity maps are only provided for reaches within the AFAs and show the peak velocities for a specified AEP.

The key features particular to the velocity maps are:

- The 10%, 1% and 0.1% are shown on individual maps.
- Flood velocities are shown on the map in five graduated classes, coloured light purple to dark purple for low to high velocities respectively.

5.3.5 Flood Hazard Map

Flood hazard function maps have been created to show the risk to people which may be experienced for a particular flood event. This was calculated as a function of the depth and velocity of the flood waters. The Shannon CFRAM Study used the methodology and concept set out in the Defra / EA guidance Flood Risks to People Phase 2 Study to calculate flood hazard without a debris factor. The flood hazard function maps were created by calculating the hazard from the depth and velocity grids, as follows:

Hazard = depth × (0.5 + velocity)

The key features particular to the velocity maps are:

- The 10%, 1% and 0.1% are shown on individual maps, and
- Flood Hazards are shown on the map in five graduated classes, coloured white to red for low to high hazards respectively.

5.3.6 Consultation

A national consultation exercise on the Draft Flood Maps was launched in November 2015 which superseded a round of 7 Public Consultation Days. All comments and objections received have been considered and where necessary changes made in developing the Final Flood Maps.

For the Final Flood Maps please see www.floodinfo.ie. For further information on public consultation and engagement see Section 4.4.3.

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).

5.4 FLOOD RISK ASSESSMENT AND MAPPING

Along with the flood hazard maps, a set of general and specific risk maps are provided. These risk maps indicate social, environmental, cultural and economic receptors at risk of flooding. The risk maps are described in Table 5.2 below.

Table 5.2: Summary of General and Specific Flood Risk Maps

Map Type	Map Description
General Risk – Social	Map outlining the following receptors at risk in the 10%, 1% (and 0.5% for coastal areas) and 0.1% AEPs; • High Vulnerability Sites • Social Infrastructure Assets • Social Amenity Site
General Risk – Environmental	Map outlining the following receptors at risk in the 10%, 1% (and 0.5% for coastal areas) and 0.1% AEPs; • IED Sites • WFD Annex IV Sites • Sites of Environmental Value
General Risk – Cultural Heritage	Map outlining Cultural Assets at risk in the 10%, 1% (and 0.5% for coastal areas) and 0.1% AEPs;
General Risk – Economy	Map outlining the following receptors at risk in the 10%, 1% (and 0.5% for coastal areas) and 0.1% AEPs; • Transport Infrastructure • Utility Infrastructure
Specific Risk – No. Inhabitants	Separate maps provided for the 10%, 1% (and 0.5% for coastal areas) and 0.1% AEP which illustrated the indicative number at risk per Hectare
Specific Risk – Type of Activity	Map provided at River Basin scale indicating the following type of activity at risk of flooding within each AFA; • Property • Infrastructure • Rural Land Use • Economic
Specific Risk – Risk Density	Separate maps provided for the 10%, 1%(and 0.5% for coastal areas) and 0.1% AEP which illustrated the Annual Average Damages at risk per Hectare. A definition of the Annual Average Damages is provided below.

In assessing the economic risk of flooding, the Annual Average Damages are calculated as the damages to the residential and non-residential properties at risk of flooding using the methodologies set out in the Flood Hazard Research Centre Handbook of 2010 (FHRC, 2010) and the Multi-Coloured Manual" of 2005 (FHRC, 2005). The Net Present Value Damages (NPVd) are the sum of discounted annual average damages over 50 years.

When calculating the number of properties at risk of flooding the method adopted for the Tralee Bay – Feale River Basin plan was that the property centroid must lie within the appropriate AEP flood extent to be counted and to therefore contribute a NPVd.

Table 5.3 presents a summary of the current flood risk within the Tralee Bay – Feale River Basin.

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

Table 5.3: Summary of Flood Risk in the Tralee Bay – Feale 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	
Abbeyfeale	2	10	2	2	€0.29
Listowel	137	150	23	24	€13.04
Moneycashen	5	7	0	0	€0.73
Athea	12	19	3	5	€0.81
Abbeydorney	4	8	5	6	€2.04
Tralee	488	828	229	390	€50.95
Banna	19	25	0	0	€3.39

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

Note 2: NPVd = Net Present Value Damages (accumulated, discounted damages over 50 years) The values provided are Uncapped i.e. the damages have not been capped to the value of the properties impacted.

The numbers of properties at risk and the damage values set out in Table 5.3 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.

The number of properties presented in the table are determined independently for each source (fluvial and coastal). For AFAs at risk of both sources, some properties may be predicted to be at risk from both sources, and such properties have been included in the numbers for both sources.

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 5.4.

Table 5.4: 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 Tralee Bay – Feale 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.

6. ENVIRONMENTAL CONSIDERATIONS

6.1 OVERVIEW

The Plan for the Tralee Bay – Feale 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[9]. This Section provides a description of the process used to ensure that the environmental considerations within the Tralee Bay – Feale 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 (Vol. III), 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 (Vol. II) 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)[10].

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 Natural 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 can not 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 Assessment and / or Appropriate Assessment, must be undertaken in accordance with the relevant legislation where relevant as part of the progression of measures

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

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 7.7). Flood relief schemes and works proposed or progressed through other projects and plans 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.

A summary of the environmental submissions is included in the SEA Conclusion Statement.

6.2 ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES IN THE TRALEE BAY – FEALE RIVER BASIN

The Tralee Bay – Feale River Basin is an area of significant biodiversity, architectural and archaeological heritage and landscape value and its watercourses and estuaries provide a range of services, including drinking water, port functions, fisheries, habitat for flora and fauna, industry including power generation and tourism and amenity.

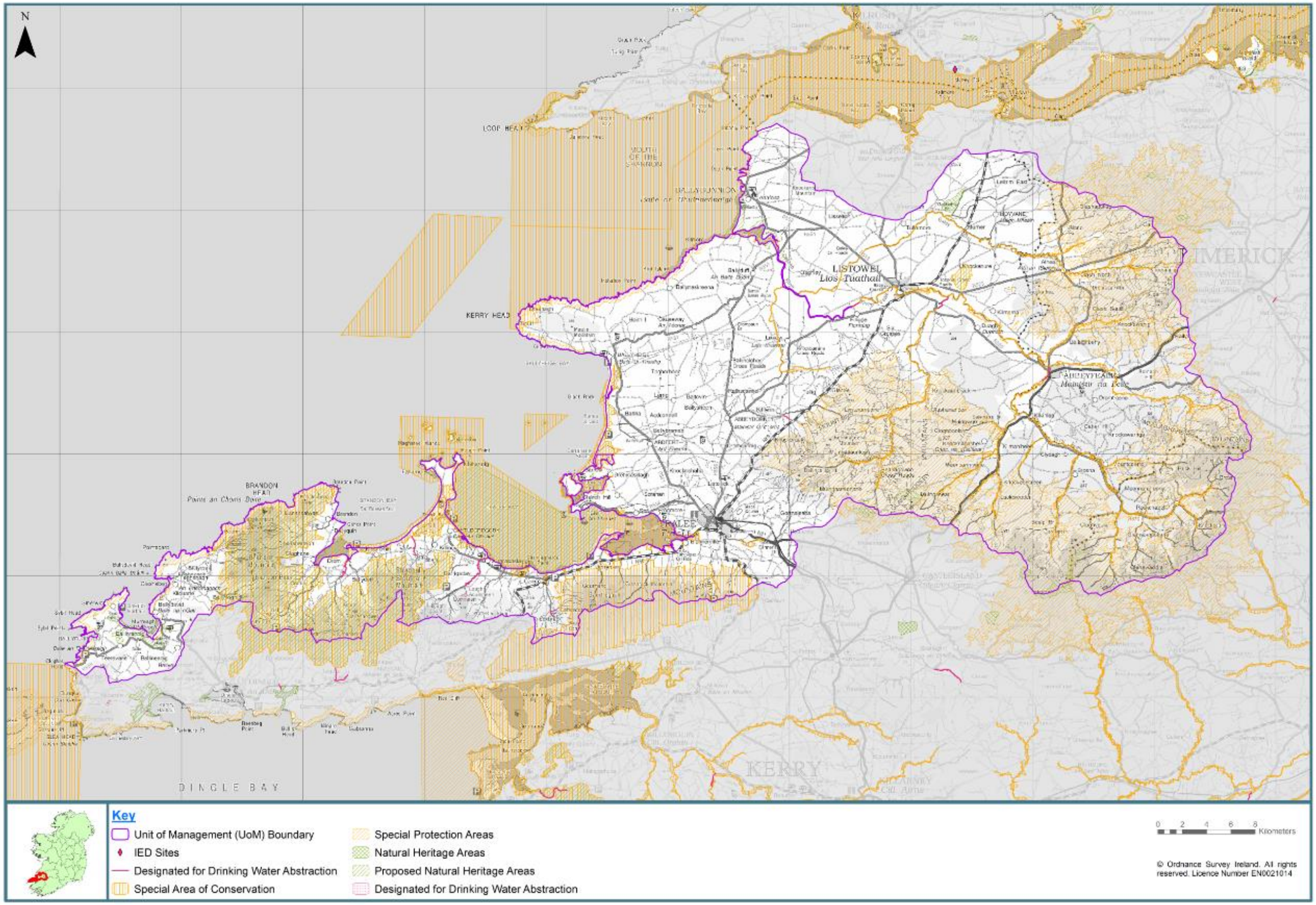
Many of the environmental features within the catchment, such as designated nature conservation sites: Special Areas of Conservation (SAC) and Special Protection Areas (SPAs), National Monuments in State Care, Recorded Protected Structures (RPS), protected views and scenic routes, receive protection under international/national legislation or local planning policy.

Many of these environmental features located within the 1% fluvial and/or the 0.5% coastal AEP flood extent for the Tralee Bay – Feale River Basin, are at risk from flooding or potentially affected by proposed flood risk management measures. These features have been specifically considered during the preparation of the Plan for the Tralee Bay – Feale River Basin. The development of the Plan for the Tralee Bay – Feale River Basin has incorporated relevant environmental issues, constraints and opportunities within the plan-making process; it has taken into account the sensitivity and value of relevant environmental features identified through the MCA and the SEA.

Figure 6.1 shows a number of key constraints within the Tralee Bay – Feale River Basin including SAC, SPA, Natural Heritage Areas (NHA), proposed NHAs and Industrial Emissions Directive (IED) sites.

The SEA Environmental Report is available on the OPW website at the following URL; www.floodinfo.ie.

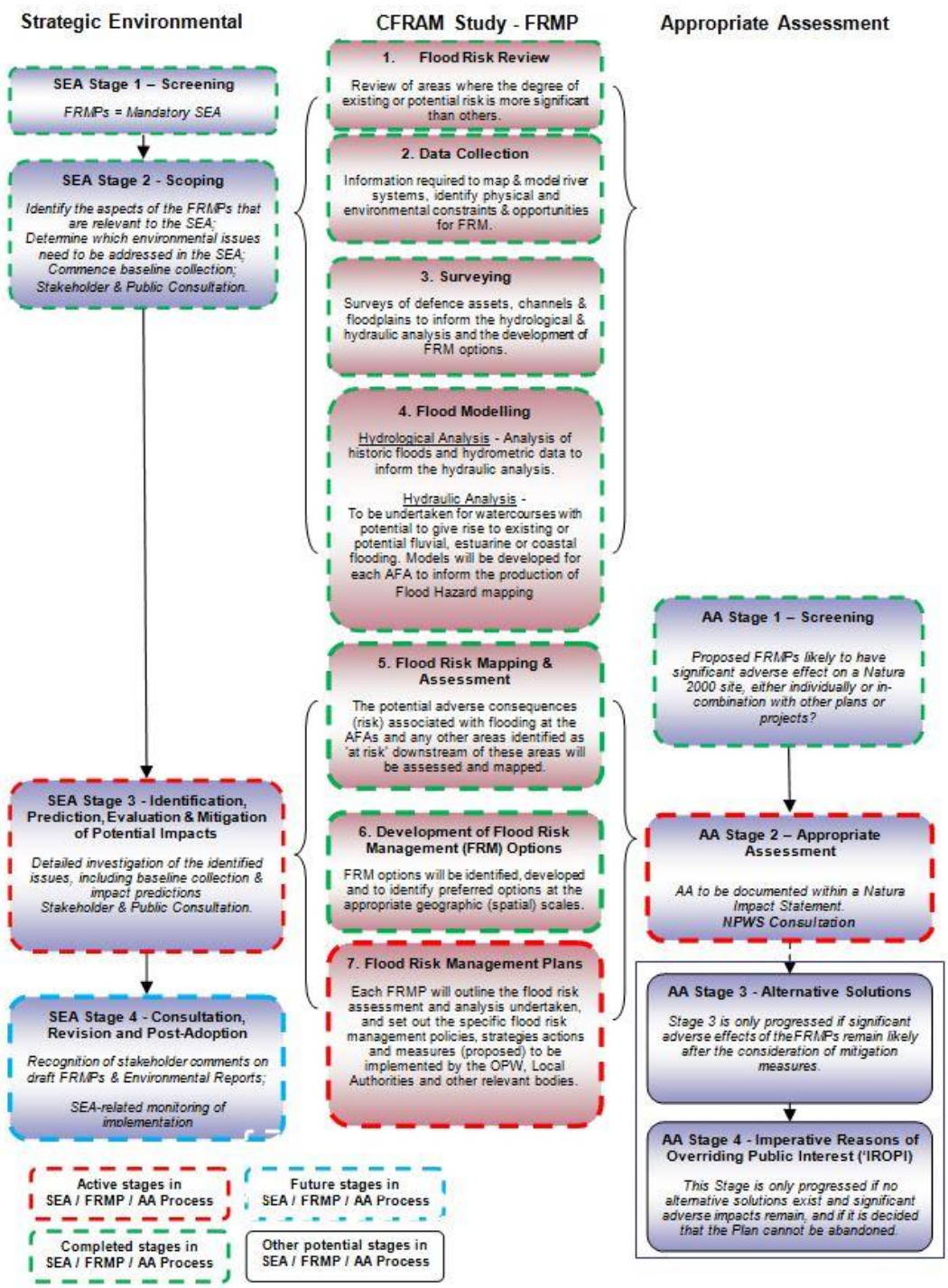
Figure 6.1: Some Key constraints within the Tralee Bay – Feale River Basin



6.3 STRATEGIC ENVIRONMENTAL ASSESSMENT

The approach to the SEA and AA on the Plan has drawn from Irish and international best practice guidance building on the SEA carried out for the pilot CFRAM studies i.e. the Lee CFRAM. The SEA and the AA is a multi-staged process as shown in Figure 6.2, feeding into the Plan development at key stages of its development.

Figure 6.2: The interactions and stages of the FRMP, SEA and AA Processes



The SEA process can be broken down into four stages. These stages are defined as:

- Stage 1 Screening: deciding whether or not SEA is required.
- Stage 2 Scoping: establishing the spatial and temporal scope of the SEA and a decision-making framework that can be used to evaluate impacts.
- Stage 3 Identification, Prediction, Evaluation and Mitigation of Potential Impacts of the plan and consideration of alternatives, and
- Stage 4 Consultation, Revision and Post-Adoption. This includes the implementation of statutory SEA monitoring.

All SEA stages included consultation with stakeholders and the public. More information on the processes involved outlined in the following sections.

6.3.1 Stage 1: Screening

Screening was completed by the OPW and concluded that a SEA was required for all Plans under the CFRAM programme..

6.3.2 Stage 2: Scoping

The Scoping of the SEA was undertaken over the period 2011 and 2012. The output of this stage was the Shannon CFRAM Study SEA Scoping Report describing the environmental characteristics of the Shannon River Basin District (RBD) and its individual River Basins including the Tralee Bay - Feale River Basin. In addition, this report presented the initial understanding of the key environmental issues relating to flood risk and its management within the Tralee Bay - Feale River Basin. The Scoping Report was published for consultation in September 2012 and was made available on the project website www.floodinfo.ie, with comments invited until December 2012.

6.3.3 Stage 3: Identification, Predication, Evaluation and Mitigation of Potential Impacts

This stage included the production of the SEA Environmental Report which identified, described and evaluated the likely significant environmental effects of the Plan for the Tralee Bay – Feale River Basin. Within this report there is an identification of the flood risk management options, the effects, potential mitigations and monitoring requirements. The SEA has identified that the proposed flood risk management options could give rise to a number of permanent positive environmental effects, but also some temporary and permanent negative environmental effects. For all identified negative effects, mitigation measures are proposed to be taken forward to the next stage of detailed option development in order to avoid or reduce the predicted effects. The SEA Environmental Report is available on the OPW website at the following URL; www.floodinfo.ie.

6.3.4 Stage 4: Consultation, Revision and Post-Adoption.

Following the consultation on the draft Plan for the Tralee Bay – Feale River Basin and the SEA Environmental Report, all comments were reviewed and the potential for changes required to the Plan were considered and actioned as appropriate. An assessment of the implications of these changes upon the SEA was undertaken to complete the SEA process, with any additional or supplementary assessment work carried out as appropriate.

6.4 APPROPRIATE ASSESSMENT

An 'appropriate assessment' (AA) of the impacts of the plan for the Tralee Bay - Feale River Basin on the sites of European nature conservation importance, (Natura 2000), within the Tralee Bay - Feale River Basin and beyond (as applicable) has also been undertaken. This specific assessment considers whether the recommendations of the plan are likely to have an effect on the ecological integrity of these sites. The AA process is defined by the following four stages:

- Stage 1: Screening.
- Stage 2: Appropriate Assessment.
- Stage 3: Alternative Solutions, and
- Stage 4: Imperative Reasons of Overriding Public Interest (IROPI).

It was concluded that the plan for the Tralee Bay – Feale River Basin, in-combination with other plans or projects, could have likely significant effects on the Qualifying Interests (Qis) of 7 cSACs and 4 SPAs. This includes the Lower River Shannon cSAC, Tralee Bay cSAC and the Tralee Bay SPA. Therefore, an NIS was required, to inform the AA, which was developed on behalf of the OPW, as proponent and Competent Authority.

Likely significant effects from the Plan, identified during Screening, and including any in-combination effects, have been assessed to determine whether they could adversely affect the "integrity" of any European site(s), with respect to its conservation objectives. Where adverse effects to integrity are identified (or there is reasonable scientific doubt), mitigation measures are proposed to reduce them below the threshold where they affect integrity. This is documented within the NIS, which informs the AA determination by the Competent Authority, the OPW.

The NIS for the Tralee Bay - Feale River Basin concluded that, with mitigation in place, the Plan would have no adverse effects on the integrity of any European sites. On that basis, the OPW has undertaken the AA and, considering the mitigation to be applied at the project level, has concluded that the Plan for the Tralee Bay - Feale River Basin would have no adverse effects on the integrity of any European sites; therefore Stages 3 or 4 are not required. The progression of any measure towards the implementation of flood relief works or a 'Scheme' will, however, be subject to project-level Screening for Appropriate Assessment and where required an Appropriate Assessment will be undertaken

The results of the AA are reported in Appendix E of the SEA Environmental Report. The SEA Environmental Report is available on the OPW website at the following URL; 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, Community 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.

6.5.2.4 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.

6.5.2.5 '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 can not 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, 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 can not 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 (SEA) and Appropriate Assessment (AA), 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 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 / Detailed Design

For the detailed design 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 detailed design 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[11].
- Ornithological surveys.
- Bat surveys.
- Fish surveys.

[11] *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,*
- *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*.

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

Where necessary, Wildlife Derogation Licences and archaeological licences will be sought from Dept. of Culture, Heritage 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[12].

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.

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[12] *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 Tralee Bay – Feale 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 Tralee Bay – Feale River Basin is set out in the Preliminary Options Report for the Shannon 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.

The methods described above, and measures to manage flood risk that combine these methods, can be applied at a range of spatial scales.

For the Tralee Bay – Feale River Basin the following Spatial Scales of Assessment (SSA) have been appraised for Flood Risk Management Options;

- River Basin (Tralee Bay – Feale River Basin): The hydrological division of land defined for the purposes of the Floods Directive. The Tralee Bay – Feale River Basin comprises 3 sub-catchments.
- Sub-catchment (SUB): A sub-catchment refers to the catchment of the principal river, including areas upstream and areas downstream to the river's discharge into another, larger river or into the sea.
- Area for Further Assessment (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 is required to determine the degree of flood risk, and develop measures to manage and reduce the flood risk.

Table 7.1 and Refer to Figure B.1 summarise the different Spatial Scales of Assessment (SSA) adopted for the Tralee Bay – Feale River Basin.

Table 7.1: List of SSA in the Tralee Bay – Feale River Basin

Sub-Catchment	AFA	Flood Risk
Feale	Moneycashen	Fluvial and Coastal
	Abbeyfeale	Coastal
	Listowel	Coastal
	Abbeydorney	Coastal
	Athea	Coastal
Tyshe	Banna	Fluvial and Coastal
Lee	Tralee	Fluvial and Coastal

The process for developing and appraising potential flood risk management options as described herein is hence undertaken at both the catchment or sub-catchment level, and 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 Step1: 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 option, 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, and,
- 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 Tralee Bay – Feale 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 Options

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 Jacobs.
- 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 Tralee Bay – Feale 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 proposed 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 Tralee Bay – Feale 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:	**IEGBNISH-23-9011-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:	**IEGBNISH-23-9012-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:	**IEGBNISH-23-9052-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 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:	**IEGBNISH-23-9013-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:	**IEGBNISH-23-9020-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:	**IEGBNISH-23-9051-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

There is one Arterial Drainage Scheme within the Tralee Bay – Feale River Basin, namely the River Feale C.D.S, as 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, and 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 Tralee Bay – Feale River Basin, namely the Akeragh Lough D.D, Banna D.D and Lough Gill D.D as shown in Figure B.3. 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, and
- 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, Community 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:	**IEGBNISH-23-9031-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:	**IEGBNISH-23-9032-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:	**IEGBNISH-23-9033-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

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:	**IEGBNISH-23-9053-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

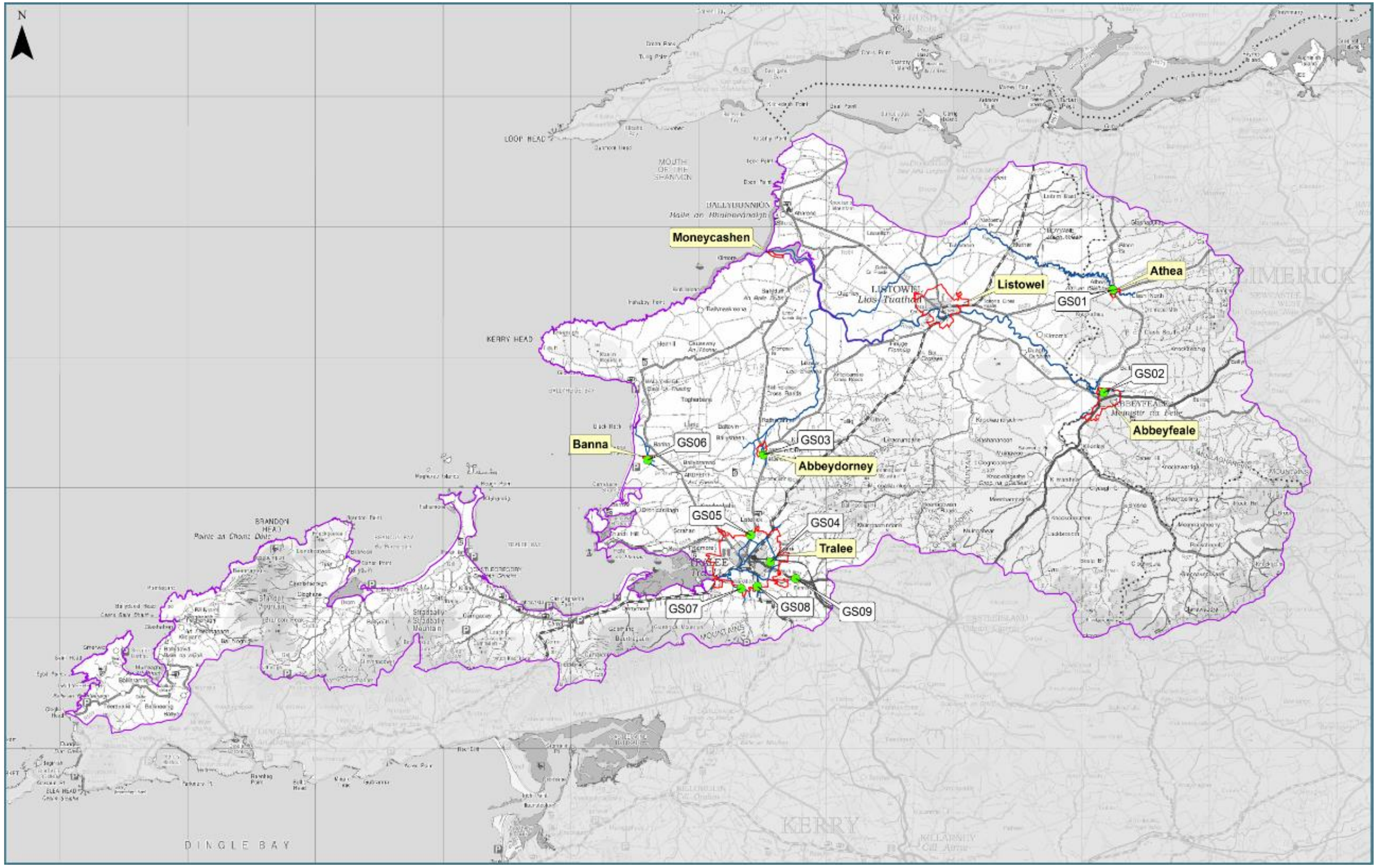
Ongoing collection and, where appropriate, publication of hydrometric and meteorological data, and data on flood events as they occur, will help us to continually improve our preparation for, and response, to flooding.

Measure Name:	Flood-Related Data Collection
Code:	**IEGBNISH-23-9041-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)

Across the Tralee Bay – Feale River Basin, there is a varying degree of certainty on the flood risk assessment, due to an inconsistent distribution of the catchment gauging stations.

Additional gauging stations are to be considered along watercourses where there is historical evidence of flooding or properties are counted as being 'at risk' in the 1% fluvial / 0.5% tidal AEP event. Figure 7.4 identifies indicative locations where gauging stations are required.

Figure 7.4: Location of Required Gauging Stations



7.4.2 Catchment / Sub-Catchment Measures

Only methods that can provide benefits to multiple AFAs within the sub-catchments and other areas are considered at this spatial scale.

In the Tralee Bay – Feale River Basin there are 3 sub-catchments namely;

- Feale,
- Tyshe, and
- Lee.

In both the Lee and Tyshe subcatchments there is only a single AFA. Therefore, there are no viable measures which can provide benefits to multiple AFAs in these sub-catchments.

For the Feale sub-catchment, Storage, Flow Diversion, Increased Conveyance, Flood Defences and Other Measures, were considered unviable because they did not provide benefits to more than a single AFA.

Although there were no viable structural measures there are certain prevention and preparedness measures related to flood risk management, as described in Section 7.2. above, that form part of wider Government policy. These measures, including Flood Forecasting and Warning and Promotion of Individual and Community Resilience/Public Awareness are considered at River Basin scale (refer to Section 7.4.1).

7.4.3 Listowel AFA Measures

Description of Measure

Potentially viable flood relief works for Listowel that may be implemented after project-level assessment and planning or Exhibition and confirmation might include:

- Increase the height of 0.9km of existing embankments and raise approximately 30m of road in order to eliminate flood risk to the properties within the 1% AEP event.
- Flood forecasting to allow the community/local authority to ensure that the amenity walkway along the river is cleared and appropriate pedestrian diversions are in place.
- Existing maintenance regime for the Feale along with a maintenance programme for the improved and existing defences.

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

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

Summary of Public Consultation Outcomes

Fifteen members of the public attended the Public Consultation Day (PCD) on the proposed measures for Listowel held at The Seanchai, Listowel on the 30th September 2015. There were two measures on display and all were considered sensible by the Local Authority representatives.

An overview of the comments and feedback received from those who attended the PCD is:

- Agreement on the emerging proposed measure design.

Therefore, the outcome from this PCD was that those in attendance were generally satisfied with the proposed flood risk management measures assessed and that which was identified as the emerging preferred.

Details of all the measures presented at the PCD can be found in Appendix C.1 of the Preliminary Option Report for UoM 23. **www.floodinfo.ie**

Outcomes of the Appraisal

A Multi Criteria Assessment (MCA), and a Cost Benefit Assessment (CBA), were carried out for each measure. For further details on MCAs and CBAs refer to Section 7.3.4 & 7.3.5.

The potential measure for Listowel was selected as it received the highest MCA Score/Cost Ratio.

Table 7.2 summarises the MCA outcomes for the Listowel AFA potential measure.

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				
Option LIL_02	540	793	728	-171	1350	1.21	1113.63	6.90

Appendix G provides more background information on the MCA, benefits and impacts of the potential measure.

Proposed Measure

Measure Name:	Progress the development of a Flood Relief Scheme for Listowel
Code:	**IEGBNISH-23-IE-AFA-230357-0001-M61**
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Listowel, 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 local authority - To be confirmed
Funding:	OPW

In parallel to this proposed measure, Kerry County Council have also submitted an application under the OPW Minor Flood Mitigation Works & Coastal Protection Scheme for the progression of flood mitigation (minor works) in the Clievragh area of Listowel, in line with the recommendations set out in the Report of May 2016 (as referenced in Section 2.6). At the time of writing, this application is currently under separate consideration by the OPW.

There are some properties within the Listowel AFA that, subject to amendment at project-level development, will not benefit from the proposed measure, and the property owners may wish to consider Individual Property Protection to provide some reduction of flood risk for their properties (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.

The proposed measures rely on flood protection being provided by some existing embankments that were constructed to provide protection to agricultural land, and that were not constructed to the modern engineering standards that would be applied now when providing urban flood protection. A detailed geotechnical structural and stability assessment of the existing embankments was not undertaken as part of the CFRAM study, but should be undertaken as part of the project-level assessment in progressing this measure.

7.4.4 Athea AFA Measures

Description of Measure

Potentially viable flood relief works for Athea that may be implemented after project-level assessment and planning or Exhibition and confirmation might include:

- Construction of 160m of flood defence walls.
- Construction of 150m of flood defence embankments.

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

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

Summary of Public Consultation Outcomes

Nine members of the public attended the Public Consultation Day (PCD) on the proposed measures for Athea held at Athea Hall on the 7th October 2015. There were two measures on display and both were considered sensible by the Local Authority representatives.

An overview of the comments and feedback received from those who attended the PCD is:

- One member of the public suggested that the river is eroding land to the south of the school and adjacent to their property. Suggested introducing gabion baskets backfilled with gravel. This was noted. It was explained the emerging proposed measure has an embankment present in this location.
- The majority of people were in agreement with the emerging proposed measure.

The outcome from this PCD was that those in attendance were generally satisfied with the proposed flood risk management measures assessed and the identified emerging proposed measure.

Details of all the measures presented at the PCD can be found in Appendix C.2 of the Preliminary Option Report for UoM 23. **www.floodinfo.ie**

Outcomes of the Appraisal

A Multi Criteria Assessment (MCA), and a Cost Benefit Assessment (CBA), were carried out for each measure. For further details on MCAs and CBAs refer to Section 7.3.4 & 7.3.5.

The potential measure for Athea was selected as it received the highest MCA Score/Cost Ratio.

Table 7.3 summarises the MCA outcomes for the Athea AFA potential 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				
Option ATA_02	1000	57	265	-419	-97	0.38	-254.71	1.42

Appendix G provides more background information on the MCA, benefits and impacts of the potential measure.

Proposed Measure

Measure Name:	Progress the development of a Flood Relief Scheme for Athea
Code:	**IEGBNISH-23-IE-AFA-232630-0002-M61**
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Athea, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation.
Implementation:	Typically the local authority under the OPW Minor Works Scheme
Funding:	Typically OPW Minor Works Scheme

7.4.5 Abbeydorney AFA Measures

Description of Measure

Potentially viable flood relief works for Abbeydorney that may be implemented after project-level assessment and planning or Exhibition and confirmation might include:

- Localised widening of the River Boherroe from a 4m to a 5.5m wide channel along the 150m metre reach between the Bridge road bridge and R556 road bridge. It is intended that the works will provide protection to properties at risk of flooding in the 1% AEP and a reduction in flood depths to properties in area.
- An earth embankment with an average height of 1m across the floodplain to prevent the flow route from the Milltown House Stream to provide complete protection to properties for the 1% AEP event.
- Introduction of maintenance programme for the defences and other watercourses within the AFA.

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

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

Summary of Public Consultation Outcomes

Three members of the public attended the Public Consultation Day (PCD) on the proposed measures for Abbeydorney held at Shannow Family Resource Centre on the 1st October 2015. There were two measures on display and all were considered sensible by the Local Authority representatives.

An overview of the comments and feedback received from those who attended is:

- The majority of people were in agreement with the proposed measure.

With such a low public turnout at this PCD it was not possible to draw any conclusions as to whether the residents of Abbeydorney were satisfied with the potential flood risk management measures assessed.

Details of all the measures presented at the PCD can be found in Appendix C.5 of the Preliminary Option Report for UoM 23. **www.floodinfo.ie**

Outcomes of the Appraisal

A Multi Criteria Assessment (MCA), and a Cost Benefit Assessment (CBA), were carried out for each measure. For further details on MCAs and CBAs refer to Section 7.3.4 & 7.3.5.

The potential measure for Abbeydorney was selected as it received the highest MCA Score/Cost Ratio.

Table 7.4 summarises the MCA outcomes for the Abbeydorney AFA potential measure.

Table 7.4: Appraisal of the Flood Risk Management Options

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Option ABY_02	1000	529	348	-160	718	.28	2581.47	3.18

Appendix G provides more background information on the MCA, benefits and impacts of the potential measure.

Proposed Measure

Measure Name:	Progress the development of a Flood Relief Scheme for Abbeydorney
Code:	IEGBNISH-23-IE-AFA-230341-0003-M61
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Abbeydorney, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation.
Implementation:	Typically the local authority under the OPW Minor Works Scheme
Funding:	Typically OPW Minor Works Scheme

7.4.6 Tralee AFA Measures

Description of Measure

Potentially viable flood relief works for Tralee that may be implemented after project-level assessment and planning or Exhibition and confirmation might include:

- Increase capacity of the diversion channel between Mackies River and the River Big.
- Provide a wall on the right bank of the open channel of the flood diversion between the Mackies River and the River Big.
- Improve inlet arrangement at the diversion channel diverting flow from the River Big to the River Ratass.
- Construct diversion channel from the River Ratass to the River Tralee.
- Construct diversion channel from the River Tralee to the River Ballynabrennagh replacing the River Tralee culvert.
- Improve the capacity of the River Ballynabrennagh and provide embankments on the left bank.
- Construct walls along the River Big downstream of Brewery Road.
- Embankment and flapped outfall to protect properties at Knockmoyle and Caheranne Village.
- Clean and maintain the Ratass watercourse as it flows through the industrial estate of Manor West.
- Embankment and raise the road to protect the Pier 17 business centre.
- Upgrade of walls adjacent to Windmill lane including the provision of floodgates at the carpark entrance.

- Construct wall to protect properties adjacent to the canal at Blennerville.
- Construct wall along Kearney's Road.
- Clean and maintain the Caherweesheen, Cloghers, Ballydunlea and Ballyvelly watercourses as shown on figure 5.3. Only cleaning is required where channel maintenance has been identified as part of the measure, changes in channel geometry in the form of deepening or widening of the channel area is required.
- Construct embankments along the right bank of the River Lee and Lower Ballynabrennagh to protect properties in Manor Village, Castlemorris Mews.
- Construct embankments along the left bank of the River Lee to protect properties in the Ballymullan area including, Hunters Wood, Cois Abhann, LIDL, Topaz, Aspen Grove, Castlemaine, Glencastle.
- Construct walls along the lower Caherweesheen watercourse. Construct embankments and raise the N70 road further upstream on the Caherweesheen and Cloghers Stream.
- Construct two embankments to provide protection from the Ballyvelly and Ballydunlea watercourses (area to the south of Tralee Rugby Club).

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

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

Summary of Public Consultation Outcomes

Thirteen members of the public attended the Public Consultation Day (PCD) on the proposed measures for Tralee held at Tralee Library on the 1st October 2015. After this date, in September and December 2016, Tralee experienced further significant flooding. The measures, initially displayed, were then updated to ensure they provided protection to those properties impacted during the 2016 events. Consequently, a second PCD on these amended measures was held on the 11th May 2017 in the Brandon Hotel. 40 people attended this PCD where there were three measures on display. All three measures were considered sensible by the Local Authority representatives

An overview of the comments and feedback received from those who attended the PCD on the 11th May 2017 is:

- Concerns were raised with the emerging preferred option regarding the diversion of flood flows into an area already prone to flooding. It was explained that works to this area also formed part of the option and that the existing and residual risk to this area would be reduced.

The outcome from this Public Consultation Day was that those in attendance were generally satisfied with the proposed flood risk management measures assessed and the identified emerging proposed measure.

Details of all the measures presented at the PCD can be found in Appendix C.5 of the Preliminary Option Report for UoM 23 www.floodinfo.ie/.

Outcomes of the Appraisal

A Multi Criteria Assessment (MCA), and a Cost Benefit Assessment (CBA), were carried out for each measure. For further details on MCAs and CBAs refer to Section 7.3.4 & 7.3.5.

The potential measure for Tralee was selected as it received the highest Economic BCR and MCA Score/Cost Ratio.

Table 7.5 summarises the MCA outcomes for the Tralee AFA potential measure.

Table 7.5: Appraisal of the Flood Risk Management Options

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Option TRA_03	506	1022	770	-385	1408	31.27	45.02	1.05

Appendix G provides more background information on the MCA, benefits and impacts of the potential measure.

Proposed Measure

Measure Name:	Progress the development of a Flood Relief Scheme for Tralee
Code:	**IEGBNISH-23-IE-AFA-230361-0004-M61**
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Tralee, 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 local authority - To be confirmed
Funding:	OPW

There are properties within the AFA at risk from wave overtopping, and it should be noted that this option does not negate the risk from this source and should be considered at the detailed design stage.

The flood risk management measures considered are based on the predicted flood risk maps which were determined using all available survey and historical flood event data up to December 2016. However, there is no suitable gauge data in the catchment available to determine the hydrology for Tralee and as such there is uncertainty associated with the predicted fluvial flood risk to the town. The Ballymullen gauge on the River Lee has a tidal influence and therefore could not be reliably used for determining the fluvial flows. It is a recommendation of this study that reliable gauging stations are installed on all watercourses to reduce the uncertainty associated with the current predicted flood extents, see section 7.4.1.14.

In addition to the uncertainty related to the hydrology in Tralee, there is also uncertainty with the fluvial/fluvial joint probability associated with the River Lee and the tributaries and also the fluvial/coastal joint probability between the watercourses and the tidal boundaries. The approach to joint probability for Tralee is consistent with all other AFAs within the Shannon CFRAM, however should further gauge data become available this should be reviewed at detailed design phase.

Tralee is a heavily urbanised town and there is interaction between the fluvial flows, coastal reaches and the drainage networks. There is historical evidence of flooding from the drainage network coinciding with tidal and fluvial events. Flood risk from the drainage network is not considered as part of the CFRAM process, nor is the potential detrimental impacts to this drainage network from the proposed CFRAM flood risk management options for example, proposed flood walls may prevent drainage outfalls freely discharging to the river network. Therefore, given the close interaction of the fluvial, coastal and drainage flood risks for Tralee, it is a recommendation of this study that a fully integrated catchment model is developed to understand all these sources of flood risk as part of the design for the Shannon CFRAM preferred flood risk management option.

There are some properties within the Tralee AFA that, subject to amendment at project-level development, will not benefit from the proposed measure, and the property owners may wish to consider Individual Property Protection to provide some reduction of flood risk for their properties

(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.

7.4.7 Banna AFA Measures

Description of Measure

Potentially viable flood relief works for Banna that may be implemented after project-level assessment and planning or Exhibition and confirmation might include:

- Construction of an embankment, 325m long with an average height 1-1.5m above ground level.
- Discontinuing the existing regime of removing silt and debris from the outfall at Blackrock.

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

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

Summary of Public Consultation Outcomes

Seven members of the public attended the Public Consultation Day (PCD) on the proposed measures for Banna held at Banna Leisure Centre on the 1st October 2015. There was one measure on display which was considered sensible by the Local Authority representatives.

An overview of the comments and feedback received from those who attended is:

- The majority of people were in agreement with the proposed measure.

The outcome from this PCD was that those in attendance were generally satisfied with the proposed flood risk management measure.

Outcomes of the Appraisal

A Multi Criteria Assessment (MCA), and a Cost Benefit Assessment (CBA), were carried out for each measure. For further details on MCAs and CBAs refer to Section 7.3.4 & 7.3.5.

The potential measure for Banna was the only viable measure identified.

Table 7.6 summarises the MCA outcomes for the Banna AFA potential measure.

Table 7.6: Appraisal of the Flood Risk Management Options

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Option BAA_01	800	672	-14	-179	479	0.14	3308.01	16.73

Appendix G provides more background information on the MCA, benefits and impacts of the potential measure.

Proposed Measure

Measure Name:	Progress the development of a Flood Relief Scheme for Banna
Code:	**IEGBNISH-23-IE-AFA-230345-0005-M61**
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Banna, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation.
Implementation:	Typically the local authority under the OPW Minor Works Scheme
Funding:	Typically OPW Minor Works Scheme

7.4.8 Abbeyfeale AFA Measures

The only viable measures identified for Abbeyfeale are the Baseline Measure "Do Nothing" and the Non-Structural Measure "Public Awareness". However, neither of these measures can provide the required 1% AEP event design standard.

Summary of Public Consultation Outcomes

Two members of the public attended the Public Consultation Day (PCD) for Abbeyfeale held at Abbeyfeale Library on the 9th December 2015.

With such a low public turnout at the PCD, it was not possible to draw any conclusions on whether the residents of Abbeyfeale were satisfied with the proposed measures.

7.4.9 Moneycashen AFA Measures

The only viable measures identified for Moneycashen are the Non-Structural Measures of "Flood Forecasting" and "Public Awareness". However, neither of these measures can provide the required 1% AEP event design standard.

Summary of Public Consultation Outcomes

Three members of the public attended the Public Consultation Day (PCD) for Moneycashen held at Buds Family Resource Centre on the 30th September 2015.

An overview of the comments and feedback received from those who attended is:

- One member of the public stated that his preference would be for the mouth of the River Chasen to be dredged in order to protect the properties.

With such a low public turnout at the PCD, it was not possible to draw any conclusions on whether the residents of Moneycashen were satisfied with the proposed measures.

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.

There are no AFA's in the Tralee Bay – Feale River Basin that have been found to have a Benefit-Cost Ratio of below unity, therefore no further assessment in this area was undertaken.

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 7.7 provides a summary of the measures that are to be progressed through the implementation of the Plan for the Tralee Bay – Feale River Basin.

Table 7.7: 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
Assessment of Potential for Voluntary Home Relocation Scheme	Interdepartmental Flood Policy Co-ordination 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 Action to Build Resilience	Public, business owners, farmers and other stakeholders	N/A
Assessment of Potential for Individual Property Protection Scheme	Home Owners, Interdepartmental Flood Policy Co-ordination Group	Homeowners
Flood-Related Data Collection	OPW, Local Authorities / EPA, and other hydro-meteorological agencies	Implementation Bodies
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.		
Listowel	OPW and/or local authority – to be confirmed	OPW
Athea	Typically the local authority under the OPW Minor Works Scheme	Typically the local authority under the OPW Minor Works Scheme
Abbeydorney	Typically the local authority under the OPW Minor Works Scheme	Typically the local authority under the OPW Minor Works Scheme
Tralee	OPW and/or local authority – to be confirmed	OPW
Banna	Typically the local authority under the OPW Minor Works Scheme	Typically the local authority under the OPW Minor Works Scheme

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 Figure 8.1).

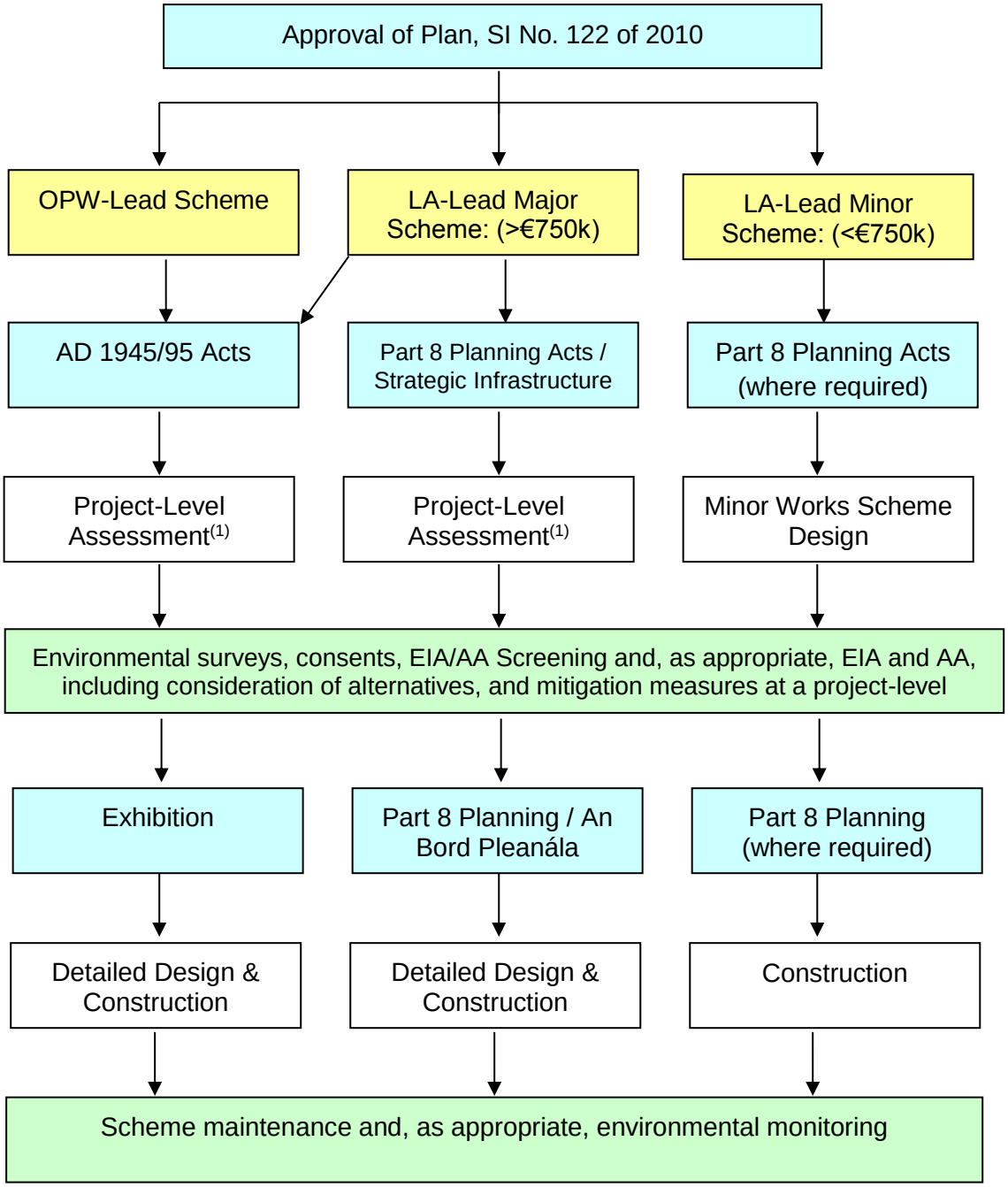
The potential physical flood relief works or 'Schemes' set out in the Plans that have been developed through the CFRAM Programme are to an outline design, and are not at this point ready for construction. Further detailed design through a project-level of assessment will be required for such works before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

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 Tralee Bay – Feale 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 withing 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

A monitoring framework has been proposed based on the SEA objectives and their associated framework of indictors and targets, utilising the data sources obtained for the MCA and the SEA. The purpose of this monitoring is twofold;

- To monitor the predicted significant negative effects of the Plan; and
- To monitor the baseline environmental conditions for all SEA objectives and inform the six yearly update of the Plan required to meet the requirements of the EU Floods Directive (Directive 2007/EC/60) on the assessment and management of flood risk.

8.4 REVIEW OF THE PFRA, FLOODS 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 (River Basin) 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	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	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.

[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)

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 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

B.1.1 Topography

The Tralee Bay – Feale River Basin is bounded on the northwest by the mouth of the Shannon Estuary and on the east and southeast by the Mullaghareirk Mountains, forming the boundary between the Tralee Bay – Feale River Basin and 24. Along the southern boundary from east to west are the Glanaruddery Mountains and the Slieve Mish Mountains which extend into the Dingle Peninsula.

The southern and south-western area is dominated by mountainous and upland areas with many steep and flashy watercourses, notably around the Dingle Peninsula and Tralee. The Slieve Mish Mountains are to the south and southwest of Tralee, with Stack's Mountains to the east and northeast of Tralee. The main rivers in this area are the River Lee and Big River, both flowing into Tralee.

The Feale sub-catchment in the central and eastern area dominates this River Basin, making up at 65% of the total area. The main watercourse in this sub-catchment is the River Feale which rises in the Mullaghareirk Mountains and flows in a north-westerly direction before flowing into the River Cashen and discharging into the Shannon Estuary. Other major tributaries to this sub-catchment are the River Brick and River Galey. These mainly drain the upland areas to the east and south of the area, with the exception of the River Brick which drains a lowland area towards the west.

The western area along the Atlantic coast (Ballyheige Bay) is a mainly low lying area with many small sub-catchments draining to the west coast. This area is protected by an extensive coastal dune system; the Akeragh Lough Drainage District which discharges into the Atlantic at an outfall in Blackrock approximately 3km north of Banna. A visual representation of the topography across the River Basin is provided in Figure 2.2

B.1.2 Geology, Soils and Groundwater

The Tralee Bay – Feale River Basin comprises a variation of poorly drained soil and peat, some scattered well drained soil is found at the upstream reach of the River Feale as well as along the coastal areas. In addition to this, some alluvium is located along the river valley of the Feale. As a consequence of the combination of the soils and aquifer geology karst is not considered to play a significant role in the hydrological flood response of the modelled sub-catchments in the Tralee Bay – Feale River Basin.

The dominant aquifer group in the Tralee Bay – Feale River Basin is the ‘locally important aquifer’ group. The lower Feale sub-catchment consists of locally and regionally karstified aquifers. Some scattered poor aquifers are also observed near the periphery of the River Basin.

B.2 LAND USE AND LAND MANAGEMENT

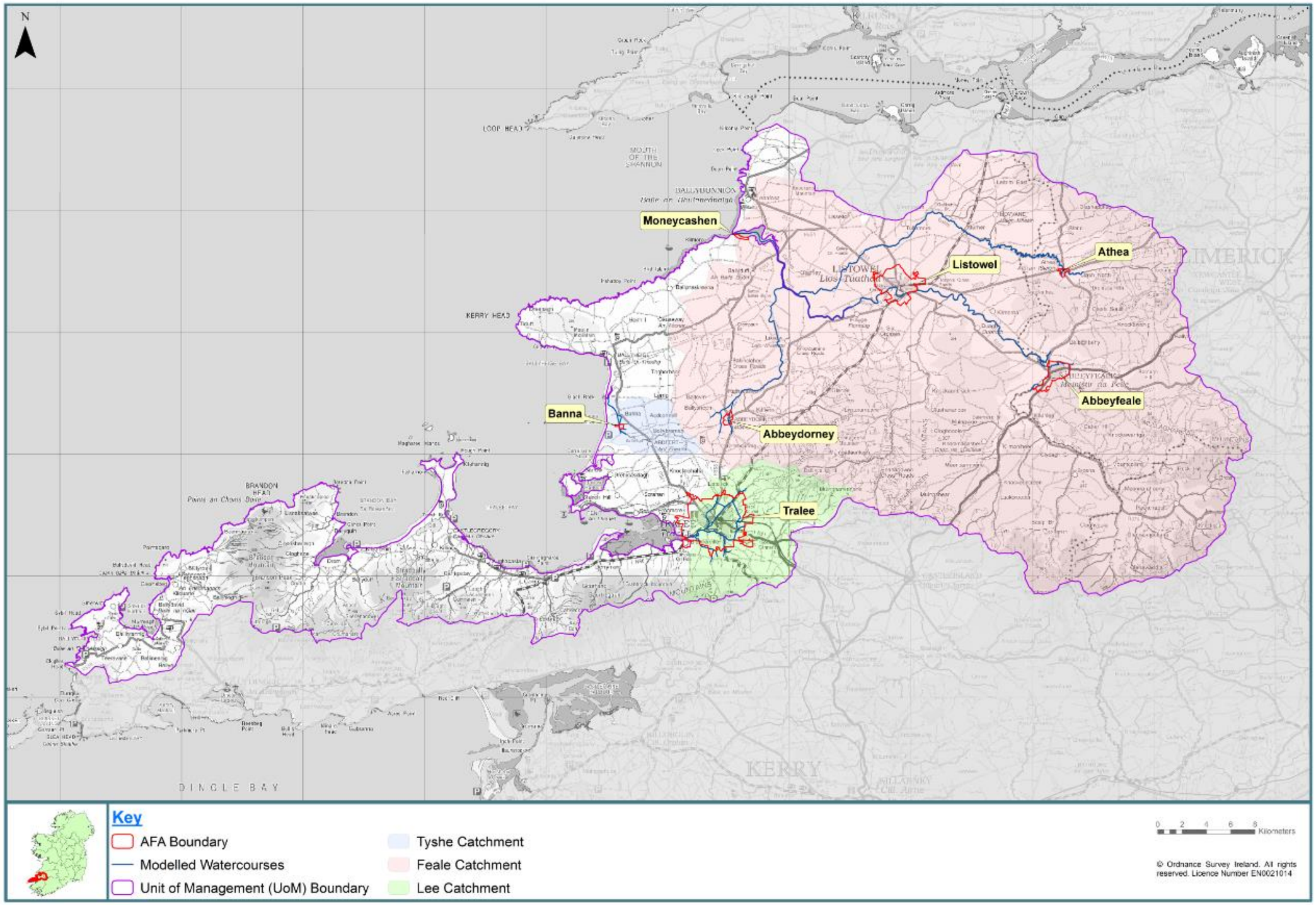
B.2.1 Urban areas (population and distribution)

As outlined in section 2.1 there are 7 no. AFAs within the Tralee Bay – Feale River Basin which are highlighted in Table 2.1 and Figure 2.3. AFAs are the towns, villages and significant infrastructure appraised by CFRAM Study and reported upon within this FRMP. The population for each AFA is provided in Table 2.1. This information was obtained from the 2011 census data.

Table B.1: Areas for Further Assessment in the Tralee Bay – Feale River Basin (2011 Census)

Sub-Catchment	Areas for Further Assessment (AFAs)	Town Population in 2011
Tyshe Sub-Catchment	Banna	732
Feale Sub-Catchment	Abbeydorney	244
	Abbeyfeale	1940
	Athea	377
	Listowel	4338
	Moneycashen	-
Lee (Kerry) Sub-Catchment	Tralee	25,744

Figure B.1: AFA's and sub-catchments within the Tralee Bay – Feale River Basin



B.2.2. Land Cover and Land Use

Agriculture is the primary land use in the Tralee Bay – Feale River Basin and this is reflected in the areas settlement patterns. Land use coverage is shown in Figure 2.4 below. The Tralee Bay – Feale River Basin is split into 3 sub-catchments.

The Feale sub-catchment is predominantly rural. The main urban areas within the sub-catchment are Athea located within the upper reaches of the River Galey, Abbeyfeale and Listowel located on the River Feale on its upper and mid reaches, Abbeydorney in the upper reaches of the River Brick and Moneychasen located at the confluence of the River Chasen and the Shannon Esturary.

The Tyshe sub-catchment is almost completely rural with the village of Banna located on the River Tyshe.

In the Lee sub-catchment varies from rural at the upstream extent to urban on the downstream extent with the significant urban development of Tralee.

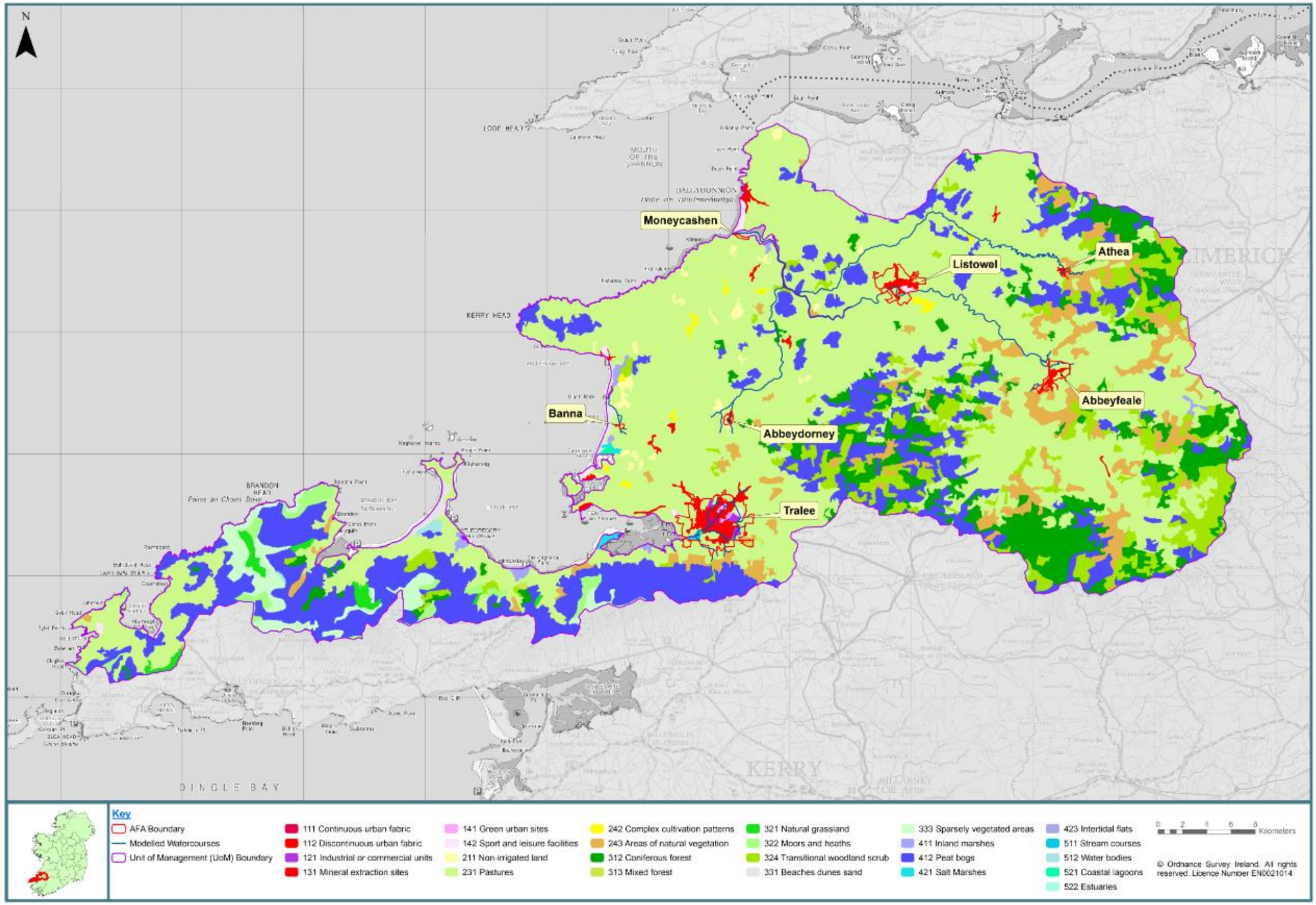
Agricultural land is the dominate land cover type within this River Basin, accounting for 62% of land-cover. Due to the coastal nature of Co. Kerry agriculture tends to be dominated by grassland based activities with limited arable production. The remaining land cover types consist of wetlands and peat bog areas (18%), forestry and semi-natural areas (18%) and built land (1%).

Table B.2 below provides a summary of the land use type for every AFA within the Tralee Bay – Feale River Basin as outlined in the relevant Local Area Plans. Table B.2 shows an overview of the land use across the River Basin taken from the CORINE 2012 data set.

Table B.2: Summary of Land Use in the Tralee Bay – Feale River Basin

Town	Land Use Type
Abbeyfeale	Zoned as urban land and pasture.
Listowel	Zoned as urban land and pasture.
Moneycashen	All zoned as pastures.
Athea	Zoned as urban land and pasture.
Abbeydorney	Zoned as urban land and pasture.
Tralee	All zoned as urban land.
Banna	All zoned as pastures.

Figure B.2: Land use in the Tralee Bay – Feale River Basin



B.2.3 Potential Future Land Use Changes

The County Development Plans for Kerry, Limerick and Cork outline the town population allocation growth, the number of houses required and the town area required for population growth for the AFAs located in the Tralee Bay – Feale River Basin.

The Local Area Plan identifies different development zones for the various AFAs. These zones include retail, conservation, industrial, mixed use, open space and strategic residential reserve.

The County Development Plans and the Local Area Plans can be viewed on the County Council Homepage.

Table B.3: Estimated Population Growth from CDP/LAP

Catchment	AFA	Recorded Population		Estimated Additional Population from CDP / LAP	
		Year	Population	Year	Population increase
Tyshe	Banna	2006	732	Data unavailable	
Feale	Abbeydorney	2006	244	Data unavailable	
	Abbeyfeale	2006	1940	2022	972
	Athea	2006	1377	2022	432
	Listowel	2006	4338	2021	314
	Moneycashen	2006	-	Data unavailable	
Lee (Kerry)	Tralee	2006	25,744	2021	1,142

As noted in Section B2.2 in the low lying areas of the Chasen sub-catchment there are significant areas of land, below the peak mean spring tide level protected by arterial drainage defences. This land is currently used for agricultural purposes. With sea levels expected to continue to rise due to climate change in the range of 0.52 to 0.98m as outlined in Appendix A, Section A2.1, consideration needs to be given to the standard of protection offered by these defences and the sustainability of the use of this land.

Similarly consideration needs to be given to the sustainability of the works which are being carried out at Blackrock to maintain a clear outfall for the Banna and Akeragh Lough drainage districts.

B.3 HYDROLOGY

B.3.1 Sub-catchments and river networks, estuarine areas and coastlines

The Tralee Bay – Feale River Basin is dominated by the Feale sub-catchment in the central and eastern area. The Feale sub-catchment in the central and eastern area dominates this River Basin, making up at 65% of the total area with an area of 1155km^2. The main watercourse in this sub-catchment is the River Feale. Tributaries of the River Feale are the River Brick and River Galey.

The Tyshe sub-catchment is the smallest sub-catchment with an area of 27km^2 a mainly low lying area with the sub-catchment draining west to the River Tyshe. This area is protected from coastal flood risk by an extensive coastal dune system. The River Tyshe, a Akeragh Lough Drainage District channel, discharges into the Atlantic, at Blackrock approximately 3km north of Banna.

The Lee sub-catchment has an area of 99km^2. The Lee sub-catchment is a steep catchment with a number of flashy watercourses to the south of Tralee draining runoff from the Slieve Mish to the River Lee. To the northeast the runoff from the Stack's Mountain drains to the River Lee through a number of watercourse including the River Big which flows though the urban area of Tralee and is culverted in its downstream reaches.

A detailed study on the Hydrology of the Tralee Bay – Feale River Basin can be downloaded at the following URL:

www.floodinfo.ie

B.3.2 Land Drainage (Inc. Arterial Drainage Schemes, Drainage Districts)

In the low lying areas of the Cashen sub-catchment there are significant areas of that are protected by arterial drainage defences. Some of this protected land is below the peak mean spring tide level. Therefore these lands are at significant risk of flooding, with a greater than 1 in 500 chance of flooding in any given year, and without these defences would likely not be available for agricultural uses.

In the upstream reaches of the River Galey works were carried out as part of the arterial drainage scheme. These are called arterial drainage channels and are shown on Figure B.3. The works carried out in these channels increased the conveyance capacity of the channels reducing flood risk to the area shown in Figure B.3 as benefiting from these schemes.

There are 3 Drainage Districts within the Tralee Bay – Feale River Basin, namely the Cashen River DD, Banna DD and the Akeragh Lough DD shown in Figure B.3.

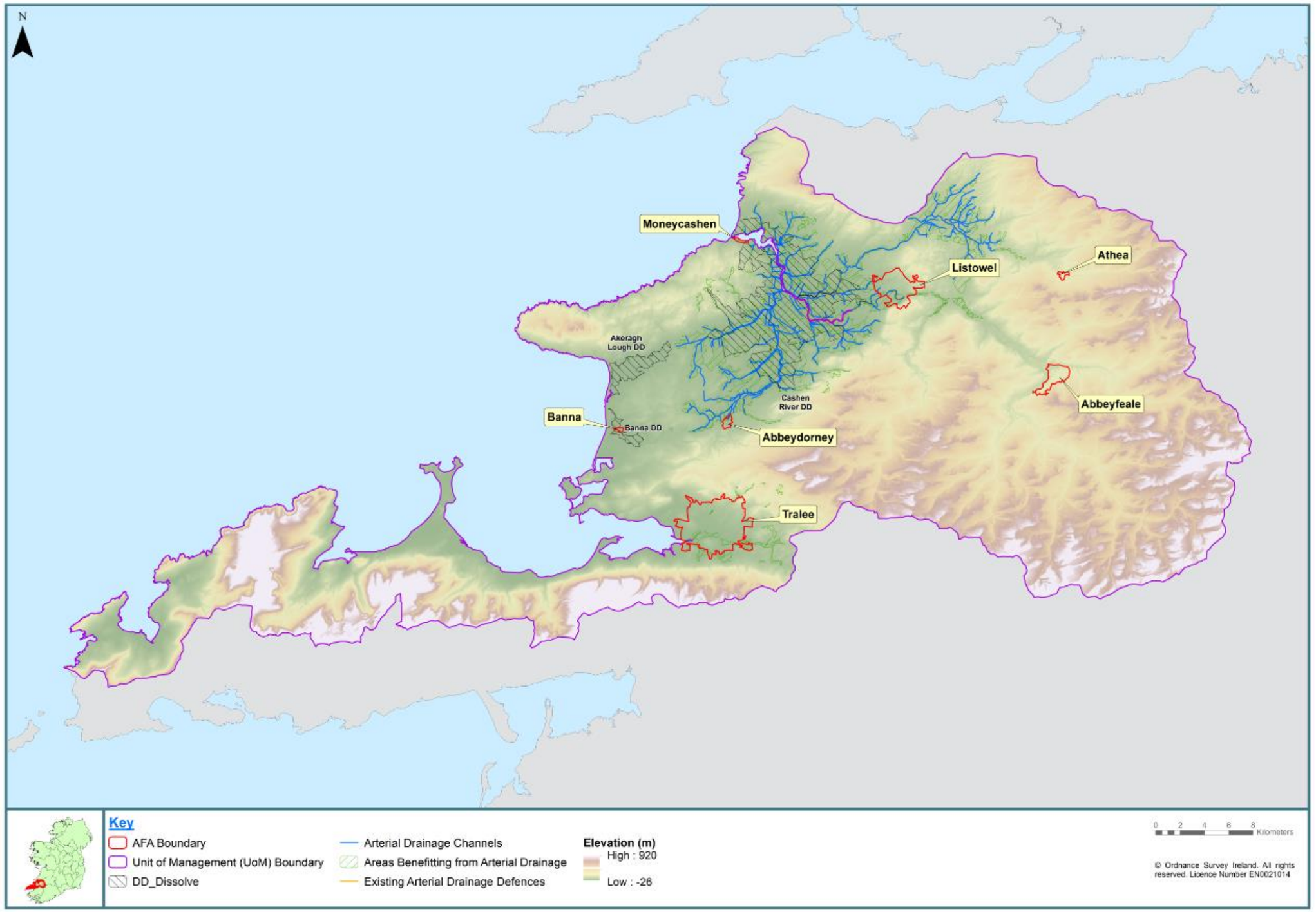
The Banna and Akeragh Lough DD both discharge to the Atlantic Ocean at the one outlet, at Blackrock. Natural coastal processes result in the frequent blocking of this outfall by sand and seaweed. On-going maintenance is required to maintain the outfall clear. Clearance works take place every two weeks, but this can be required daily in the winter months. The annual cost of these works is estimated at approximately €150,000. Both drainage systems back up when this outfall at Blackrock is not clear.

B.3.3 Rainfall Distribution

Annual precipitation within the Tralee Bay – Feale River Basin varies with topography with rainfall varying between 1460mm per annum in the upland areas to 1035mm per annum in the low lying areas.

The dearth of sub-daily rainfall records for the catchment severely limited the application of traditional rainfall runoff techniques. Rainfall runoff modelling has therefore been discounted for the Tralee Bay – Feale River Basin

Figure B.3: Arterial Drainage and Drainage Area Districts in the Tralee Bay – Feale River Basin



B.3.4 Hydrometric data availability

The design hydrology approach adopted for the Tralee Bay – Feale River Basin focuses on the use of gauged flow data, supplemented by Flood Study Update (FSU) techniques where no flow data is available. The focus for the use of hydrometric data within the Shannon RBD is on river gauging stations where there are time series records of both water level and flow. As there is limited sub-daily rainfall data available within the Shannon RBD, and therefore rainfall-runoff modelling has not been used, the derivation of flow estimates for input to the hydraulic models is therefore based on the statistical analysis of flows across the sub-catchment. The gauging stations for the Tralee Bay – Feale River Basin are listed in Table B.4.

Table B.4: Gauging Stations Rating Reviews

Gauging Station Number	Gauging Station Name
23001	Inch Bridge
23002	Listowel
23012	Ballymullen
23022	Big

A detailed study on the Hydrology of the Tralee Bay – Feale River Basin can be downloaded at the following URL:

www.floodinfo.ie

B.3.5 Flood History

Table B.5 to B.7 below provide a summary of the past major flood events within the Feale, Tyshe, and Lee sub-catchments within the Tralee Bay – Feale River Basin. This information provided is up to the date of December 2013 which was when the Hydrological Study was completed.

Table B.5: Summary of major historical flood events within the Feale Sub-catchment

Event	Peak Flow (m^3/s)	Peak Level (mOD - Malin)	Estimated Annual Exceedance Probability (AEP) (%)	Flood Extents & Damages
Listowel				
12 Aug 2003	420.71 (Listowel)	19.10 (Listowel)	38	Pluvial and fluvial in combination; land at Coibee, Listowel flooded as a result of storm events which generate high surface runoff beyond the capacity of the drainage system.
11 Nov 2002	271.70 (Listowel)	18.65 (Listowel)	>50	Pluvial and fluvial in combination; house at Curraghatoosane and septic tank at Gortnaminch, Listowel flooded as a result of storm events which generate high surface runoff beyond the capacity of the drainage system.
25 Jul 2002	-	-	-	Pluvial and fluvial in combination; field at Greenville, Listowel flooded as a result of storm events which generate high surface runoff beyond the capacity of the drainage system.
22 Feb	104.13	12.19	-	Pluvial and fluvial in combination; field at

2001	(Listowel)	(Listowel)		Shrone West, Listowel flooded as a result of storm events which generate high surface runoff beyond the capacity of the drainage system.
Abbeyfeale				
Jan 2005	-	-	-	Fluvial flooding caused by the high flow record at (Listowel). Local road at Allaghaun Bridge, Ballaugh impassable. One house under threat of flooding.
Recurring	-	-	-	Flooding occurs roughly twice a year at Allaghaun Bridge, Ballaugh.
Moneycashen				
Feb 2002	-	-	-	Major tital flood event when levels were at their highest in 80 years. 3 or 4 houses flooded at Cashen Village and Moneycashen.
Recurring	-	-	-	4 properties flooded as a result of tidal flooding.
Athea				
02 Sep 2009	158.37 (Inch Bridge)	12.76 (Inch Bridge)	13	Approximately 4 properties, The Avenue & Con Colbert (main street) flooded.
06 Aug 2008	138.29 (Inch Bridge)	12.56 (Inch Bridge)	22	At least 12 properties, R523, Wastewater treatment plant flooded due to extreme rainfall. At least 14 properties flooded (2 additional properties compared to 01st August 2008 event).
Apr 2005	159.42 (Inch Bridge)	12.77 (Inch Bridge)	12	Area adjacent to the bridge in the village was affected by flooding. One resident's house was flooded.
Abbeydorney				
Oct/Nov 1994	-	-	-	Abbeydorney was affected by local surface water flooding.

N.B: unless stated otherwise all levels are mOD Malin

Table B.6: Summary of major historical flood events within the Lee Sub-Catchment

Event	Peak Flow (m^3/s)	Peak Level (mOD- Malin)	Estimated Annual Exceedance Probability (AEP) (%)	Flood Extents & Damages
Tralee				
Sep 2015	-	-	-	The source of the flooding was fluvial. Excessive rainfall resulted in an increase in the water level in the River Lee and the Big River. There was no loss of life or injury reported as a result of the flooding. One resident was evacuated from their home on Roger Casement Avenue as their house was considered at risk of flooding. This property did not flood. Several commercial and residential properties experienced internal flooding. The Ballyard Road, a local access road was flooded. The

				N70 National Route was flooded at the junction with the L6548 (Ahern's Road) Local Road. The Clashlehane Roundabout on the N21 National Road was flooded. Other unnamed and local access roads were flooded
Jan 2014	-	-	-	The tidal flooding in Tralee during recent times was at Ballyvelly. Tidal waters filled the canal and over-topped the tow path walk leading to the fields being flooded. Estimate of 200mm depth of water above the tow path in places.
Feb 2011	-	5.593	-	Karney's Rd Blennerville flooded. The two tributaries; Rivers Big and Balloonagh drain the steeply sloping ground to the north of the town. Due to the underlying geology and steepness of the catchments, storm flows in the Big and Balloonagh are characterised by short durations and high peak flows resulting in flash flooding.
19 Nov 2009		3.3 (1m deep) (flood level at Curragraigue)		Flooding occurred in Curragraigue TD and Ballymullen (Munster Bar Road U171) N70 from Army Barracks to Ballymullen roundabout. The flood affected 6 residential, 1 commercial – public House in Ballymullen and Local GAA Clubhouse flooded to depth of 300mm in Curragraigue. The flood in Curragraigue disrupted road access to Blennerville.
13 Aug 2008		6.3 (0.6m deep) (flood level at Caherweeshee)		Caherweesheen TD, Ballyard, 0.6m deep flood. One house and a farm building were flooded. Access to L6516 affected for a number of hours.
01 Dec 2005				Flooding occurred in three areas Ballinorig,Caherleheen, Ardfert
31 Aug 1997		3 feet (1.0m)-deep flood at Killarney Road		Tralee Killarney Road, Ardnabraher Ballinorig – 3 properties flooded (PFRA). One property at Ballycarty Cross flooded (PFRA).
24 Nov 1996	-	-	-	Flooding in Ballyseedy area.
05 Aug 1986	31.74 (Ballymullen)	7.24 (Ballymullen)	1	Entire business centre of Tralee flooded causing severe damage to shops, offices & private dwellings. Severe flooding in Ballymullen & Castlecountess areas. Roads impassable.
02 Nov 1980	16.94 (Ballymullen)	6.71 (Ballymullen)	42	Ballyseedy, Ballyard, Oakview and the railway yard near Ashe Street flooded. New Ring Road flooded due to surface water.

				Ballymullen areas – Killerisk, terrace of houses opposite Army Barracks and land near Castlemaine Road flooded.
December 1973	-	-	2 (1 in 49 years1)	Entire business area of Tralee flooded.
May 1971	-	-	-	No Flooding details available.
Mar 1955	-	-	-	No Flooding details available.
Jan 1925	-	-	-	No Flooding details available.
Jan 1925	-	-	-	No Flooding details available.
Nov/ Dec 1924	-	-	-	No Flooding details available.
Nov 1916	-	-	-	Ballinorig: Castleisland to Tralee Road and 5 properties affected (PFRA), Caherleheen: N70 - Tralee to Castlemaine Ardfert: R551 and 10 houses affected.

N.B: unless stated otherwise all levels are mOD Malin

Table B.7: Summary of major historical flood events in Tyshe Sub-Catchments

Event	Peak Flow (m^3/s)	Peak Level (mOD -Malin)	Estimated Annual Exceedance Probability (AEP) (%)	Flood Extents & Damages
Banna				
03 Nov 1980	-	4.585 (Banna House)	-	Main Ballyheigue – Ardfert Road flooded to approximately 0.15m.

N.B: unless stated otherwise all levels are mOD Malin

Information on the above 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.

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 [1]) 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.

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).

[1] 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.

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. of Housing, Planning and Local Government
- Dept. of 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 Éireann
- Office of Emergency Planning
- Rivers Agency (Northern Ireland)
- Waterways Ireland

APPENDIX D.2

Membership of the Shannon CFRAM Study Advisory Group and Progress Group

- Office of Public Works;
- Jacobs;
- Cavan County Council;
- Clare County Council;
- Galway County Council;
- Kerry County Council;
- Laois County Council;
- Leitrim County Council;
- Limerick City and County Council;
- Longford County Council;
- Mayo County Council;
- Meath County Council;
- Offaly County Council;
- Roscommon County Council;
- Sligo County Council;
- Tipperary County Council;
- Westmeath County Council;
- Regional Authorities / Assemblies (Midlands, Mid-West, South-West, Northern and Western, Eastern and Midlands);
- WFD coordinator; and
- 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 Shannon CFRAM Study Stakeholder Workshops

Table D.4 Organisations Represented at Meetings of the Shannon CFRAM Study Stakeholder Workshops (other than OPW and Jacobs)

Ministerial Workshop 26th July 2011	SEA Pre-Scoping Workshop 27th July 2011	SEA Scoping Workshop 25th October 2011	Draft Flood Map Preparation Stage Workshop 21st April 2015	Preliminary Option Report stage workshop 25th May 2016
Electric Supply Board (ESB) Energy International	Environmental Protection Agency (EPA)	Mid-West Regional Authority	Tipperary County Council	Shannon Airport
BirdWatch Ireland	Inland Fisheries Ireland	Clare County Council	Limerick County Council	Shannon Foynes Port Company
Bord na Móna	Nation Parks and Wildlife Service (NPWS) – Department of Culture, Heritage and the Gaeltacht	Waterways Ireland	Inland Fisheries Ireland	Waterways Ireland
Clare County Council		Inland Fisheries Ireland	Waterways Ireland	Fisheries Ireland
Flood Alleviation Ballinasloe			Shannon Foynes Port Company	Inland Waterways Association of Ireland
Galway County Council		Department of Housing, Planning and Local Government	Clare County Council	Irish Rail
Galway East Fianna Fail TD	Built Heritage and Architectural Policy Section - Department of Culture, Heritage and the Gaeltacht		Limerick City and County Council	ESB
Inland Fisheries Ireland		Electric Supply Board (ESB)	West Regional Assembly	Leitrim County Council
Irish Creamery Milk Suppliers Association		Leitrim County Council	Westmeath County Council	Limerick City and County Council
Irish Farmer Association	Department of Agriculture, Food and the Marine	Clare County Council	Bord na Móna	Irish Water
Limerick County Council		Irish National Flood Forum	Offaly County Council	Tipperary County Council
Longford County Council		Bord na Móna	Northern and Western Regional Assembly	National Parks and Wildlife Service (NPWS)
Midland Regional Authority		Roscommon County Council	Electric Supply Board (ESB)	
Roscommon County Council		An Taisce	Roscommon County Council	
Springfield, Clonlara Residents		Irish Peatland Conservation Council	Offaly County Council	

Waterways Ireland		Midland Regional Authority	Eastern and Midland Regional Assembly	
Westmeath Community Development		South West Regional Authority	Jazz Pharmaceuticals	
		Dublin Airport Authority (Shannon Airport)		
		Kerry County Council		
		Longford County Council		
		Irish Farmers Association		

APPENDIX D.5

Public Consultation Days Held at the Flood Mapping Stage in the Tralee Bay – Feale River Basin

Table D.5 Flood Mapping PCDs Held in the Tralee Bay – Feale River Basin

AFA	Date	Venue	No. Attendees
Tralee	24/03/2015	Tralee Library	45
Banna	24/03/2015	Banna Leisure Centre	26
Abbeyfeale	25/09/2014	Abbeyfeale Library	10
Athea,	25/09/2014	Athea Hall	9
Abbeydorney	24/09/2014	Shannow Family Resource Centre	4
Moneycashen	24/09/2014	Ballyduff Family Resource Centre	2
Listowel	24/09/2014	Listowel Library	12

APPENDIX D.6

Public Consultation Days Held at the Flood Risk Management Optioneering Stage in the Tralee Bay – Feale River Basin

Table D.6 Flood Risk Management Optioneering PCDs Held in the Tralee Bay – Feale River Basin

AFA	Date	Venue	No. Attendees
Abbeyfeale	9/12/2015	Abbeyfeale Library	2
Athea	7/10/2015	Athea Hall	9
Abbeydorney	1/10/2015	Shannow Family Resource Centre	3
Banna	1/10/2015	Banna Leisure Centre	7
Tralee	1/10/2015 11/05/2017	Tralee Library Brandon Hotel	13 40
Moneycashen	30/09/2015	Buds Family Resource Centre	3
Listowel	30/09/2015	The Seanchai, Listowel	15

APPENDIX D.7

Public Consultation Days Held at the Draft Flood Risk Management Plan Stage in the Tralee Bay – Feale River Basin

Table D.7 Draft Flood Risk Management Plan PCDs Held in the Tralee Bay – Feale River Basin

AFA	Date	Venue	No. Attendees
Athea	17/08/2016	Athea Hall	7
Listowel	17/08/2016	The Seanchai, Listowel	6
Tralee	16/08/2016	Brandon Hotel	34

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.

Key Risk Issues for Listowel AFA				
AFA	Listowel			
Summary of Flood Risk in 1% Fluvial AEP Event				
Source of flood risk	**Fluvial**	Coastal	Both	
Total Number of Properties at risk in AFA in 1% Fluvial AEP Event:		**Residential**	**Non-Residential**	**Total**
	Fluvial	137	23	160
Summary of PV Damages				
Total PV Damages:		**Uncapped**	**Capped**	
	Fluvial	€ 13,037,292	€ 11,931,988	
Max Capped Benefits for 1% AEP Fluvial Event*:	€ 8,813,377 *These are the maximum benefits available if a FRM option with a 1% Fluvial SOP is provided to all properties within the AFA.			
Annual Average Damages (fluvial):	6488			
Social Risk				
High Vulnerability Properties at risk :	**Type**	**Description**		
	None	N/A		
Social Infrastructure Assets:	Community Centre	**2% AEP Fluvial Flood Extent.**		
		Listowel Community Centre		
	Sports Club	**5% AEP Fluvial Flood Extent.**		
		Off Bridge road		
	Racecourse	**5% AEP Fluvial Flood Extent.**		
		Listowel Racecourse		
Social Amenity Sites:	Walkway	**50% AEP Fluvial Flood Extent.**		
		Walkway along River Feale		
Risk to the Environment				
	Type	**Description**		
Risk to WFD Annex IV:	None	N/A		
Risk to SACs:	Candidate Special Area of Conservation	The River Feale itself and lands to the right and left of the watercourse are designated candidate Special Area of Conservation (the Lower Shannon cSAC).		
Risk to Cultural Heritage				
Risk to Sites of Cultural Heritage:	**Type**	**Description**		
	NIAH	**10% AEP Fluvial Flood Extent.**		
		Listowel Bridge, a regionally important structure		
		1% AEP Fluvial Flood Extent.		
		Dandy Lodge, a regionally important gate lodge		

Risk to the Economy		
Risk to Transport Infrastructure	**Type**	**Description**
	National Road	**5% AEP Fluvial Flood Extent.**
		N69 to the south of Listowel
	Regional Road	**5% AEP Fluvial Flood Extent.**
		R555
Risk to Utility Infrastructure	**Type**	**Description**
	Water Pumping Station	**1% AEP Fluvial Flood Extent.**
		Water pumping station and abstraction point to the east of Listowel. This abstraction point and pumps are no longer in use but remain in working order and are used as a backup in the event of any difficulties with the main abstraction point further downstream.

Impact of Future Scenarios on Risk:
A summary of the impact of future scenarios on the risks outlined above is detailed in the Flood Risk Tables for each AFA.

Key Risk Issues for Abbeyfeale AFA				
AFA	Abbeyfeale			
Summary of Flood Risk in 1% Fluvial AEP Event				
Source of flood risk	**Fluvial**	Coastal	Both	
Total Number of Properties at risk in AFA in 1% Fluvial AEP Event:		**Residential**	**Non-Residential**	**Total**
	Fluvial	2	2	4
Summary of PV Damages/Potential PV Benefits				
Total PV Damages:		**Uncapped**	**Capped**	
	Fluvial	€ 287,462	€ 287,462	
Max Capped Benefits 1% Fluvial AEP Event*:	€ 203,644 *These are the maximum benefits available if a FRM option with a 1% Fluvial SOP is provided to all properties within the AFA.			
Annual Average Damages (fluvial):	12866			
Social Risk				
	Type	**Description**		
High Vulnerability Properties at risk:	None	N/A		
Social Infrastructure Assets:	None	N/A		
Social Amenity Sites:	None	N/A		
Risk to the Environment				
	Type	**Description**		
Risk to WFD Annex IV:	Drinking Water	The section of the River Feale adjacent to Abbeyfeale is designated as drinking water under the WFD.		
Risk to SACs:	cSAC	The River Feale itself and lands to the right and left of the watercourse are designated candidate Special Area of Conservation (the Lower Shannon cSAC).		
Risk to Cultural Heritage				
	Type	**Description**		
Risk to Sites of Cultural Heritage:	NIAH	**50% AEP Flood Extent**		
		R524 bridge on River Allaghaun is a structure of significant structural importance as it has been listed an NIAH structure.		
Risk to the Economy				
	Type	**Description**		
Risk to Transport	Regional Route	**50% AEP Flood Extent**		

Infrastructure:		
		R524
Risk to Utility Infrastructure:	None	N/A
Impact of Future Scenarios on Risk:		
A summary of the impact of future scenarios on the risks outlined above is detailed in the Flood Risk Tables for each AFA.		

Key Risk Issues for Athea AFA				
AFA	Athea			
Summary of Flood Risk in 1% AEP Event				
Source of flood risk	**Fluvial**	Coastal	Both	
Total Number of Properties at risk in AFA in 1% Fluvial AEP Event:		**Residential**	**Non-Residential**	**Total**
	Fluvial	12	3	15
Summary of PV Damages				
Total PV Damage:		**Uncapped**	**Capped**	
	Fluvial	€ 809,096	€ 809,096	
Max Capped Benefits for 1% Fluvial AEP Event*:	€ 543,552 *These are the maximum benefits available if a FRM option with a 1% Fluvial SOP is provided to all properties within the AFA.			
Annual Average Damages (fluvial):	32827			

Social Risk		
	Type	**Description**
High Vulnerability Properties at risk:	School	**0.1% AEP Flood Extent**
		Athea National School
Social Infrastructure Assets:	Community Centre	**1% AEP Flood Extent**
		Con Colbert Memorial Hall
Social Amenity Sites:	None	N/A
Risk to the Environment		
	Type	**Description**
Risk to WFD Annex IV	None	N/A
Risk to SACs	Candidate Special Area of Conservation	The Lower River Shannon is classified as a cSAC.
Risk to Cultural Heritage		
	Type	**Description**
Risk to Sites of Cultural Heritage:	NIAH Buildings	**10% AEP Flood Extent**
		Handball alley
		Athea Bridge
Risk to the Economy		
	Type	**Description**
Risk to Transport Infrastructure:	Regional Road	**50% AEP Flood Extent**
		R523
		R524

	Type	Description
Risk to Utility Infrastructure:	None	N/A

Impact of Future Scenarios on Risk:
A summary of the impact of future scenarios on the risks outlined above is detailed in the Flood Risk Tables for each AFA.

Key Risk Issues for Tralee AFA				
AFA	Tralee			
Summary of Flood Risk in 1% Fluvial / 0.5% Coastal AEP Event				
Source of flood risk	Fluvial	Coastal	**Both**	
Total Number of Properties at risk in AFA:		**Residential**	**Non-Residential**	**Total**
	Fluvial	438	222	660
	Coastal	52	10	62
	Combined	488	229	717
Relevant Comments:	Although there are 717 properties identified as being at risk for this combined Annual Exceedance Probability (AEP) scenario, there are potentially significantly more properties at risk in the 0.1% Fluvial / 0.5% Coastal AEP scenario in certain flood cells, some of which were impacted during the September and December 2015 flood events. Although the CFRAM preferred design standard is the 1% Fluvial / 0.5% Coastal AEP scenario, in accordance with the Project Brief, we believe that assessing the 0.1% Fluvial / 0.5% Coastal scenario for certain flood cells could provide additional economic benefit to Tralee. Therefore the potential benefits of a 0.1% Fluvial / 0.5% Coastal scenario for certain flood cells have been considered and are outlined below.			
Summary of Flood Risk in 1% / 0.1% Fluvial and 0.5% Coastal AEP Event				
Total Number of Properties at risk in AFA:		**Residential**	**Non-Residential**	**Total**
	Fluvial	486	227	713
	Coastal	52	10	62
	Combined	536	234	770
Relevant Comments:	The table above reflects the properties at risk for the following scenario: • 1% Fluvial / 0.5% Coastal AEP for Flood Cells TRA_A, TRA_B and TRA_C. • 0.1% Fluvial / 0.5% Coastal AEP For Flood Cell TRA_D. This mixed design standard arrangement provides the best economic value for Tralee whilst ensuring the majority of properties impacted during the September and December 2015 flood events receive an improved standard of protection. It is this mixed design standard which is being adopted for Tralee.			
Summary of PV Damages/Potential PV Benefits				
Total PV Damages:		**Capped**	**Uncapped**	
	Fluvial	€ 39,811,969	€ 46,167,145	
	Coastal	€ 3,817,011	€ 4,784,018	
	Combined	€ 43,477,799	€ 50,951,163	
Max Combined Capped	€ 32,761,899			

Benefits for adopted mixed design standard		
Relevant Comments:	The design standard providing the best economic value for Tralee, whilst ensuring the majority of properties impacted during the September and December 2015 flood events receive an improved standard of protection, is as follows: • 1% Fluvial / 0.5% Coastal AEP for Flood Cells TRA_A, TRA_B and TRA_C. • 0.1% Fluvial / 0.5% Coastal AEP For Flood Cell TRA_D. It is this mixed design standard arrangement which is being adopted for Tralee.	
Annual Average Damages (coastal):	214,151	
Annual Average Damages (fluvial):	2,066,574	
Social Risk		
	Type	**Description**
High Vulnerability Properties at risk:	Halting Site	**0.1% AEP Fluvial Flood Extent**
		Dingle Road Halting Site
	School	**5% AEP Fluvial Flood Extent**
		Scoil Mhuire na Mbraithre on Brewery Road / Edward Street
	Hospital	**2% AEP Fluvial Flood Extent**
		Kerry General Hospital
	Nursing Home	**50% AEP Fluvial Flood Extent**
		OUTSIDE AFA: Cuil Didin Residential Care Facility to the south of Tralee
Social Infrastructure Assets:	Garda Station	**2% AEP Fluvial Flood Extent**
		Tralee Garda Station, New Road
Social Amenity Sites:	None	N/A
Risk to the Environment		
	Type	**Description**
Risk to WFD Annex IV:	Special Protection Area	**50% AEP Flood Extent**
		Tralee Bay Complex SPA
	Licensed IPPC Facility	**1% AEP Fluvial Flood Extent**
		Henry Denny & Sons ltd. Factory (Racket Lane)
Risk to SACs:	Special Area of Conservation	**50% AEP Flood Extent**
		Tralee Bay and Magharees Peninsula (west to Cloghane)

		Ballyseedy Wood
		Akeragh, Banna and Barrow Harbour
Risk to Cultural Heritage		
Risk to Sites of Cultural Heritage:	**Type**	**Description**
	Kerry National Monument	**50% AEP Fluvial Flood Extent**
		Ring-ditch, Blennerville
		10% AEP Fluvial Flood Extent
		Enclosure, Manor West
		5% AEP Flood Extent
		Burnt Mound, Ballingowan
		1% AEP Flood Extent
		Unknown, west of Blennerville
		The Pikeman Monument, Denny Street
		0.5% AEP Flood Extent
		Fulacht Fia, Ballingowan
		Burnt Mound, Ballingowan
		Ring barrow, Manor East
		0.1% AEP Flood Extent
		Balloonagh Castle, North Circular Road
		Cross-inscribed stone, Ashe Memorial Hall, Denny Street
		Ogham stone, Ashe Memorial Hall, Denny Street
		0.1% AEP Coastal Flood Extent
		Standing Stone, Tonavane
		Mound, Blennerville
		Mound, Blennerville
	Proposed Natural Heritage Area	**50% AEP Flood Extent**
		The Proposed Natural Heritage Area of Tralee Bay and Magharees Peninsula (west to Cloghane)
		Akeragh, Banna and Barrow Harbour
		10% AEP Flood Extent
		Unnamed House on intersection of Dingle Road & Windmill Lane
Risk to Sites of Cultural Heritage:	NIAH Buildings	**20% AEP Coastal Flood Extent**
		Ballyard Bridge
		2% AEP Coastal Flood Extent
		Blennerville Windmill
		2% AEP Flood Extent

		1-4, 6 – 8, 14, 15 Prince's Quay
		1 – 6 & 3 Unnamed Houses, Godfrey Place
		Bella Bia & 1 Unnamed House, Ivy Terrace
		Cassidy's Restaurant, Abbey Street
		19th Century Arch, Russell Street
		120 & O'Flynn Interiors Ltd, Rock Street
		The Corner House & Godley's Bar, Pembroke Street
		The Original Gem & 50 Bridge Street
		120 Rock Street
		1, 3, 7 Russell Street
		9 & Tralee Laundry, Pembroke Street
		1% AEP Flood Extent
		Military Barracks, Ballymullen
		5, 9, 13, 16 Prince's Quay
		19th Century Gates/Railings/Walls, Prince's Quay
		5 The Square
		Caball, Eason's, Ryle & Nolan's, The Mall
		Der O'Sulivan & Sons, Dunnes Stores, L Quinlan, The Snackery, The Mall
		8, 9, 11, 13, 31, Unnamed Building, Milk Market Lane
		21 Ashe Street
		109 – 112 Rock Street
		0.5% AEP Flood Extent
		Blennerville House & Outbuildings
		13 The Mall
		42 Ashe Street
		14, 18 Milk Market Lane
		20, 21 Ashe Street
		0.1% AEP Flood Extent
		Cloonbeg Barracks, Gary Ruth Street
		12 Prince's Quay
		Ashe Memorial Hall, Denny Street
		Town Park, Ashe Memorial Hall
		2, 3 Staughton Row
		Pikeman Bar & Unnamed house, Denny Street
		1 – 3 & Unnamed House, Church Street

		37 Ashe Street
		1-3, 5 The Square
		7-9, 30, 33 & The Kerry Bookshop, The Mall
		5 , 18 Milk Market Lane.
		4, 14, 33, 34 Lower Castle Street
		St John's COI, Ashe Street
		14 Rock Street
		Kelliher's Hardware, Gas House Terrace
		Pembroke House, Pembroke Street
Risk to the Economy		
	Type	**Description**
Risk to Transport Infrastructure:	National Secondary Road	**50% AEP Fluvial Flood Extent**
		N70
		20% AEP Coastal & Fluvial Flood Extent
		N86
	Regional Road	**10% AEP Fluvial Flood Extent**
		R874
		5% AEP Fluvial Flood Extent
		R919
		R551
		R875
	Local Road	**50% AEP Fluvial Flood Extent**
		Kearney's Road
		Ballyard Road
Risk to Utility Infrastructure:	High Vulnerability Utility	**10% AEP Fluvial Flood Extent**
		Eircom Depot at Castlewood Park / Kilerisk Road
	Low Vulnerability Utility	**0.1% AEP Flood Extent**
		Pumping station for the Tralee sewerage scheme, to the south of Tralee.

Impact of Future Scenarios on Risk:
A summary of the impact of future scenarios on the risks outlined above is detailed in the Flood Risk Tables for each AFA.

Key Risk Issues for Banna AFA				
AFA	Banna			
Summary of Flood Risk in 1% AEP Fluvial Event/ 0.5% Coastal Event				
Source of flood risk	Fluvial	Coastal	**Both**	
Total Number of Properties at risk in AFA in 1% Fluvial / 0.5% Coastal AEP Event:		**Residential**	**Non-Residential**	**Total**
	Fluvial	19	0	19
	Coastal	18	0	18
	Combined	19	0	19
Summary of PV Damages/Potential PV				
Total PV Damages:		**Uncapped**	**Capped**	
	Fluvial	€ 1,720,700	€ 1,720,700	
	Coastal	€ 1,663,874	€ 1,663,874	
	Combined	€ 3,384,574	€ 2,674,804	
Max Combined Capped Benefits for 1% Fluvial and 0.5% Coastal AEP Event:	€ 2,424,244 *These are the maximum benefits available if a FRM option with a 1% Fluvial/ 0.5% Coastal AEP SOP is provided to all properties within the AFA.			
Annual Average Damages (fluvial):	77024			
Annual Average Damages (coastal):	74479			
Social Risk				
	Type	**Description**		
High Vulnerability Properties at risk:	None	N/A		
Social Infrastructure Assets:	None	N/A		
Social Amenity Sites:	None	N/A		
Risk to the Environment				
	Type	**Description**		
Risk to WFD Annex IV:	None	N/A		
Risk to SACs:	SACs & SPAs	There are no designated sites within the AFA the closest is the Akeragh, Banna And Barrow Harbour SAC, Tralee Bay Complex SPA less than 500m west.		
Risk to Cultural Heritage				
	Type	**Description**		
Risk to Sites of Cultural	None	N/A		

Heritage:		
Risk to the Economy		
	Type	**Description**
Risk to Transport Infrastructure:	None	N/A
Risk to Utility Infrastructure:	None	N/A
Impact of Future Scenarios on Risk:		
A summary of the impact of future scenarios on the risks outlined above is detailed in the Flood Risk Tables for each AFA.		

Key Risk Issues for Abberydorney AFA				
AFA	Abbeydorney			
Summary of Flood Risk in 1% AEP Event				
Source of flood risk	**Fluvial**	Coastal	Both	
Total Number of Properties at risk in AFA in 1% Fluvial AEP Event:		**Residential**	**Non-Residential**	**Total**
	Fluvial	4	5	9
Summary of PV Damages/Potential PV Benefits for 1% Fluvial SOP				
Total PV Damages:		**Uncapped**	**Capped**	
	Fluvial	€ 2,044,997	€ 964,689	
Max Capped Benefits for 1% Fluvial AEP Event*:	€ 882,835 *These are the maximum benefits available if a FRM option with a 1% Fluvial SOP is provided to all properties within the AFA.			
Annual Average Damages (fluvial):	91537			
Social Risk				
	Type	**Description**		
High Vulnerability Properties at risk:	None	N/A		
Social Infrastructure Assets:	Sports Facility	**50% AEP Flood Extent**		
		GAA Pitch		
	Community Centre	**50% AEP Flood Extent**		
		GAA Clubhouse		
Social Amenity Sites:	None	N/A		
Risk to the Environment				
	Type	**Description**		
Risk to WFD Annex IV:	None	N/A		
Risk to SACs:	None	N/A		
Risk to Cultural Heritage				
	Type	**Description**		
Risk to Sites of Cultural Heritage:	NIAH Buildings	**1% AEP Flood Extent**		
		Saint Bernard's Catholic Church, regionally important		
Risk to the Economy				
	Type	**Description**		
Risk to Transport Infrastructure:	Regional Road	**10% AEP Flood Extent**		
		R556		

		R557
Risk to Utility Infrastructure:	Low vulnerability infrastructure	**0.1% AEP Flood Extent**
		Hand water pump

Impact of Future Scenarios on Risk:
A summary of the impact of future scenarios on the risks outlined above is detailed in the Flood Risk Tables for each AFA.

Key Risk Issues for Moneycashen AFA				
AFA	Moneycashen			
Summary of Flood Risk in 1% Fluvial/0.5% Coastal AEP Event				
Source of flood risk	Fluvial	Coastal	**Both**	
Total Number of Properties at risk in AFA in 1% Fluvial / 0.5% Coastal AEP Event:		**Residential**	**Non-Residential**	**Total**
	Fluvial	5	0	5
	Coastal	5	0	5
	Combined	5	0	5
Summary of PV Damages/Potential PV Benefits				
Total PV Damages:		**Uncapped**	**Capped**	
	Fluvial	€ 42,437	€ 42,437	
	Coastal	€ 686,095	€ 678,899	
	Combined	€728,532	€ 707,820	
Max Combined Capped Benefits for 1% Fluvial and 0.5% Coastal AEP Event*:	€ 633,752 *These are the maximum benefits available if a FRM option with a 1% Fluvial/ 0.5% Coastal AEP SOP is provided to all properties within the AFA.			
Annual Average Damages (fluvial):	1900			
Annual Average Damages (coastal):	30711			
Social Risk				
High Vulnerability Properties at risk :	**Type**	**Description**		
	None	N/A		
Social Infrastructure Assets:	None	N/A		
Social Amenity Sites:	None	N/A		
Risk to the Environment				
	Type	**Description**		
Risk to WFD Annex IV	None	N/A		
Risk to SACs	Candidate Special Area of Conservation	The Cashen Estuary is part of the Lower Shannon cSAC, part of which falls within this AFA.		
Risk to Cultural Heritage				
Risk to Sites of Cultural Heritage:	**Type**	**Description**		
	None	N/A		
Risk to the Economy				
Risk to Transport	**Type**	**Description**		

Infrastructure	Local Rural Road	**20% AEP Flood Extent.**
		Unnamed Local Road
Risk to Utility Infrastructure	**Type**	**Description**
	None	N/A

Impact of Future Scenarios on Risk:
A summary of the impact of future scenarios on the risks outlined above is detailed in the Flood Risk Tables for each AFA.

Flood Risk Analysis and Mapping

LISTOWEL **Type of Risk**	**Flood Risk for Design AEP (%) Event**		
	10% AEP	**1% AEP**	**0.1% AEP**
Current Scenario (Present Day)			
Event Damage (€)	-	€ 14,092,124	€ 22,718,542
No. Residential Properties at Risk	0	137	150
No. Business Properties at Risk	4	23	24
No. Utilities at Risk	0	1	1
No. Major Transport Assets at Risk	1	2	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	3	3
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	-	-	-
Mid-Range Future Scenario			
Event Damage (€)	€ 5,317,552	€ 21,896,447	€ 33,787,849
No. Residential Properties at Risk	89	142	156
No. Business Properties at Risk	11	23	24
No. Utilities at Risk	0	1	1
No. Major Transport Assets at Risk	3	4	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	3	3	3
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	1
High-End Future Scenario			
Event Damage (€)	€ 12,322,211	€ 26,020,198	€ 37,013,193
No. Residential Properties at Risk	128	151	158
No. Business Properties at Risk	11	23	24
No. Utilities at Risk	0	1	1
No. Major Transport Assets at Risk	3	5	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	3	3	3
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	1

ABBEYFEALE **Type of Risk**	**Flood Risk for Design AEP (%) Event**		
	10% AEP	**1% AEP**	**0.1% AEP**
Current Scenario (Present Day)			
Event Damage (€)	-	€ 325,891	€ 816,307
No. Residential Properties at Risk	0	2	10
No. Business Properties at Risk	0	2	2
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	2	2	2
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	-	-	-
Mid-Range Future Scenario			
Event Damage (€)	€ 322,476	€ 1,414,509	€ 2,198,512
No. Residential Properties at Risk	0	6	10
No. Business Properties at Risk	1	2	3
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	2	2	2
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	5	5	5
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	€ 544,600	€ 1,709,100	€ 2,534,340
No. Residential Properties at Risk	2	10	12
No. Business Properties at Risk	2	2	3
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	2	2	2
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	5	5	5
No. Potential Pollution Sources at Risk	0	0	0

MONEYCASHEN **Type of Risk**	**Flood Risk for Design AEP (%) Event**		
	10% AEP	**1% AEP**	**0.1% AEP**
Current Scenario (Present Day)			
Event Damage (€)	€ 48,713	€ 568,053	€ 784,799
No. Residential Properties at Risk	4	5	7
No. Business Properties at Risk	0	0	0
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	1	1	1
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	-	-	-
Mid-Range Future Scenario			
Event Damage (€)	€ 922,815	€ 1,451,859	€ 1,909,758
No. Residential Properties at Risk	5	8	11
No. Business Properties at Risk	0	0	0
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	1	1	1
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	€ 1,768,606	€ 2,366,987	€ 3,822,320
No. Residential Properties at Risk	10	14	17
No. Business Properties at Risk	0	0	0
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	0	0	0
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

ATHEA **Type of Risk**	**Flood Risk for Design AEP (%) Event**		
	10% AEP	**1% AEP**	**0.1% AEP**
Current Scenario (Present Day)			
Event Damage (€)	€ 12,251	€ 774,438	€ 2,600,883
No. Residential Properties at Risk	0	12	19
No. Business Properties at Risk	0	3	5
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	3	4	4
No. Highly Vulnerable Properties at Risk	0	0	1
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	-	-	-
Mid-Range Future Scenario			
Event Damage (€)	€ 67,780	€ 990,180	€ 2,733,852
No. Residential Properties at Risk	10	15	26
No. Business Properties at Risk	2	3	7
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	3	4	4
No. Highly Vulnerable Properties at Risk	0	0	1
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	-	-	-
High-End Future Scenario			
Event Damage (€)	€ 140,126	€ 1,095,977	€ 2,789,133
No. Residential Properties at Risk	27	27	29
No. Business Properties at Risk	5	5	7
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	3	4	4
No. Highly Vulnerable Properties at Risk	0	0	1
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	-	-	-

ABBEYDORNEY **Type of Risk**	**Flood Risk for Design AEP (%) Event**		
	10% AEP	**1% AEP**	**0.1% AEP**
Current Scenario (Present Day)			
Event Damage (€)	€ 198,970	€ 354,764	€ 573,077
No. Residential Properties at Risk	2	4	8
No. Business Properties at Risk	2	5	6
No. Utilities at Risk	0	0	1
No. Major Transport Assets at Risk	2	2	3
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	2	2	2
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	-	-	-
Mid-Range Future Scenario			
Event Damage (€)	€ 218,511	€ 421,923	€ 634,278
No. Residential Properties at Risk	3	7	12
No. Business Properties at Risk	3	7	12
No. Utilities at Risk	0	0	1
No. Major Transport Assets at Risk	2	2	3
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	2	2	2
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	-	-	-
High-End Future Scenario			
Event Damage (€)	€ 240,395	€ 454,401	€ 759,304
No. Residential Properties at Risk	6	8	12
No. Business Properties at Risk	3	7	13
No. Utilities at Risk	0	1	1
No. Major Transport Assets at Risk	2	2	3
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	2	2	2
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	-	-	-

TRALEE **Type of Risk**	**Flood Risk for Design AEP (%) Event**		
	10% AEP	**1% AEP**	**0.1% AEP**
Current Scenario (Present Day)			
Event Damage (€)	€4,970,896	€ 41,248,811	€ 76,747,226
No. Residential Properties at Risk	107	488	828
No. Business Properties at Risk	10	229	390
No. Utilities at Risk	1	1	2
No. Major Transport Assets at Risk	5	8	8
No. Highly Vulnerable Properties at Risk	1	3	4
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	4	5	5
No. Potential Pollution Sources at Risk	-	-	-
Mid-Range Future Scenario			
Event Damage (€)	€18,324,470	€ 88,540,964	€ 184,586,206
No. Residential Properties at Risk	416	830	1281
No. Business Properties at Risk	84	337	480
No. Utilities at Risk	1	1	2
No. Major Transport Assets at Risk	6	8	8
No. Highly Vulnerable Properties at Risk	3	4	4
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	4	5	5
No. Potential Pollution Sources at Risk	-	-	-
High-End Future Scenario			
Event Damage (€)	€ 154,581,217	€ 323,585,802	€ 459,026,415
No. Residential Properties at Risk	815	1173	1505
No. Business Properties at Risk	321	436	531
No. Utilities at Risk	1	2	2
No. Major Transport Assets at Risk	8	8	8
No. Highly Vulnerable Properties at Risk	4	4	5
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	4	5	5
No. Potential Pollution Sources at Risk	-	-	-

BANNA **Type of Risk**	**Flood Risk for Design AEP (%) Event**		
	10% AEP	**1% AEP**	**0.1% AEP**
Current Scenario (Present Day)			
Event Damage (€)	€ 284,614	€ 982,495	€ 2,566,517
No. Residential Properties at Risk	14	19	25
No. Business Properties at Risk	0	0	0
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	0	0	0
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	-	-	-
Mid-Range Future Scenario			
Event Damage (€)	€ 358,149	€ 1,212,272	€ 2,883,458
No. Residential Properties at Risk	14	19	25
No. Business Properties at Risk	0	0	0
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	0	0	0
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	€ 433,116	€ 2,086,351	€ 3,374,105
No. Residential Properties at Risk	14	25	28
No. Business Properties at Risk	0	0	0
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	0	0	0
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	0	0	0

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 Tralee Bay – Feale River Basin River Basin should:

- Make themselves aware of the potential for flooding in their area, including the likely extents, depths and risk-to-life
- 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.

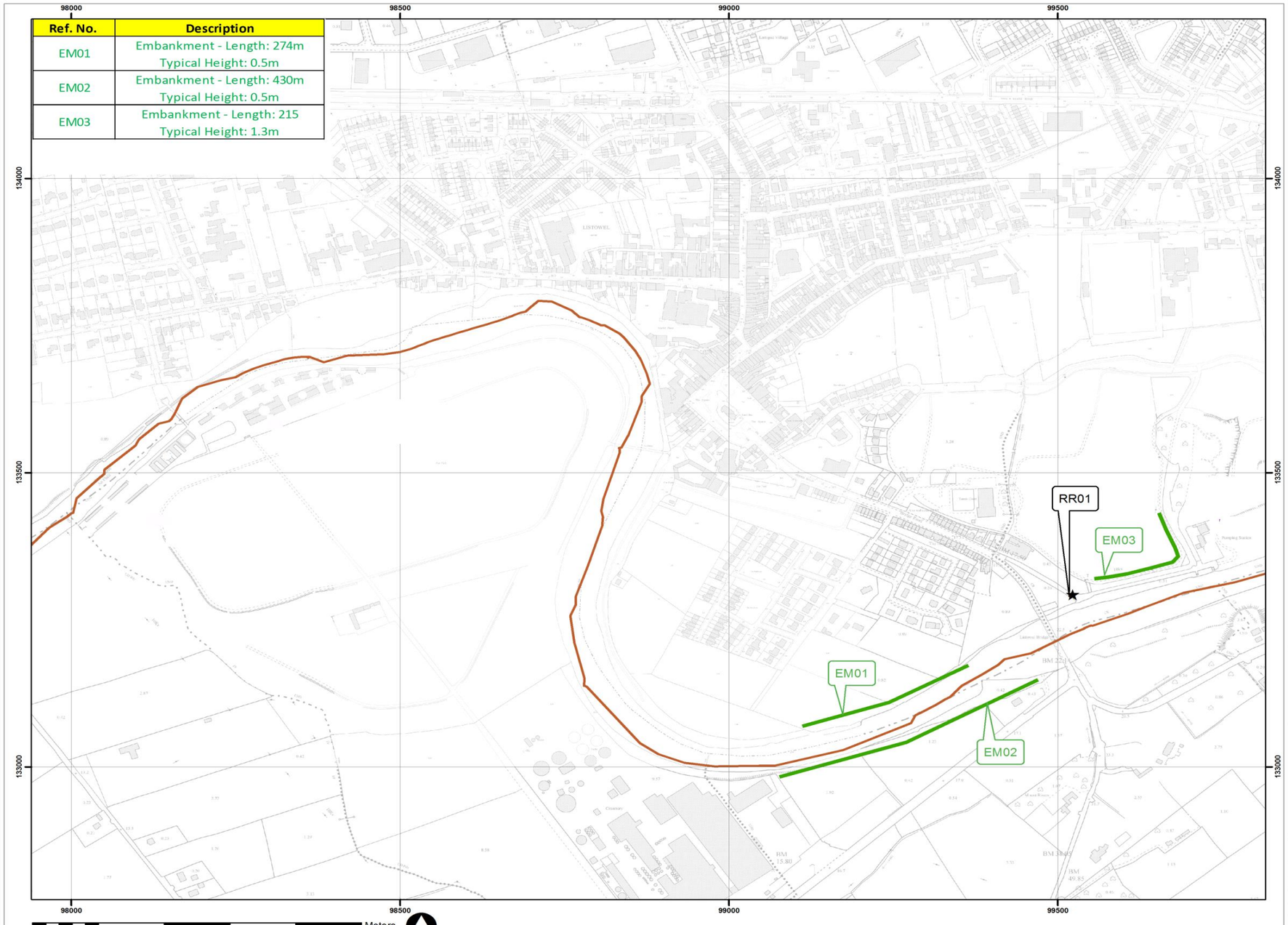
APPENDIX G

DESCRIPTION OF POTENTIALLY VIABLE FLOOD RELIEF WORKS

G.1 Tralee Bay – Feale River Basin / Feale / Listowel AFA

River Basin	Shannon
AFA	Listowel
Measure	Progress the development of a Flood Relief Scheme for Listowel
Code	IEGBNISH-23-IE-AFA-230357-0001-M61
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Listowel, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation.
IMPORTANT NOTE: 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 7.1 and 10.1).	

Ref. No.	Description
EM01	Embankment - Length: 274m Typical Height: 0.5m
EM02	Embankment - Length: 430m Typical Height: 0.5m
EM03	Embankment - Length: 215 Typical Height: 1.3m



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Legend

- AFA Boundary
- River Centreline

Potential Measures

- Structure Enhancement
- Structure Replacement
- Property Relocation
- Pump
- Flood Gate
- Flapped Outfall
- Replace Culvert
- Weir
- Existing Defence
- Raise Existing Defences
- Embankment
- Wall
- Existing Diversion
- Flow Diversion
- Channel Maintenance
- Increase Conveyance
- Storage Area

IMPORTANT USER NOTE:
This outline plan provides the indicative details of a potential flood risk management option developed for the Shannon CFRAM Study. The information provided is suitable as a concept design ONLY and will need to be reviewed before commencement of any detailed design phase.

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

Merrion House
Merrion Road
Dublin

Project: SHANNON CFRAM STUDY

Map: **LISTOWEL OPTION 2**

Drawn by:	AC	Date: September 2015
Checked by:	PT	Date: September 2015
Reviewed by:	MC	Date: September 2015
Approved by:	PS	Date: September 2015
Map Scale: 1: 5,000		Plot Scale: 1:1 @ A3

MCA Appraisal Outcomes			
Objective	**Un-weighted Score**	**Local Weighting**	**Comment**
1.a	2.00	5	This score is determined for this option as it has very low operational risks to operate or perform successfully.
1.b	2.00	5	This score is determined for this option as it has low health and safety risks associated with the construction and operation of flood risk management option.
1.c	1.40	5	This score is determined for this option as it can be adapted at a moderate impact on flood risk.
2.a	3.62	4.63	This score is calculated based on the reduction in AAD, following the full implementation of option.
2.b	0.20	5	This score is calculated based on the reduction in flood risk to transport routes, following full implementation of option.
2.c	4.52	5	This score is calculated based on a reduction in flood risk to utility infrastructure, following full implementation of option.
2.d	0.00	3.5	This score is determined based an increase in the area of agricultural land flooded and applicable to flood warning.
3.a.i	4.20	5	This score is calculated based on a reduction in flooding to residential properties, following full implementation of the option.
3.a.ii	1.00	0	This score is calculated based on a reduction in flooding to high vulnerability properties, following full implementation of the option.
3.b.i	1.14	5	This score is calculated based on a reduction in flood risk to social infrastructure assets, following full implementation of the option. The calculated score was then increased to account of protection to assets of particular social value.
3.b.ii	5.00	5	This score is calculated based on the reduction in flood risk to assets of local employment, following full implementation of the option.
4.a	-1.00	5	Potential short term construction impacts that can be mitigate.

4.b	-1.00	5	No likely significant effects subject to mitigation implementation in full. Which include otter and invasive species surveys, and development of pollution control measures for freshwater pearl mussel, lamprey, and aquatic habitats.
4.c	-1.00	2	Neutral. Potential for positive impact to local flora and fauna if species-rich planting mix used in proposed flood embankment.
4.d	-1.00	3	Potential short term construction impacts that can be mitigated.
4.e	-1.00	1	There will be construction related impact to the Sive walk. The option will require the raising of the embankment on the landside of the Sive walk. There Sive walk will continue to flood during the 1 AEP.
4.f.i	1.00	2	The option will reduce the potential for flooding in the 1% AEP for 1 RPS/NIAH and 400m2 of ACA.
4.f.ii	1.00	2	The option will reduce the potential for flooding in the 1% AEP in the vicinity of a National Monument in State care. There will be no change to the potential flooding of the RMP.

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
1350	1.212	1113.63

No Properties Benefitting	**10% AEP Event**	**1%/05% AEP Event**	**0.1% AEP Event**
Residential	-	137	-
Commercial	-	6	-

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
€ 13.04	€ 1.21	€ 8.37	6.90
Environmental Assessments			

Key Conclusions:

- Potential short term construction impacts that can be mitigate;
- No likely significant effects subject to mitigation implementation in full;
- Potential for positive impact to local flora and fauna if species-rich planting mix used in proposed flood embankment;
- Potential short term construction impacts that can be mitigated on fisheries habitat;
- There will be construction related impact to the Sive walk;
- Reduction in the potential for flooding in the 1% AEP for 1 RPS/NIAH and 400m2 of ACA;
- Reduction in the potential for flooding in the 1% AEP in the vicinity of a National Monument in State care.

Adaptability to Potential Future Changes

The proposed embankments and walls can be increased in height for climate change events.

Public Consultation Outcomes

1 public consultation meeting was held on 24/09/14 and 01/10/15. 12 people attended this meeting. Any comments that were made were given consideration when selecting the preferred options.

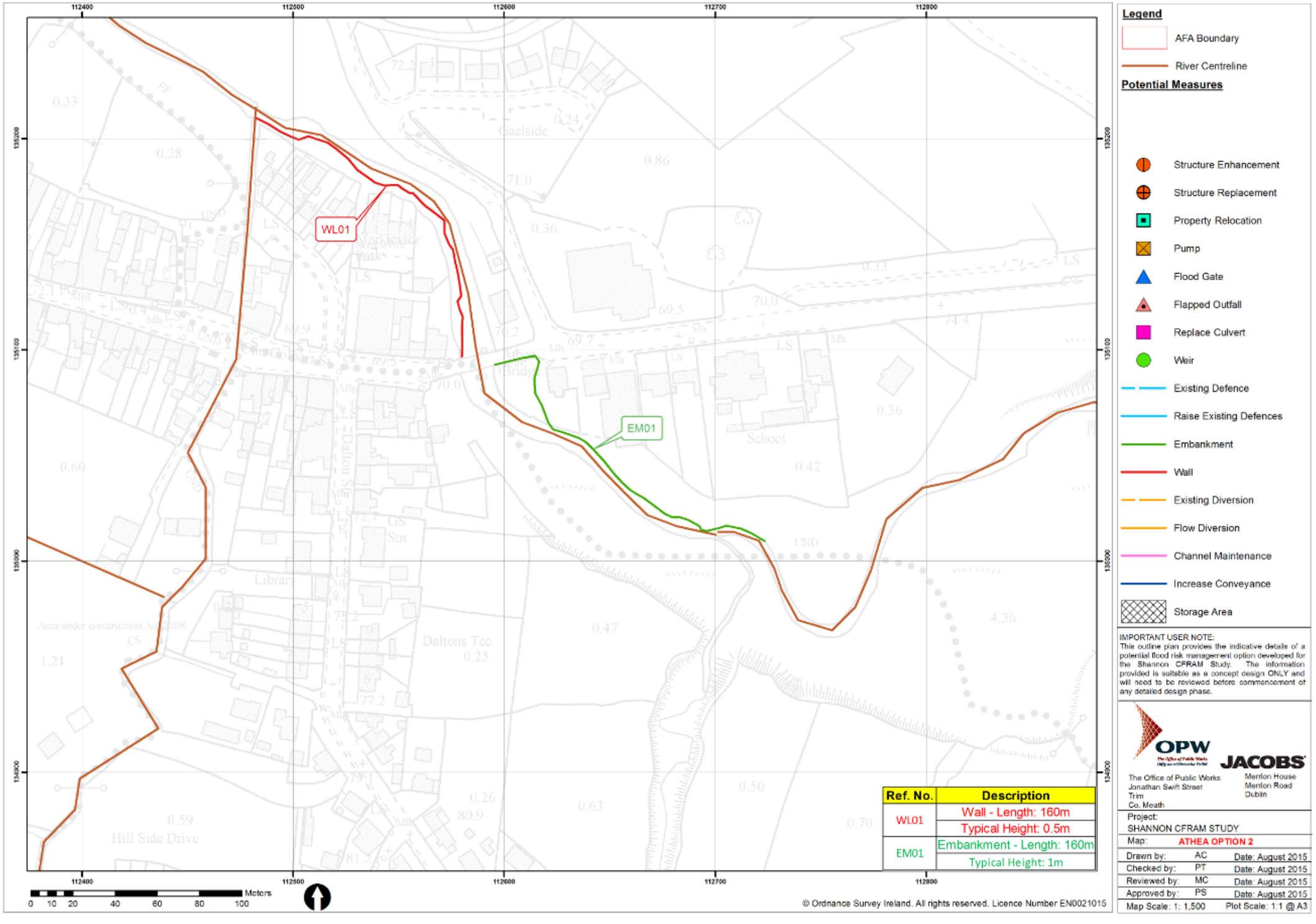
Other Issues / Conclusions

In parallel to this proposed measure, Kerry County Council have also submitted an application under the OPW Minor Flood Mitigation Works & Coastal Protection Scheme for the progression of flood mitigation (minor works) in the Clievragh area of Listowel, in line with the recommendations set out in the Report of May 2016 (as referenced in Section 2.6). At the time of writing, this application is currently under separate consideration by the OPW.

There are some properties within the Listowel AFA that, subject to amendment at project-level development, will not benefit from the proposed measure, and the property owners may wish to consider Individual Property Protection to provide some reduction of flood risk for their properties (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.

G.2 Tralee Bay – Feale River Basin / Feale / Athea AFA

River Basin	Shannon
AFA	Athea
Measure	Progress the development of a Flood Relief Scheme for Athea
Code	IEGBNISH-23-IE-AFA-232630-0002-M61
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Athea, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation.
IMPORTANT NOTE: 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 7.1 and 10.1).	


112400
112500
112600
112700
112800
135200
135100
135000
134900
WL01
EM01
Gaelside
Daltons Tce
Hill Side Drive
School
Library
Area under construction June 2008
Meters
0 10 20 40 60 80 100
Ref. No.
Description
WL01
Wall - Length: 160m
Typical Height: 0.5m
EM01
Embankment - Length: 160m
Typical Height: 1m
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Legend
AFA Boundary
River Centreline
Potential Measures
Structure Enhancement
Structure Replacement
Property Relocation
Pump
Flood Gate
Flapped Outfall
Replace Culvert
Weir
Existing Defence
Raise Existing Defences
Embankment
Wall
Existing Diversion
Flow Diversion
Channel Maintenance
Increase Conveyance
Storage Area
IMPORTANT USER NOTE:
This outline plan provides the indicative details of a potential flood risk management option developed for the Shannon CFRAM Study. The information provided is suitable as a concept design ONLY and will need to be reviewed before commencement of any detailed design phase.
OPW
The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath
JACOBS
Merrion House
Merrion Road
Dublin
Project:
SHANNON CFRAM STUDY
Map:
ATHEA OPTION 2
Drawn by: AC Date: August 2015
Checked by: PT Date: August 2015
Reviewed by: MC Date: August 2015
Approved by: PS Date: August 2015
Map Scale: 1: 1,500
Plot Scale: 1:1 @ A3

MCA Appraisal Outcomes			
Objective	**Un-weighted Score**	**Local Weighting**	**Comment**
1.a	5.00	5.00	This score is determined for this option as it has no operational risks to operate or perform successfully.
1.b	2.00	5.00	This score is determined for this option as it has low health and safety risks associated with the construction and operation of flood risk management option.
1.c	3.00	5.00	This score is determined for this option as it can be adapted at impact on flood risk.
2.a	3.23	0.25	This score is calculated based on the reduction in AAD, following the full implementation of option.
2.b	4.90	5.00	This score is calculated based on the reduction in flood risk to transport routes, following full implementation of option.
2.c	0.00	0.00	This score is calculated based on a reduction in flood risk to utility infrastructure, following full implementation of option.
2.d	0.00	4.00	This score is determined to be zero as the option has no effect on flood risk to agriculture
3.a.i	4.14.	0.41	This score is calculated based on a reduction in flooding to residential properties, following full implementation of the option.
3.a.ii	0.00	0.05	This score is calculated based on a reduction in flooding to high vulnerability properties, following full implementation of the option.
3.b.i	2.27	0.33	This score is calculated based on a reduction in flood risk to social infrastructure assets, following full implementation of the option. The calculated score was then increased to account of protection to assets of particular social value.
3.b.ii	2.98	0.21	This score is calculated based on the reduction in flood risk to assets of local employment, following full implementation of the option.

4.a	-2.50	5.00	Construction related impacts due to significant construction works in and adjacent to the Galey River due to the construction of the flood defence wall and embankment, PC. The proposed wall will permanently replace the natural bank for approx. 150 m. These measures could cause potential changes to the hydrological and morphological regime of the watercourses, HM. The embankment will be set back from the watercourse as far a reasonably practical therefore impacts to the hydrological and morphological regime of the watercourses as a result of the embankment are unlikely. There will be reduced flooding in area with no significant polluting sources in 1% AEP. Therefore a potential for medium-term or recurring impediment to the achievement of WB objectives.
4.b	-1.50	5.00	Potentially significant effects are: • Increases in suspended sediment; • Pollution risks to the Galey Feale; • Risk of disturbance to otter or their resting sites during proposed works; • Risk of invasive species spread during proposed works; • Loss of riparian habitat within the Csac; • Impact to fish species includes salmon and lamprey; • Loss of fisheries habitat; • Loss of life to FWPM (the River Galey is within a catchment with pre-1970 live records (extant populations unlikely, but information in insufficient to list as 'extinct') surveys by qualified ecologist to inform the Appropriate Assessment will be undertaken during the detailed design phase in order to identify if this species is occurring within the waterbody (River Galey). Therefore, a potential detrimental impact upon existing cSAC site, including a delay in recovery of the site, but excluding impacts on the conservations objectives of the site, as a result of flood risk management measures, where suitable mitigation measures are technically feasible.

4.c	-1.50	2.00	Potentially significant effects are: • Increases in suspended sediment; • Pollution risks to the Galey River; • Risk of disturbance to otter or their resting sites during proposed workS; • Risk of invasive species spread during proposed works; • Loss of riparian habitat; • Impact to fish species includes salmon and lamprey; • Loss of fisheries habitat; • Loss of life to FWPM (unlikely) Therefore a potential localised loss of or disturbance to flora/fauna.
4.d	-4.50	2.00	Potential short term construction impacts that can be mitigated. Impact to the hydrological and morphological regimes and also an indirect negative /effect to ecological receptors (including fisheries) due to loss of the natural bank and dredging works. Therefore, a potential medium to long-term alternation of fisheries habitat.
4.e	-2.50	1.00	There is no impact on designated landscape features. The permanent wall and embankment within the AFA adjacent to watercourse within the Town will alter the visual amenity in the area. Therefore, a potential for long term impact to a low sensitivity landscape character/feature in the zone of visibility of the selected measure.
4.f.i	1.00	2.00	The setting of the Athea Bridge (RPS/NIAH) could be affected by the proposed flood defence wall. There is a existing risk to 2 architectural Heritage features in the AFA (one is the Athea Bridge). The Athea Bridge will be afforded some protection in the 1%AEP with this option. Therefore, there is a potential increase in the level of protection for architectural features (Record of Protected Structures and NIAH) from flooding, such that it is less vulnerable to flood damage.

4.f.ii	0.00	0.00	There are no RMPs in the AFA therefore, no significant impacts are predicted. There is a potential for unknown archaeological features to be impacted but these are not known. Therefore, no effects on archaeological features are predicted.

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
-97	0.38	-254.71

No Properties Benefitting	**10% AEP Event**	**1%/05% AEP Event**	**0.1% AEP Event**
Residential	-	12	-
Commercial	-	3	-

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions

Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
€ 0.81	€ 0.38	€ 0.54	1.42

Environmental Assessments

Key Conclusions:

- Potential for medium-term or recurring impediment to the achievement of WB objectives;
- Potential for a detrimental impact upon the existing cSAC site, including a delay in recovery of the site, but excluding impacts on the conservations objectives of the site, as a result of flood risk management measures, where suitable mitigation measures are technically feasible;
- Potential localised loss of or disturbance to flora/fauna;
- Potential medium to long-term alternation of fisheries habitat;
- Potential for long term impact to a low sensitivity landscape character/feature in the zone of visibility of the selected measure;
- Potential increase in the level of protection for architectural features (Record of Protected Structures and NIAH) from flooding, such that it is less vulnerable to flood damage;
- No effects on archaeological features are predicted.

Adaptability to Potential Future Changes

The proposed embankments and walls can be increased in height for climate change events.

Public Consultation Outcomes

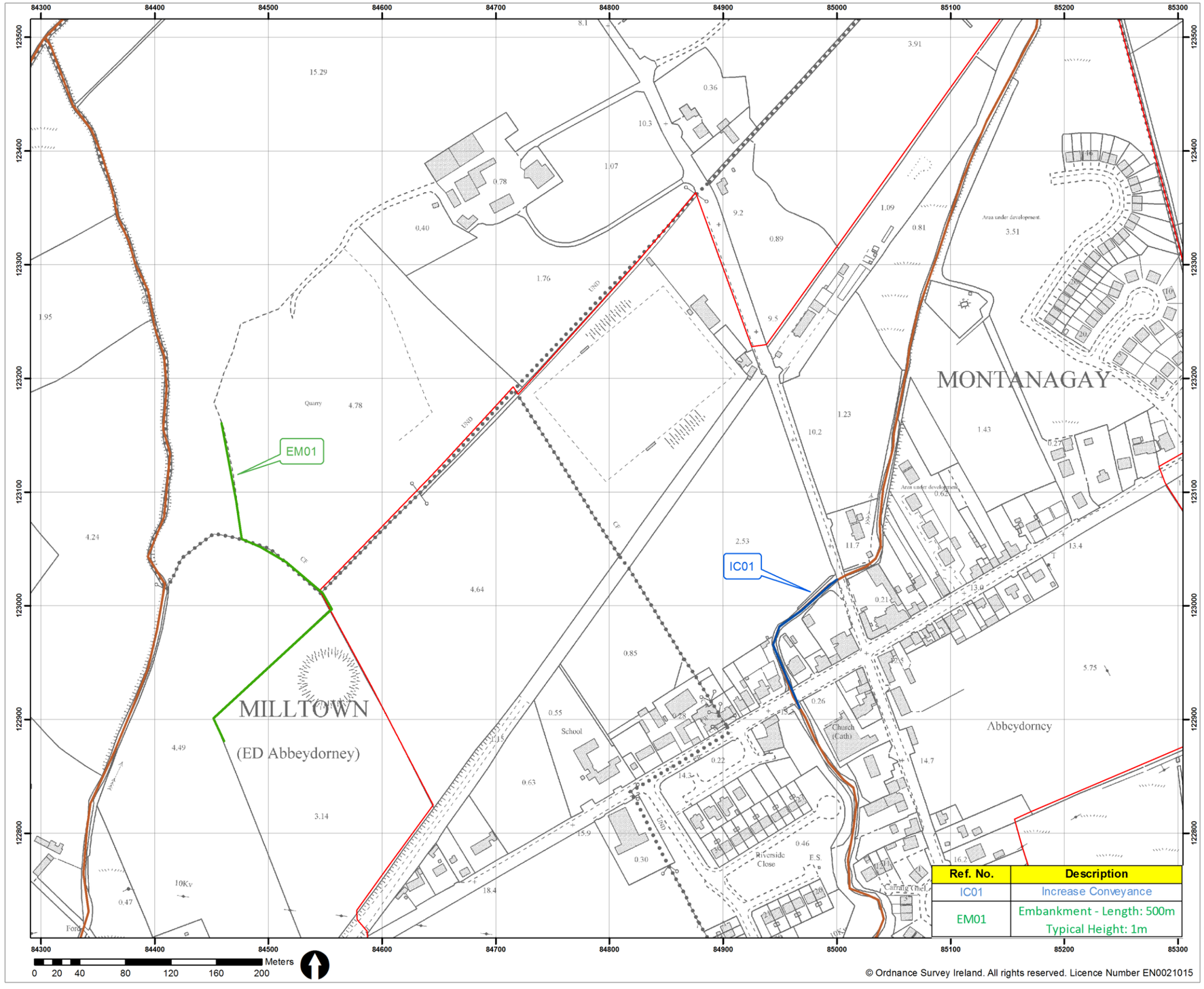
2 public consultation meetings were held on 24/09/14 and 30/09/15. 2 people attended the first meeting and 3 people attended the second. Any comments that were made were given consideration when selecting the preferred options.

Other Issues / Conclusions

This option will provide a 1% Fluvial AEP Design standard to all properties within the AFA identified as being at risk.

G.3 Tralee Bay – Feale River Basin / Feale / Abbeydorney AFA

River Basin	Shannon
AFA	Abbeydorney
Measure	Progress the development of a Flood Relief Scheme for Abbeydorney
Code	IEGBNISH-23-IE-AFA-230341-0003-M61
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Abbeydorney, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation.
IMPORTANT NOTE: 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 7.1 and 10.1).	



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Legend

- AFA Boundary
- River Centreline

Potential Measures

- Structure Enhancement
- Structure Replacement
- Property Relocation
- Pump
- Flood Gate
- Flapped Outfall
- Replace Culvert
- Weir
- Existing Defence
- Raise Existing Defences
- Embankment
- Wall
- Existing Diversion
- Flow Diversion
- Channel Maintenance
- Increase Conveyance
- Storage Area

IMPORTANT USER NOTE:
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OPW The Office of Public Works Oifig na nOibreacha Poibli
JACOBS
The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath
Merrion House
Merrion Road
Dublin

Project:	SHANNON CFRAM STUDY
Map:	ABBEYDORNEY OPTION 2
Drawn by:	AC Date: September 2015
Checked by:	JR Date: September 2015
Reviewed by:	MC Date: September 2015
Approved by:	PS Date: September 2015
Map Scale: 1: 2,500	Plot Scale: 1:1 @ A3

MCA Appraisal Outcomes			
Objective	**Un-weighted Score**	**Local Weighting**	**Comment**
1.a	5.00	5.00	This score is determined for this option as it has no operational risks to operate or perform successfully.
1.b	3.00	5.00	This score is determined for this option as it has very low health and safety risks associated with the construction and operation of flood risk management option.
1.c	2.00	5.00	This score is determined for this option as it can be adapted at a moderate impact on flood risk.
2.a	4.84	0.87	This score is calculated based on the reduction in AAD, following the full implementation of option.
2.b	2.94	5.00	This score is calculated based on the reduction in flood risk to transport routes, following full implementation of option.
2.c	0.00	0.25	This score is calculated based on a reduction in flood risk to utility infrastructure, following full implementation of option.
2.d	0.00	0.00	This score is determined to be zero as the option has no effect on flood risk to agriculture
3.a.i	4.81	1.48	This score is calculated based on a reduction in flooding to residential properties, following full implementation of the option.
3.a.ii	0.00	0.00	This score is calculated based on a reduction in flooding to high vulnerability properties, following full implementation of the option.
3.b.i	4.95	5.00	This score is calculated based on a reduction in flood risk to social infrastructure assets, following full implementation of the option. The calculated score was then increased to account of protection to assets of particular social value.
3.b.ii	4.78	3.43	This score is calculated based on the reduction in flood risk to assets of local employment, following full implementation of the option.
4.a	-1.50	5.00	Potential short term construction and maintenance impacts that can be mitigated.

4.b	-1.00	1.00	No likely significant effects subject to mitigation implementation in full, which includes further surveys potentially including licenced derogation works, to develop specific mitigation measures. Pollution control measures for freshwater pearl mussel must exceed best practice standards due to their sensitivity to siltation and will require that no silt is discharged to watercourses.
4.c	-1.00	1.00	Neutral, subject to full implementation of mitigation measures. Measures to include further survey to inform detailed mitigation measures, potentially including licenced derogation works. Potential for positive impact to local flora and fauna if species-rich planting mix used in proposed flood embankment.
4.d	-2.50	1.00	Potential short term construction impacts that can be mitigated and recurring maintenance impacts that can be mitigated.
4.e	0.00	0.00	There will be construction and maintenance related impact but at a small scale.
4.f.i	1.00	2.00	The option will reduce the potential for flooding in the 1% AEP for 1 RPS.
4.f.ii	0.00	0.00	There are no RMPs within the 1% or the AFA. There are a number of RMPs in close proximity to the 1%AEP but this is outside the AFA boundary and will be considered at sub-catchment scale.

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
718	0.28	2581.47

No Properties Benefitting	**10% AEP Event**	**1%/05% AEP Event**	**0.1% AEP Event**
Residential	-	4	-
Commercial	-	5	-

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
€ 2.04	€ 0.28	€ 0.88	3.18

Environmental Assessments

Key Conclusions:

- Potential short term construction and maintenance impacts that can be mitigated;
- No likely significant effects subject to mitigation implementation in full;
- Neutral on avoiding damage to the flora and fauna of the catchment, subject to full implementation of mitigation measures;
- Potential short term construction impacts that can be mitigated and recurring maintenance impacts that can be mitigated on fisheries habitat;
- There will be construction and maintenance related impact but at a small scale to landscape/character;
- Reduction in the potential for flooding in the 1% AEP for 1 RPS;
- There are no RMPs within the 1% or the AFA therefore there will be no effects on archaeological features.

Adaptability to Potential Future Changes

The proposed embankments and walls can be increased in height for climate change events. The increase conveyance measures will not be easily adaptable to potential future changes.

Public Consultation Outcomes

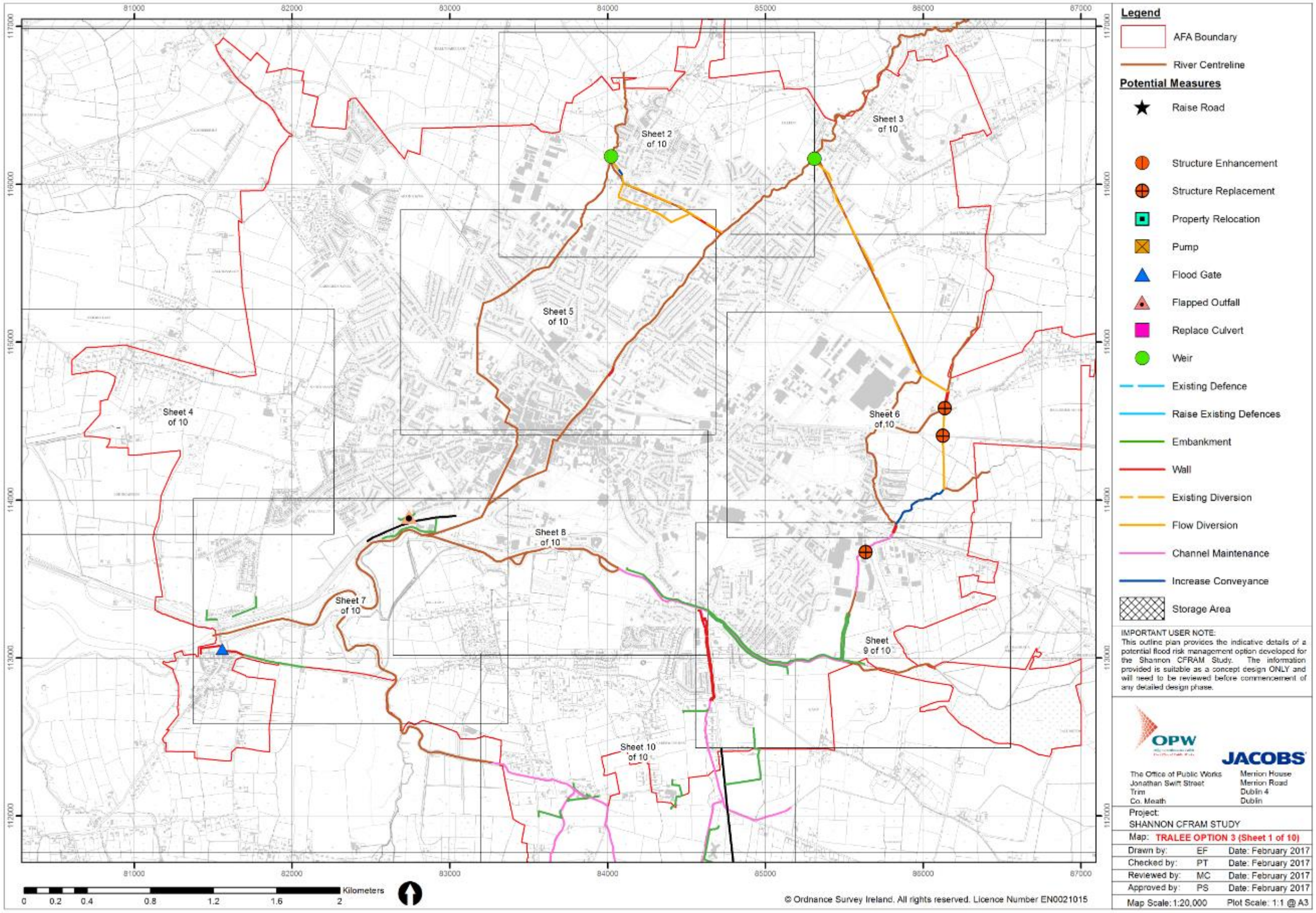
2 public consultation meetings were held on 24/09/14 and 01/10/15. 4 people attended the first meeting and 3 people attended the second. Any comments that were made were given consideration when selecting the preferred options.

Other Issues / Conclusions

This option will provide a 1% Fluvial AEP Design standard to all properties within the AFA identified as being at risk.

G.4 Tralee Bay – Feale River Basin / Lee / Tralee AFA

River Basin	Shannon
AFA	Tralee
Measure	Progress the development of a Flood Relief Scheme for Tralee
Code	IEGBNISH-23-IE-AFA-230361-0004-M61
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Tralee, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation.
IMPORTANT NOTE: 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 7.1 and 10.1).	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82000
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Sheet 2 of 10
Sheet 3 of 10
Sheet 4 of 10
Sheet 5 of 10
Sheet 6 of 10
Sheet 7 of 10
Sheet 8 of 10
Sheet 9 of 10
Sheet 10 of 10
Kilometers
0 0.2 0.4 0.8 1.2 1.6 2
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Legend
AFA Boundary
River Centreline
Potential Measures
Raise Road
Structure Enhancement
Structure Replacement
Property Relocation
Pump
Flood Gate
Flapped Outfall
Replace Culvert
Weir
Existing Defence
Raise Existing Defences
Embankment
Wall
Existing Diversion
Flow Diversion
Channel Maintenance
Increase Conveyance
Storage Area
IMPORTANT USER NOTE:
This outline plan provides the indicative details of a potential flood risk management option developed for the Shannon CFRAM Study. The information provided is suitable as a concept design ONLY and will need to be reviewed before commencement of any detailed design phase.
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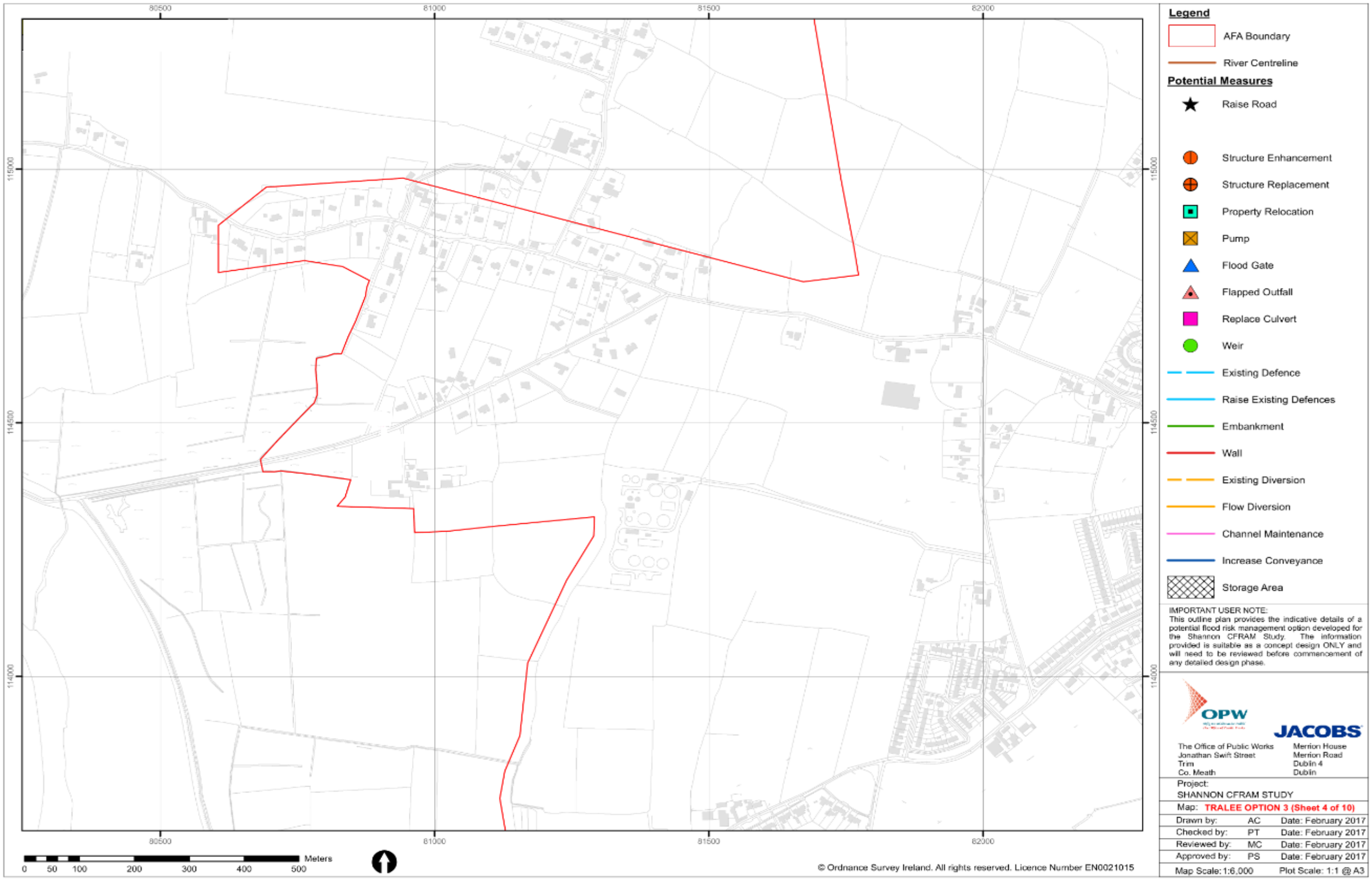
Project:
SHANNON CFRAM STUDY
Map: TRALEE OPTION 3 (Sheet 1 of 10)
Drawn by: EF Date: February 2017
Checked by: PT Date: February 2017
Reviewed by: MC Date: February 2017
Approved by: PS Date: February 2017
Map Scale: 1:20,000 Plot Scale: 1:1 @ A3


80500
81000
81500
82000
115000
114500
114000
0 50 100 200 300 400 500 Meters
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Legend
AFA Boundary
River Centreline
Potential Measures
Raise Road
Structure Enhancement
Structure Replacement
Property Relocation
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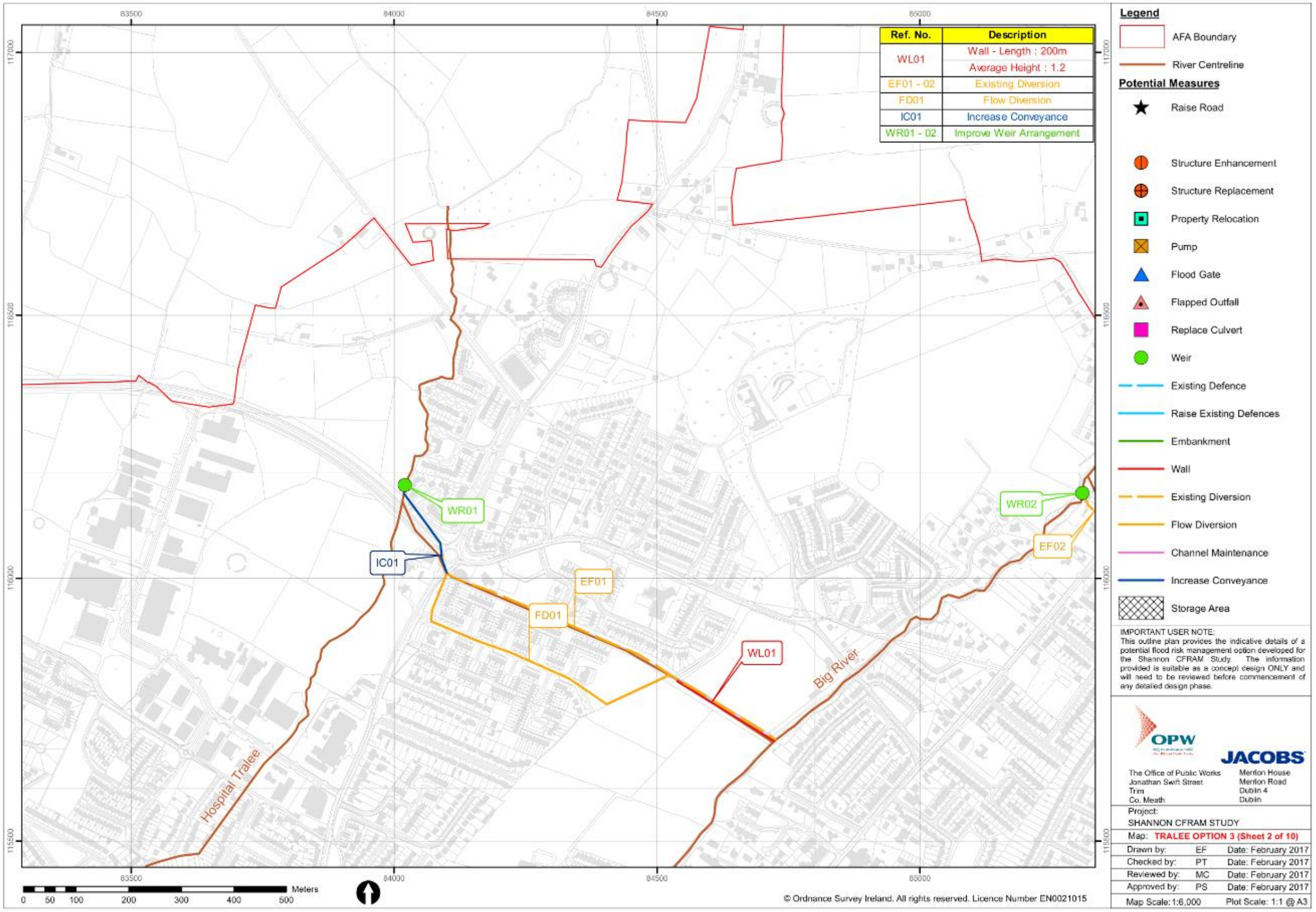
Map: TRALEE OPTION 3 (Sheet 4 of 10)
Drawn by: AC Date: February 2017
Checked by: PT Date: February 2017
Reviewed by: MC Date: February 2017
Approved by: PS Date: February 2017
Map Scale: 1:6,000 Plot Scale: 1:1 @ A3


83500
84000
84500
85000
117000
116500
116000
115500
Ref. No.
Description
WL01
Wall - Length : 200m
Average Height : 1.2
EF01 - 02
Existing Diversion
FD01
Flow Diversion
IC01
Increase Conveyance
WR01 - 02
Improve Weir Arrangement
WR01
WR02
IC01
EF01
EF02
FD01
WL01
Big River
Hospital Tralee
0 50 100 200 300 400 500
Meters
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Legend
AFA Boundary
River Centreline
Potential Measures
Raise Road
Structure Enhancement
Structure Replacement
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Pump
Flood Gate
Flapped Outfall
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Existing Defence
Raise Existing Defences
Embankment
Wall
Existing Diversion
Flow Diversion
Channel Maintenance
Increase Conveyance
Storage Area
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Map: TRALEE OPTION 3 (Sheet 2 of 10)
Drawn by: EF Date: February 2017
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Approved by: PS Date: February 2017
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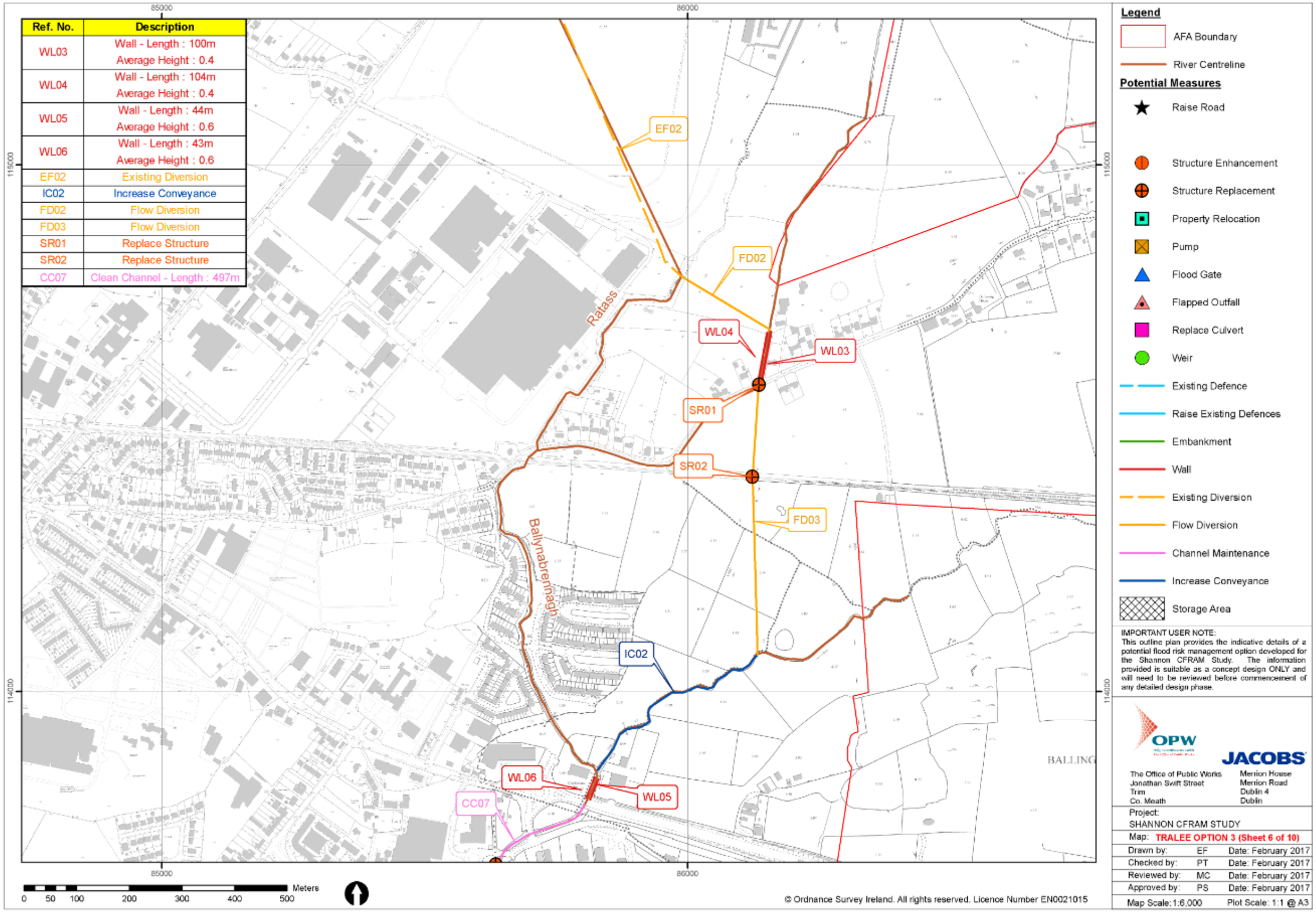
Plot Scale: 1:1 @ A3


85000
86000
115000
114000
Ref. No. | Description
WL03 | Wall - Length : 100m Average Height : 0.4
WL04 | Wall - Length : 104m Average Height : 0.4
WL05 | Wall - Length : 44m Average Height : 0.6
WL06 | Wall - Length : 43m Average Height : 0.6
EF02 | Existing Diversion
IC02 | Increase Conveyance
FD02 | Flow Diversion
FD03 | Flow Diversion
SR01 | Replace Structure
SR02 | Replace Structure
CC07 | Clean Channel - Length : 497m
EF02
FD02
Ratass
WL04
WL03
SR01
SR02
FD03
Ballynabrennagh
IC02
WL06
WL05
CC07
BALLING
Meters
0 50 100 200 300 400 500
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Legend
AFA Boundary
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Raise Road
Structure Enhancement
Structure Replacement
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Existing Defence
Raise Existing Defences
Embankment
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Project:
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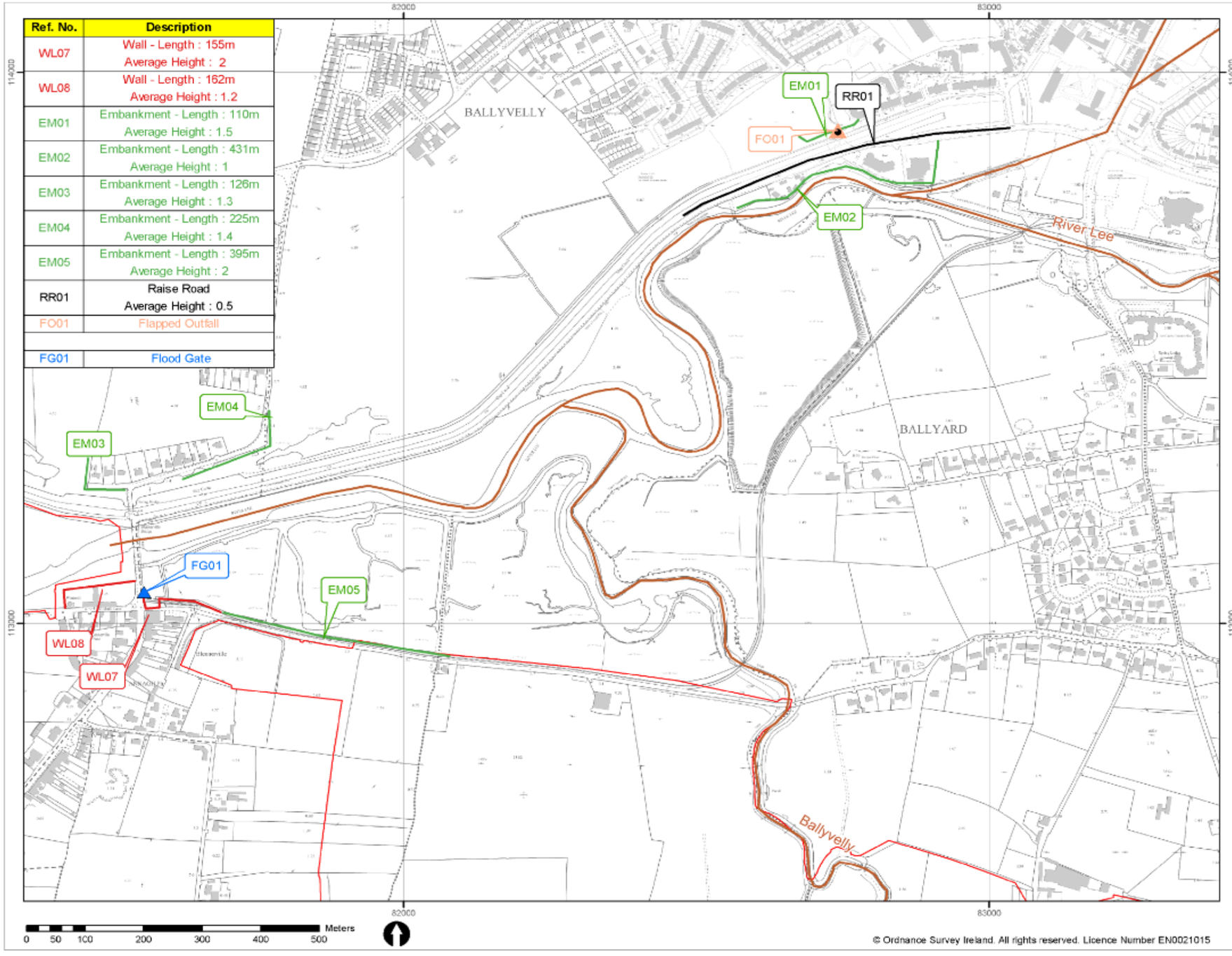
Map: TRALEE OPTION 3 (Sheet 6 of 10)
Drawn by: EF Date: February 2017
Checked by: PT Date: February 2017
Reviewed by: MC Date: February 2017
Approved by: PS Date: February 2017
Map Scale: 1:6,000 Plot Scale: 1:1 @ A3

Ref. No.	Description
WL07	Wall - Length : 155m Average Height : 2
WL08	Wall - Length : 162m Average Height : 1.2
EM01	Embankment - Length : 110m Average Height : 1.5
EM02	Embankment - Length : 431m Average Height : 1
EM03	Embankment - Length : 126m Average Height : 1.3
EM04	Embankment - Length : 225m Average Height : 1.4
EM05	Embankment - Length : 395m Average Height : 2
RR01	Raise Road Average Height : 0.5
FO01	Flapped Outfall
FG01	Flood Gate



Legend

- AFA Boundary
- River Centreline

Potential Measures

- Raise Road
- Structure Enhancement
- Structure Replacement
- Property Relocation
- Pump
- Flood Gate
- Flapped Outfall
- Replace Culvert
- Weir
- Existing Defence
- Raise Existing Defences
- Embankment
- Wall
- Existing Diversion
- Flow Diversion
- Channel Maintenance
- Increase Conveyance
- Storage Area

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Project:
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Map: **TRALEE OPTION 3 (Sheet 7 of 10)**

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Reviewed by:	MC	Date: February 2017
Approved by:	PS	Date: February 2017

Map Scale: 1:6,000 Plot Scale: 1:1 @ A3

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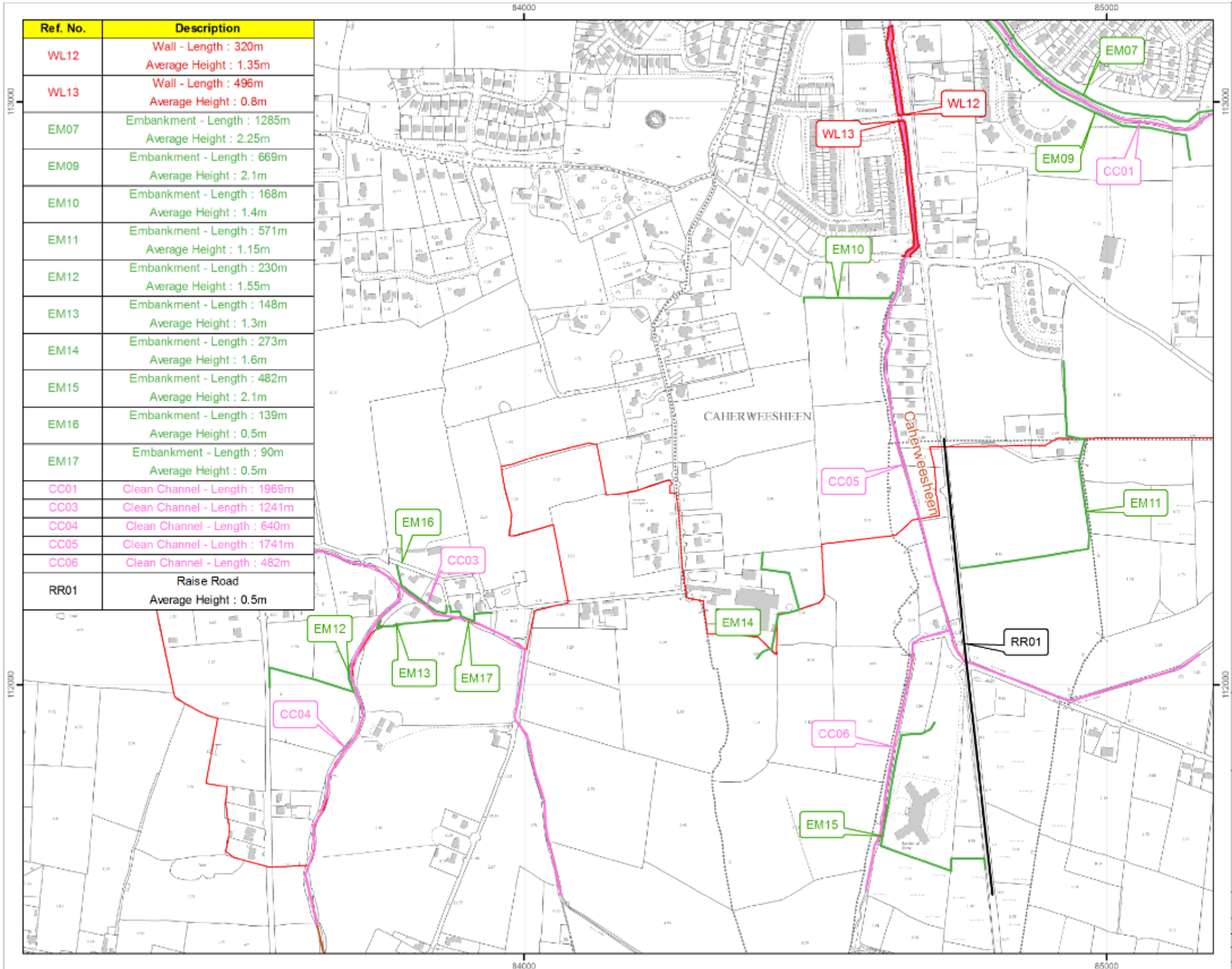
Ref. No.	Description
WL12	Wall - Length : 320m Average Height : 1.35m
WL13	Wall - Length : 496m Average Height : 0.8m
EM07	Embankment - Length : 1285m Average Height : 2.25m
EM09	Embankment - Length : 669m Average Height : 2.1m
EM10	Embankment - Length : 168m Average Height : 1.4m
EM11	Embankment - Length : 571m Average Height : 1.15m
EM12	Embankment - Length : 230m Average Height : 1.55m
EM13	Embankment - Length : 148m Average Height : 1.3m
EM14	Embankment - Length : 273m Average Height : 1.6m
EM15	Embankment - Length : 482m Average Height : 2.1m
EM16	Embankment - Length : 139m Average Height : 0.5m
EM17	Embankment - Length : 90m Average Height : 0.5m
CC01	Clean Channel - Length : 1969m
CC03	Clean Channel - Length : 1241m
CC04	Clean Channel - Length : 640m
CC05	Clean Channel - Length : 1741m
CC06	Clean Channel - Length : 482m
RR01	Raise Road Average Height : 0.5m



Legend

- AFA Boundary
- River Centreline

Potential Measures

- Raise Road
- Structure Enhancement
- Structure Replacement
- Property Relocation
- Pump
- Flood Gate
- Flapped Outfall
- Replace Culvert
- Weir
- Existing Defence
- Raise Existing Defences
- Embankment
- Wall
- Existing Diversion
- Flow Diversion
- Channel Maintenance
- Increase Conveyance
- Storage Area

IMPORTANT USER NOTE:
This outline plan provides the indicative details of a potential flood risk management option developed for the Shannon CFRAM Study. The information provided is suitable as a concept design ONLY and will need to be reviewed before commencement of any detailed design phase.

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Project:
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Map: TRALEE OPTION 3 (Sheet 10 of 10)

Drawn by:	EF	Date: February 2017
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MCA Appraisal Outcomes			
Objective	**Un-weighted Score**	**Local Weighting**	**Comment**
1.a	3.50	5.00	This score is determined for this option as it has very low operational risks to operate or perform successfully.
1.b	-1.00	5.00	This score is determined for this option as it has low/moderate health and safety risks associated with the construction and operation of flood risk management option.
1.c	2.56	5.00	This score is determined for this option as it can be adapted at a moderate impact on flood risk.
2.a	3.99	5.00	This score is calculated based on the reduction in AAD, following the full implementation of option.
2.b	3.81	5.00	This score is calculated based on the reduction in flood risk to transport routes, following full implementation of option.
2.c	4.84	5.00	This score is calculated based on a reduction in flood risk to utility infrastructure, following full implementation of option.
2.d	1.00	1.16	This score is determined based on its applicability to flood warning.
3.a.i	2.00	5.00	This score is calculated based on a reduction in flooding to residential properties, following full implementation of the option.
3.a.ii	2.00	5.00	This score is calculated based on a reduction in flooding to high vulnerability properties, following full implementation of the option.
3.b.i	4.16	3.78	This score is calculated based on a reduction in flood risk to social infrastructure assets, following full implementation of the option. The calculated score was then increased to account of protection to assets of particular social value.
3.b.ii	4.09	5.00	This score is calculated based on the reduction in flood risk to assets of local employment, following full implementation of the option.

4.a	-2.00	5.00	There will be 2 pollution sources potentially removed from the 1% AEP. Construction related impacts due to significant construction works in and adjacent to watercourses. There are structural enhancements and proposed improvement to weirs at 2 locations. In addition improvement of channel conveyance and maintenance is proposed along a number of watercourses. There is also a flow diversion channel proposed. All these measures could cause potential changes to the hydrological and morphological regime of the watercourses. Overall a potential short-term or intermittent impediment to the achievement of wb objectives.

4.b	-1.50	3.00	Potentially significant effects in relation to works within the boundary of the Tralee Bay And Magharees Peninsula, West To Cloghane SAC. However, it is noted in relation to the proposed wall that the boundary of the cSAC in this area falls on an existing access road which is highly unlikely to be qualifying habitat. There are also construction works proposed to improve/replace the wall adjacent to the Tralee Bay And Magharees Peninsula, West To Cloghane SAC. There are also embankments under this option to the north and south of the SAC, these will be outside the SAC boundary or within existing hard standing associated with an old railway line. The flood model was run for a 1 in 10 flood event to investigate potential changes to the hydrological regime within the Ballyseedy SAC. In summary with the option in place, a slightly bigger area will be flooded and the depth of flooding will increase by approximately 0.05m. The area floods for less than 12 hours in a flood event. There will be no change to the frequency of flooding. This is not considered to be significant. Potentially significant effects during construction are: • Pollution risks to the Tralee Bay And Magharees Peninsula, West To Cloghane SAC • Disturbance to bird species within and outside the SPA • Disturbance to otter within and outside the cSAC Therefore, there is a potential detrimental impact upon existing cSAC site, including a delay in recovery of the site, but excluding impacts on the conservations objectives of the site, as a result of flood risk management measures, where suitable mitigation measures are technically feasible.

4.c	-1.50	3.00	Potentially significant effects in relation to works within the boundary of the Tralee Bay And Magharees Peninsula, West To Cloghane pNHA. However, it is noted in relation to the proposed wall that the boundary of the pNHA in this area fall on an existing access road which is highly unlikely to be qualifying habitat. There are also construction works proposed to improve/replace the wall adjacent to the Tralee Bay And Magharees Peninsula, West To Cloghane pNHA. There are also embankments under this option to the north and south of the pNHA, these will be outside the pNHA boundary or within existing hard standing associated with an old railway line. Potentially significant effects are • Pollution risks to the Tralee Bay And Magharees Peninsula, West To Cloghane SAC • Loss of intertidal habitat adjacent to the Tralee Bay and Magharees Peninsula, West To Cloghane in relation to the proposed wall • Disturbance to bird species Therefore, a potential localised loss of or disturbance to flora/fauna.
4.d	-5.00	3.00	Potential short term construction impacts on water quality and subsequent fish species. There are long term impacts associated with increased conveyance (more than Option 1) and maintenance along sections of a number of waterbodies in the area. In addition there are a number of new/replacement weirs proposed. Impact to the hydrological and morphological regimes and also an indirect negative effect to ecological receptors (including fisheries) due to offline storage areas, increased conveyance and maintenance. Therefore, a potential medium to long-term alteration of fisheries habitat.

4.e	-1.50	1.00	There is no impact on designated landscape features with this option. Permanent embankments and walls within the AFA adjacent to watercourse within Tralee Town will alter the visual amenity in the area. The North Kerry Way will continue to flood in the 1% AEP. Therefore, a potential for long term impact to a low sensitivity landscape character/feature in the zone of visibility of the selected measure.
4.f.i	3.50	3.00	The option will not affect the setting of the ACA and the NIAH/RPS. The proposed wall in the vicinity of the ACA is unlikely to effect the setting of any architectural features. There is a significant existing risk to architectural heritage in the AFA with a large portion of the ACA and a number of NIAH/RPS in the 1% AEP that will now be protected. Therefore, there is a potential to increase in the level of protection for a number of architectural features (Record of Protected Structures and NIAH) from flooding, such that they are substantially less vulnerable to flood damage.
4.f.ii	1.00	2.00	There are RMP in the vicinity of the proposed works. However no significant impact are predicted to any RMPs. There is the potential for RMPs of low vulnerability to be removed from the 1% AEP. Therefore, there is a potential to increase the level of protection for archaeological features (Recorded Monuments) from flooding, such that it is less vulnerable to flood damage.

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
1408	31.27	45.02

No Properties Benefitting	**10% AEP Event**	**1%/0.5% AEP Event**	**0.1%/0.5% AEP Event**
Residential		462	72
Commercial		227	7

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
€ 50.95	€31.27	€ 32.76	1.05
Environmental Assessments			

Key Conclusions:

- Potential short-term or intermittent impediment to the achievement of WB objectives;
- Potential for a detrimental impact upon existing cSAC site, including a delay in recovery of the site, but excluding impacts on the conservations objectives of the site, as a result of flood risk management measures, where suitable mitigation measures are technically feasible;
- Potential localised loss of or disturbance to flora/fauna;
- Potential medium to long-term alternation of fisheries habitat but with the potential for removal of existing barriers to movement;
- Potential for long term impact to a low sensitivity landscape character/feature in the zone of visibility of the selected measure;
- Potential to increase in the level of protection for a number of architectural features (Record of Protected Structures and NIAH) from flooding, such that they are substantially less vulnerable to flood damage;
- Potential to increase the level of protection for archaeological features (Recorded Monuments) from flooding, such that it is less vulnerable to flood damage.

Adaptability to Potential Future Changes

The proposed embankments and walls can be increased in height for climate change events. The increase conveyance measures will not be easily adaptable to potential future changes.

Public Consultation Outcomes

2 public consultation meetings were held on 24/03/15 and 01/10/15. 45 people attended the first meeting and 13 people attended the second. Any comments that were made were given consideration when selecting the preferred options.

Other Issues / Conclusions

There are properties within the AFA at risk from wave overtopping, and it should be noted that this option does not negate the risk from this source and should be considered at the detailed design stage.

The flood risk management options considered are based on the predicted flood risk maps which were determined using all available survey and historical flood event data up to December 2016. However, there is no suitable gauge data in the catchment available to determine the hydrology for Tralee and as such there is uncertainty associated with the predicted fluvial flood risk to the town. The Ballymullen gauge on the River Lee has a tidal influence and therefore could not be reliably used for determining the fluvial flows. It is a recommendation of this study that reliable gauging stations are installed on all watercourses to reduce the uncertainty associated with the current predicted flood extents, see section 7.4.1.14..

In addition to the uncertainty related to the hydrology in Tralee there is also uncertainty with the fluvial/fluvial joint probability associated with the River Lee and the tributaries and also the fluvial/coastal joint probability between the watercourses and the tidal boundaries. The approach to joint probability for Tralee is consistent with all other AFAs within the Shannon CFRAM however should further gauge data become available this should be reviewed at detailed design phase.

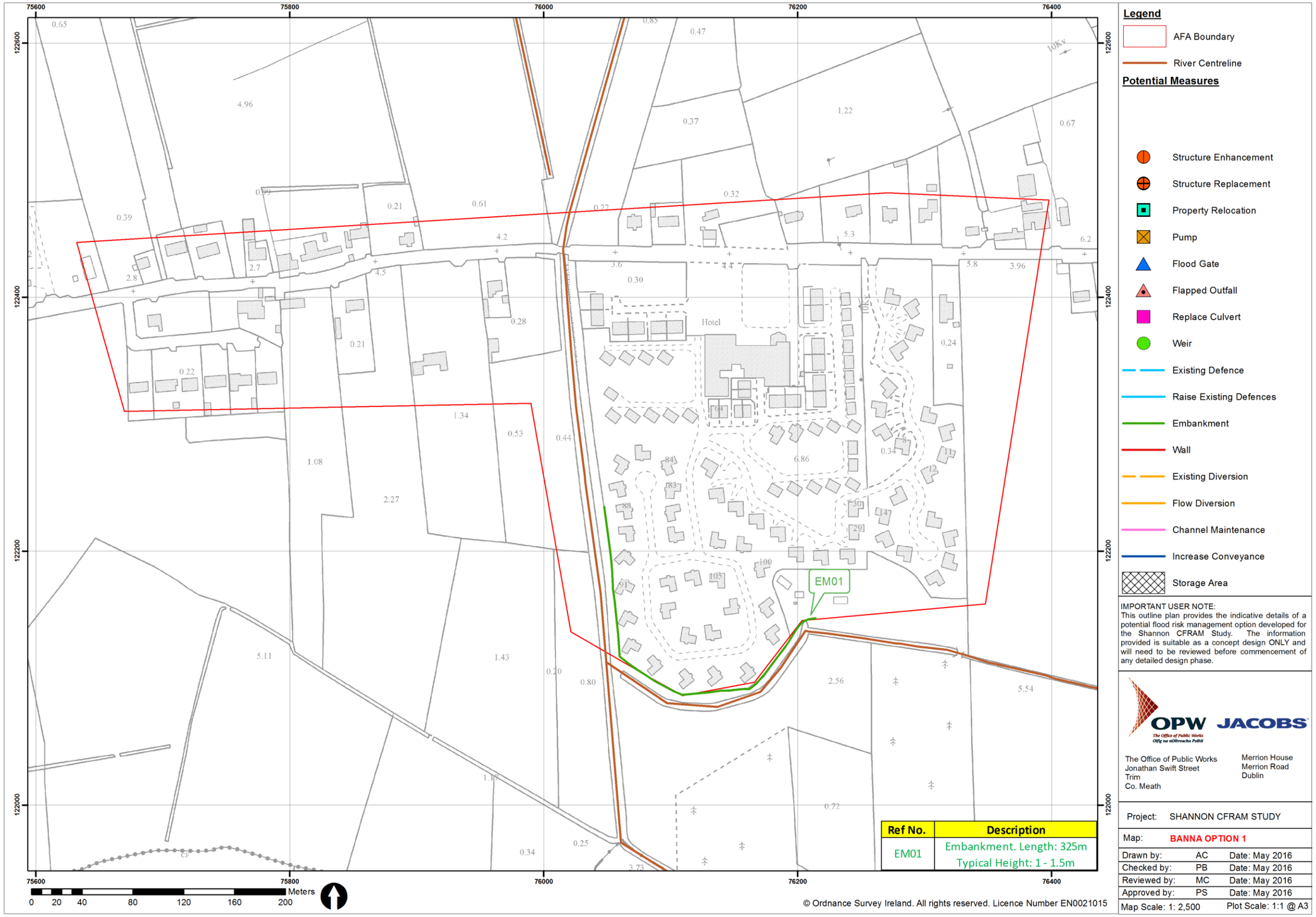
Tralee is a heavily urbanised town and there is interaction between the fluvial flows, coastal reaches and the drainage networks. There is historical evidence of flooding from the drainage network coinciding with tidal and fluvial events. Flood risk from the drainage network is not considered as part of the CFRAM process, nor is the potential detrimental impacts to this drainage network from the proposed CFRAM flood risk management options for example, proposed flood walls may prevent drainage outfalls freely discharging to the river network. Therefore, given the close interaction of the fluvial, coastal and drainage flood risks for Tralee, it is a recommendation of this study that a fully integrated catchment model is developed to understand all these sources of flood

risk as part of the design for the Shannon CFRAM preferred flood risk management option.

There are some properties within the Tralee AFA that, subject to amendment at project-level development, will not benefit from the proposed measure, and the property owners may wish to consider Individual Property Protection to provide some reduction of flood risk for their properties (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.

G.5 Tralee Bay – Feale River Basin / Tyshe / Banna AFA

River Basin	Shannon
AFA	Banna
Measure	Progress the development of a Flood Relief Scheme for Banna
Code	IEGBNISH-23-IE-AFA-230345-0005-M61
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Banna, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation.
IMPORTANT NOTE: 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 7.1 and 10.1).	



Legend

- AFA Boundary
- River Centreline

Potential Measures

- Structure Enhancement
- Structure Replacement
- Property Relocation
- Pump
- Flood Gate
- Flapped Outfall
- Replace Culvert
- Weir
- Existing Defence
- Raise Existing Defences
- Embankment
- Wall
- Existing Diversion
- Flow Diversion
- Channel Maintenance
- Increase Conveyance
- Storage Area

IMPORTANT USER NOTE:
This outline plan provides the indicative details of a potential flood risk management option developed for the Shannon CFRAM Study. The information provided is suitable as a concept design ONLY and will need to be reviewed before commencement of any detailed design phase.

OPW The Office of Public Works Oifig na nOibreacha Poiblí
JACOBS

The Office of Public Works
Jonathan Swift Street
Trim
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Dublin

Project:	SHANNON CFRAM STUDY	
Map:	BANNA OPTION 1	
Drawn by:	AC	Date: May 2016
Checked by:	PB	Date: May 2016
Reviewed by:	MC	Date: May 2016
Approved by:	PS	Date: May 2016
Map Scale: 1: 2,500		Plot Scale: 1:1 @ A3

MCA Appraisal Outcomes			
Objective	**Un-weighted Score**	**Local Weighting**	**Comment**
1.a	3.50	350	This score is determined for this option as it has negligible operational risks to operate or perform successfully.
1.b	-1.00	-100	This score is determined for this option as it has very low health and safety risks associated with the construction and operation of flood risk management option.
1.c	2.56	256	This score is determined for this option as it can be adapted at a moderate impact on flood risk.
2.a	3.99	478	This score is calculated based on the reduction in AAD, following the full implementation of option.
2.b	3.81	191	This score is calculated based on the reduction in flood risk to transport routes, following full implementation of option.
2.c	4.84	339	This score is calculated based on a reduction in flood risk to utility infrastructure, following full implementation of option.
2.d	1.00	14	This score is determined based on an increase in the Area of Agricultural Land Flooded, Frequency & Seasonality of Flooding, Duration of Flooding and Risk to Agricultural Infrastructure.
3.a.i	2.00	270	This score is calculated based on a reduction in flooding to residential properties, following full implementation of the option.
3.a.ii	2.00	170	This score is calculated based on a reduction in flooding to high vulnerability properties, following full implementation of the option.
3.b.i	4.16	187	This score is calculated based on a reduction in flood risk to social infrastructure assets, following full implementation of the option. The calculated score was then increased to account of protection to assets of particular social value.
3.b.ii	4.09	143	This score is calculated based on the reduction in flood risk to assets of local employment, following full implementation of the option.

4.a	-2.00	160	Construction - Related impacts due to construction works adjacent to the Tyshe river due to the construction of embankment. There measures could cause potential changes physico-chemical impacts due to sediment release. Operational - The proposed embankment will be set back from the watercourse as far as reasonably practical therefore impacts to the hydrological and morphological regime of the watercourse as a result of the embankment are unlikely. There will be reduced flooding in areas with no significant polluting sources in 1% Fluvial &/or 0.5% AEP coastal in the AFA. Therefore a potential for medium-term or recurring impediment to the achievement of WB objectives.
4.b	-1.50	-45	Potentially significant effects are: • Increases in suspended sediment; • Risk of invasive species spread during proposed works; • Impact to fish species. There is the potential for a positive impact through the creation of new wetland outside the AFA, as water can no longer flow from the Tyshe River into the sea. This could extend the existing SAC and SPA. Therefore, an overall neutral effect may occur, with the implementation of suitable mitigation measures.
4.c	-1.50	-23	Potential significant effects are: • Increase in suspended solids; • Pollution risks to the bay and harbour; • Risk of invasive species spread during proposed works; • Impact to fish species. There is the potential for a positive impact through the creation of new wetland outside the AFA, as water can no longer flow from the Tyshe River into the sea. This could extend the existing pNHA. Therefore, an overall small positive effect may occur, with the implementation of suitable mitigation measures.

4.d	-5.00	-195	There are potential short term impacts associated with the embankment construction works, which can be mitigated. Potential impact to the hydrological and morphological regimes due to the abandonment of the existing excavation and maintenance regime. Therefore a potential impact of fisheries habitat.
4.e	-1.5	-12	There is no impact on designated landscape features. The permanent embankment within the AFA adjacent to the watercourse and residential properties will alter the visual amenity in the area. The embankment will be set back as far as practical from the Tyshe River to limit visual impact. Long term impact to a low sensitivity landscape in the vicinity of the proposed option, with the implementation of suitable mitigation measures.
4.f.i	3.50	42	There are no RPS or ACAs within the 1% AEP Fluvial &/or 0.5% AEP coastal or within the AFA. Therefore, there is no potential for change.
4.f.ii	1.00	8	There are no RMP's within the 1% AEP Fluvial &/or 0.5% AEP coastal or within the AFA, therefore no significant impacts are predicted. There is potential for unknown archaeological features to be impacts but these are not known. Therefore, no effects on archaeological features are predicted.

Total MCA-Benefit Score	**Option Cost (€millions)**	**MCA-Benefit Score / Cost Ratio**
479	0.14	3308.01

No Properties Benefitting	**10% AEP Event**	**1%/05% AEP Event**	**0.1% AEP Event**
Residential	-	19	-
Commercial	-	0	-

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	**Option Cost**	**Option NPVb (capped)**	**Benefit - Cost Ratio**
€ 3.39	€ 0.14	€ 2.42	16.73
Environmental Assessments			

Key Conclusions:

- Potential for medium-term or recurring impediment to the achievement of WB objectives;
- Overall there will be a neutral effect with option 4B, with the implementation of suitable mitigation measures;
- Overall small positive effect may occur with flora and fauna, with the implementation of suitable mitigation measures;
- Potential impact of fisheries habitat;
- Long term impact to a low sensitivity landscape in the vicinity of the proposed option, with the implementation of suitable mitigation measures;
- There are no RPS or ACAs within the 1% AEP Fluvial &/or 0.5% AEP coastal or within the AFA. Therefore, there is no potential for change;
- No effects on archaeological features are predicted.

Adaptability to Potential Future Changes

The height of the embankments can be increase to facilitate increases in flood risk due to climate change.

Public Consultation Outcomes

2 public consultation meetings were held on 24/03/15 and 01/10/15. 26 people attended the first meeting and 7 people attended the second. Any comments that were made were given consideration when selecting the preferred options.

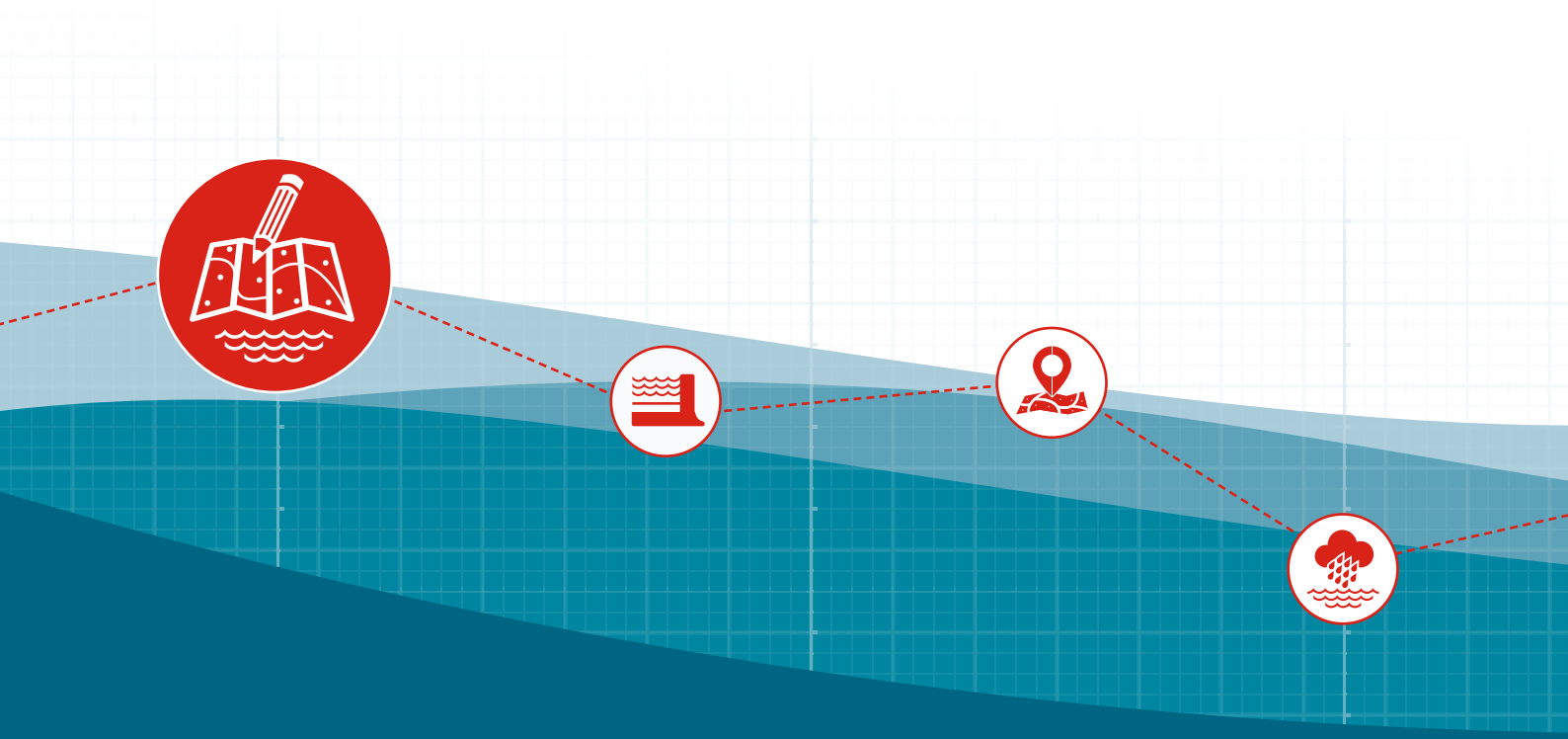
Other Issues / Conclusions

The River Tyshe flows to the sea at Black Rock. The outfall at Black Rock is vulnerable to blockage from build-up of sand. Sand and seaweed are excavated out of the channel opening. These works currently take place at least every two weeks, but this can be daily in the winter months. Maintenance work is also carried out to keep tidal flaps, approx. 600m upstream of the outfall, functioning.

Sluice gates are manually operated to close on high tides to prevent tide backing up on Tyshe River, typically closed once every few weeks.

A blockage analysis was carried out to determine the flood risk to the Banna AFA if the the excavation of sand and seaweed from the channel entrance was to cease. The flood extents resulting from this blockage analysis were used as a basis for assessing the current flood risk and optioneering.

The preferred option involves discontinuing the removal of sand at the outfall at Blackrock however prior to discontinuing the removal of sand at the outfall the impact this will have on Ballyheige will need to be assessed. The watercourse in this area has not been modelled as part of the CFRAM.



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