

Irish Coastal Protection Strategy Study, Phase 3 - South Coast

Work Packages 9A - Appendix 2 - Flood Mapping for High End Future Scenario

IBE0071 / November 2013





Office of Public Works

Irish Coastal Protection Strategy Study - Phase 3

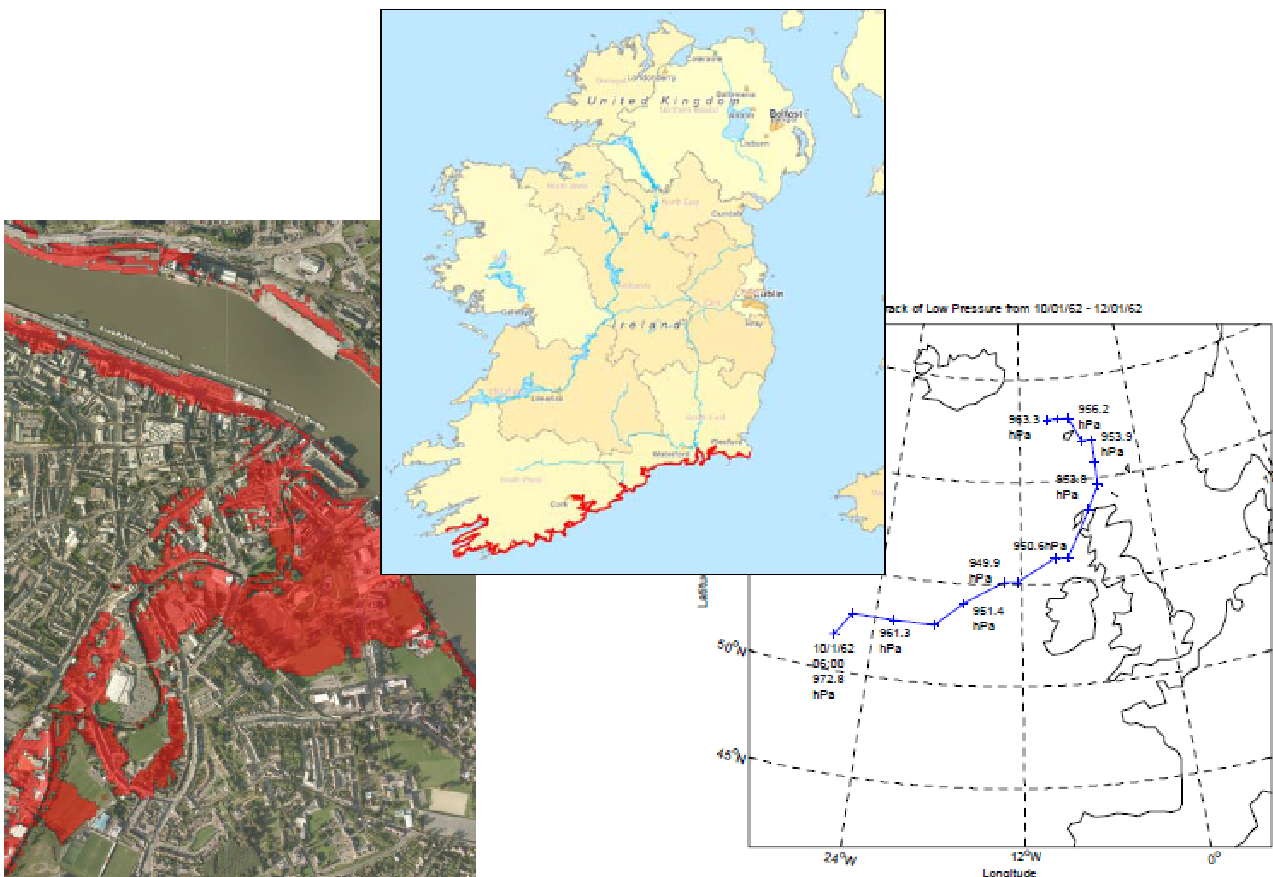
Work Package 9A

Strategic Assessment of Coastal Flooding Extents – Future Scenario

South Coast – Carnsore Point to Bantry Bay

Appendix 2 - Flood Mapping for High End Future Scenario

November 2013





Office of Public Works

Irish Coastal Protection Strategy Study - Phase 3

Work Package 9A

Strategic Assessment of Coastal Flooding Extents – Future Scenario

South Coast - Carnsore Point to Bantry Bay

Appendix 2 - Flood Mapping for High End Future Scenario

November 2013

DOCUMENT CONTROL SHEET

Client	Office of Public Works
Project Title	Irish Coastal Protection Strategy Study, Phase 3, Work Package 9A
Document Title	Strategic Assessment of Coastal Flooding Extents – Future Scenario
Document No.	IBE0071/ FS_App9A_R01
Document Date	November 2013

IMPORTANT DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE FOR FLOOD MAPS

COASTAL FLOOD MAPS FOR HIGH END FUTURE SCENARIO FOR SOUTH COAST

Please read the disclaimer, guidance notes and conditions of use below carefully to avoid incorrect interpretation of the information and data provided on the maps contained in this volume. The maps must be used only in conjunction with these notes, and must not be used in isolation.

PURPOSE OF THE MAPS

The maps contained within this bound volume were prepared under the following project:

- ***Project Name: Irish Coastal Protection Strategy Study (ICPSS)***
- ***Project Period: 2005 – 2013***

The maps were prepared for the purpose of assessing the degree of flood hazard and risk to assist in the identification and development of measures for managing the flood risk. They may, however, also be of use to the public, Local Authorities and other parties as indicative maps of flood-prone areas for a range of purposes, including raising awareness of flood hazard and risk, preparedness and response planning for flood events, assisting in planning and development decisions, adaptation to climate change etc.

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GUIDANCE NOTES

This bound volume contains future scenario flood maps. How these maps have been derived, and what they do and do not present, is described below.

Derivation of Maps

The maps included within this bound volume are 'predictive' flood maps, as they provide predicted flood extent and other information for a future scenario 'design' flood event (High End to 2100) that has an estimated probability of occurrence (e.g., the 0.5% AEP event – see below), rather than information for floods that have occurred in the past (which is presented on 'historic' flood maps).

The predicted extents are based on analysis and modelling. This includes:

- Numerical Modelling of combined storm surges and tide levels which was used to estimate extreme water levels along the coastline
- Statistical extreme value analysis and joint probability analysis to both historic recorded tide gauge data and data generated by numerical modelling, which allowed an estimation of the extreme water levels of defined annual exceedance probability (AEP) to be established along the coastline
- Definition of the plan extent of the predictive floodplain, by use of a Digital Terrain Model (DTM) commissioned by the Office of Public Works. The predictive flood outlines shown on these maps were calculated by combining the results of the surge and tide level modelling, the statistical analysis, the DTM using GIS technology and incorporating future allowances for both mean sea level rise and glacial isostatic adjustment (GIA).

The maps have been produced at a strategic level to provide an overview of coastal flood hazard and risk in Ireland, and minor or local features may not have been included in their preparation. A DTM is used to generate the maps, which is a 'bare earth' model of the ground surface with the digital removal of man-made and natural landscape features such as vegetation, buildings, bridges and embankments. The mapping process can show some of these man-made features, such as bridges and embankments, as flooded on the flood maps, when in reality they do not flood. In addition, 'cleansing' is undertaken during flood map production, which involves various processes such as the removal of very small areas of flooding that is remote and isolated, the removal of very small islands within the flooded area, etc. Therefore, the maps should not be used to assess the flood hazard and risk

associated with individual properties or point locations, or to replace a detailed local flood risk assessment. Local factors such as flood defence schemes, structures in or around river channels (e.g. bridges), buildings and other local influences, which might affect a coastal flood, have not been accounted for.

The maps were produced based on survey data captured prior to, and during the early part of the project. They do not account for changes in development, infrastructure or topography that occurred after the date of survey data capture (except for GIA).

The DTM is derived from airborne survey data. The majority of this data is Light Detection and Ranging (LiDAR) data. Where LiDAR data was not available, Interferometric Synthetic Aperture Radar (IfSAR) data has been used to derive the DTM.

Detailed explanations of the methods of derivation, survey data used, etc. are provided in the relevant reports produced for the project under which the maps were prepared. **Users of the maps should familiarise themselves fully with the contents of these reports in advance of the use of the maps.**

Flood Event Probabilities

The maps refer to flood event probabilities in terms of a percentage Annual Exceedance Probability, or 'AEP'. This represents the probability of an event of this, or greater, severity occurring in any given year. These probabilities may also be expressed as odds (e.g., 100 to 1) of the event occurring in any given year. They are also commonly referred to in terms of a return period (e.g., the 100-year flood), although it should be understood that this does not mean the length of time that will elapse between two such events occurring, as, although unlikely, two very severe events may occur within a very short space of time.

Table 1 below sets out a range of flood event probabilities expressed in terms of AEP, and identifies their parallels under other forms of expression.

Table 1: Flood Event Probabilities

Annual Exceedance Probability (%)	Odds of Occurrence in any Given Year	Return Period (yrs)
50	2 : 1	2
20	5 : 1	5
10	10 : 1	10
5	20 : 1	20
2	50 : 1	50
1	100 : 1	100
0.5	200 : 1	200
0.2	500 : 1	500
0.1	1000 : 1	1000

Uncertainty

Although great care and modern, widely-accepted methods have been used to prepare the maps, there is a range of inherent uncertainties within the process of preparing the predicted flood extents maps. These include:

- Uncertainty in Flood Levels: This can arise due to uncertainties in topographic, bathymetric and other survey data, meteorological data, assumptions and / or approximations in the hydraulic / hydrodynamic models in representing physical reality, assumptions in the hydraulic / hydrodynamic modelling, and datum conversions, etc.
- Uncertainty in Flood Extents: This can arise due to uncertainties in flood levels, topographic and other survey data, assumptions and / or approximations in the way that flooding spreads over a floodplain, etc.

The flood maps are therefore only indicative, and the potential for inaccuracy should be recognised if these maps are to be used for any purpose.

Types of Flood Map

This volume contains only flood extent maps as outlined below. Further details on this type of map, including the methods of derivation, assumptions made, data used, etc. are provided in the relevant project reports.

Flood Extent Maps

Flood extent maps contained in this volume show the predicted extents of flooding for future scenario flood events of two estimated probabilities of occurrence:

- 0.5% AEP flood event
- 0.1% AEP flood event

It should be noted that the flood extent maps indicate the predicted maximum extent of flooding (subject to limitations referred to herein), and flooding in some areas, such as near the edge of the flooded area, might be very shallow.

Due to the various uncertainties within the process of preparing the maps (see 'Uncertainty' above), it is not possible to state that the maps are absolutely accurate.

Consideration of Projected Future Changes in Climate

The maps produced in this bound volume represent a projected future scenario for the year 2100 and include allowances for projected future changes in climate and glacial isostatic adjustment (GIA). The maps represent a High End Future Scenario (HEFS) reflecting changes that are within the typical range projected.

The allowances used for this High End Future Scenario are as follows:-

Mean Sea Level Rise: + 1000 mm (to 2100)
Land Movement (GIA): Varies - 0.1 to - 0.5 mm/year (South Coast)

This volume includes maps that show the predicted extents of (tidal/coastal) flooding for the HEFS for flood events of two estimated probabilities of occurrence:-

0.5 % AEP
0.1% AEP

The future scenario water levels shown on the maps are relative to Ordnance Datum Malin and include the above mean sea level rise allowance (+ 1000mm) but have not been adjusted for GIA.

Sources of Flooding Not Mapped

The maps indicate only the extents associated with flooding from coastal areas and the sea. There are however many other possible sources of flooding, such as fluvial flooding from rivers, surcharged urban drainage systems, ponding rainwater, groundwater, overtopping or breaching of water retaining structures (such as embankments and reservoirs), etc. Flooding from these other sources have not been mapped, and so areas that are not shown as being within a flood extent may therefore be at risk from flooding from one of these other sources.

CONDITIONS OF USE

Please read the following statements and conditions of use of the maps in this bound volume carefully. Use of these maps is conditional upon the following:-

The user of these maps shall be deemed to have agreed to, and unconditionally accepted all of these statements and conditions.

The user is deemed to have read in full, understood and accepted all of the above disclaimer, guidance notes and statements concerning the preparation, limitations and use of the maps in this bound volume.

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CONTACTS REGARDING MAP INFORMATION

Any user who has reason to believe that these maps contain an error, or who wishes to contribute additional information, is requested to contact the Office of Public Works Engineering Services Section at the following address:

Flood Mapping Queries
Engineering Services
Office of Public Works
17-19 Lower Hatch Street
Dublin 2

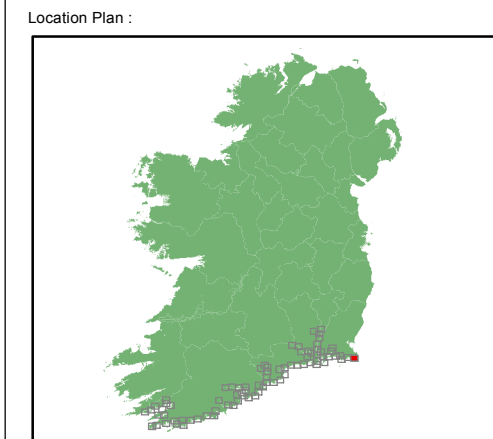
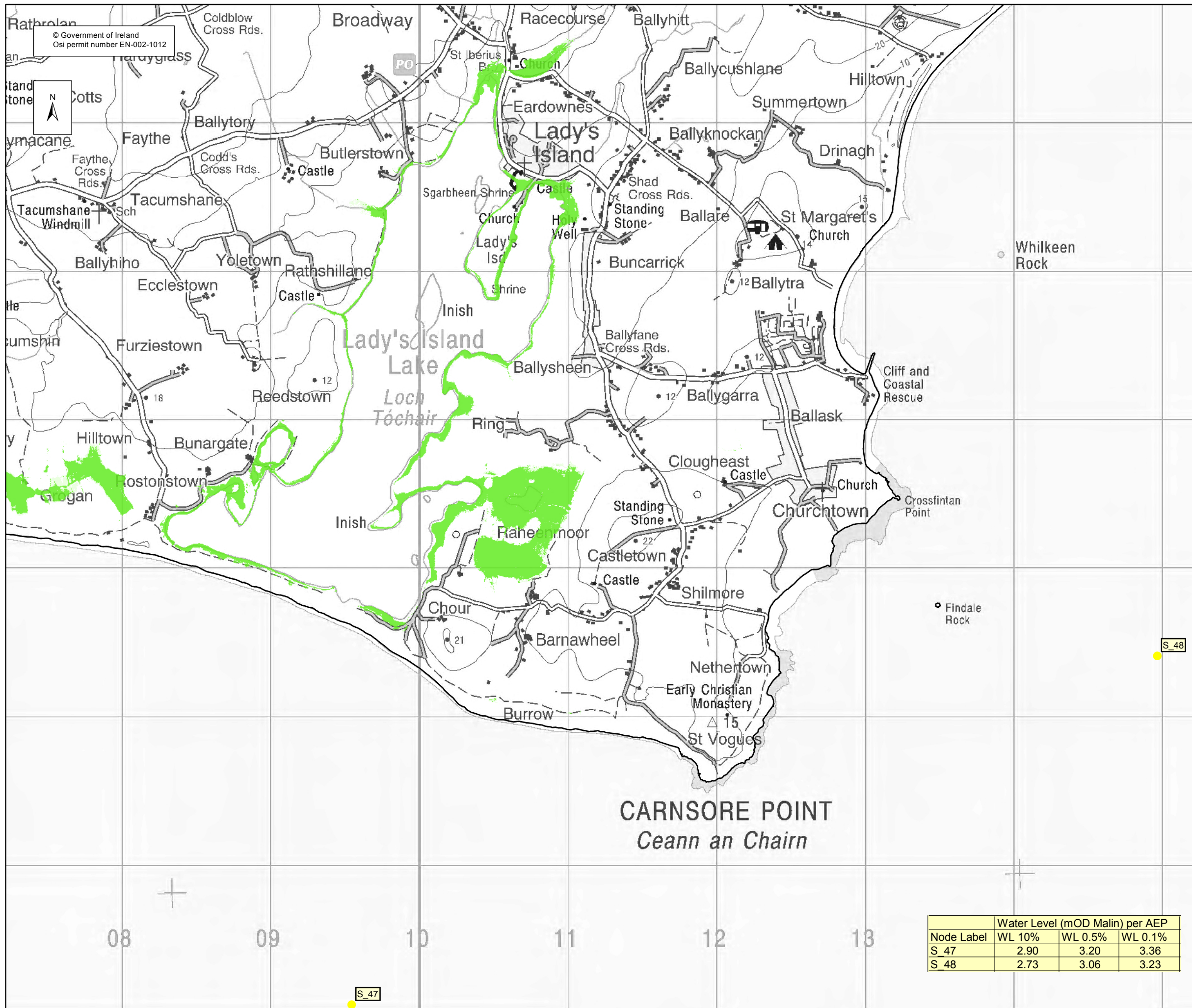
Predicted Extreme Water Levels Associated with Combined Tide and Surge

PREDICTION POINT ID	ANNUAL EXCEEDANCE PROBABILITY (AEP)								CO-ORDINATES OF PREDICTION POINTS	
	50%	20%	10%	5%	2%	1%	0.5%	0.1%	EASTINGS	NORTHINGS
S 1	3.02	3.14	3.24	3.33	3.44	3.53	3.62	3.83	47518	37498
S 2	2.99	3.09	3.16	3.23	3.32	3.39	3.46	3.62	61323	34874
S 3	2.99	3.09	3.16	3.22	3.31	3.38	3.45	3.60	68403	40252
S 4	3.06	3.18	3.27	3.35	3.46	3.55	3.63	3.82	78156	42234
S 5	3.17	3.26	3.32	3.38	3.46	3.52	3.59	3.73	89346	46985
S 6	3.14	3.25	3.33	3.42	3.52	3.60	3.68	3.86	94294	51888
S 7	2.97	3.07	3.14	3.21	3.29	3.36	3.43	3.58	71586	29038
S 8	3.08	3.20	3.29	3.37	3.48	3.56	3.64	3.83	78289	33325
S 9	3.09	3.20	3.28	3.36	3.46	3.54	3.62	3.79	88471	38657
S 10	2.90	3.00	3.07	3.14	3.24	3.30	3.37	3.53	76230	20017
S 11	2.89	2.99	3.07	3.14	3.23	3.30	3.37	3.53	85398	25368
S 12	2.91	3.00	3.07	3.14	3.23	3.30	3.36	3.52	92346	25216
S 13	2.91	3.00	3.07	3.13	3.22	3.28	3.35	3.49	98600	25088
S 14	2.90	3.01	3.08	3.15	3.24	3.31	3.38	3.54	102726	22781
S 15	2.91	3.01	3.09	3.16	3.25	3.32	3.39	3.55	109697	23766
S 16	2.90	3.00	3.08	3.15	3.24	3.31	3.38	3.54	116684	25872
S 17	2.93	3.03	3.10	3.18	3.27	3.34	3.41	3.57	123697	30213
S 18	2.95	3.05	3.12	3.19	3.28	3.35	3.42	3.58	132056	32320
S 19	2.96	3.06	3.13	3.20	3.29	3.35	3.42	3.58	137579	30024
S 20	2.97	3.07	3.14	3.21	3.31	3.38	3.45	3.61	141114	35545
S 21	2.97	3.07	3.14	3.21	3.29	3.36	3.43	3.58	146649	34371
S 22	3.01	3.11	3.18	3.25	3.35	3.42	3.49	3.65	153646	40979
S 23	3.03	3.12	3.19	3.26	3.34	3.41	3.47	3.63	159879	40925
S 24	3.05	3.14	3.21	3.27	3.36	3.43	3.49	3.64	165450	45335
S 25	3.07	3.16	3.23	3.30	3.39	3.45	3.52	3.67	172382	47518
S 26	3.09	3.18	3.25	3.32	3.40	3.47	3.53	3.68	179317	51935
S 27	3.12	3.22	3.29	3.36	3.44	3.51	3.57	3.73	181760	58602
S 28	3.12	3.21	3.27	3.34	3.42	3.48	3.54	3.69	188312	56357
S 29	3.13	3.22	3.28	3.34	3.42	3.49	3.55	3.69	196599	58570
S 30	3.18	3.27	3.34	3.41	3.49	3.56	3.62	3.77	203495	66359
S 31	3.19	3.28	3.36	3.42	3.52	3.58	3.65	3.81	211746	74160
S 32	3.13	3.22	3.28	3.34	3.42	3.48	3.54	3.68	222739	77536
S 33	3.13	3.21	3.27	3.33	3.41	3.47	3.53	3.66	229602	79797
S 34	3.14	3.23	3.29	3.36	3.44	3.50	3.56	3.70	234351	88730
S 35	3.19	3.28	3.35	3.41	3.50	3.56	3.62	3.77	229742	90926
S 36	3.14	3.23	3.30	3.36	3.44	3.50	3.56	3.71	242536	94357
S 37	3.12	3.20	3.27	3.33	3.41	3.47	3.53	3.67	253489	95575
S 38	3.08	3.17	3.23	3.29	3.38	3.44	3.50	3.64	261696	96783
S 39	3.06	3.15	3.21	3.26	3.34	3.40	3.46	3.59	267206	94629
S 40	3.06	3.14	3.20	3.26	3.34	3.40	3.46	3.59	270584	98014
S 41	2.99	3.07	3.13	3.19	3.27	3.33	3.38	3.52	275412	95859
S 42	3.03	3.12	3.18	3.24	3.32	3.38	3.43	3.57	278767	100363
S 43	3.08	3.17	3.23	3.29	3.37	3.44	3.50	3.64	282115	104869
S 44	3.08	3.16	3.21	3.26	3.33	3.37	3.41	3.50	288954	104987
S 45	2.95	3.04	3.09	3.15	3.22	3.28	3.34	3.46	295878	100664
S 46	2.82	2.90	2.97	3.03	3.12	3.18	3.24	3.39	302677	103026
S 47	2.73	2.83	2.90	2.97	3.06	3.13	3.20	3.36	309543	102059
S 48	2.55	2.65	2.73	2.80	2.90	2.98	3.06	3.23	314966	104408
C 1	3.19	3.28	3.35	3.41	3.50	3.56	3.63	3.78	179706	62504
C 2	3.28	3.38	3.45	3.51	3.60	3.66	3.73	3.88	177923	64960
C 3	3.43	3.53	3.60	3.67	3.76	3.82	3.89	4.04	174916	70092
C 4	3.27	3.36	3.43	3.49	3.58	3.64	3.70	3.85	182133	66389
C 5	3.29	3.38	3.45	3.52	3.60	3.66	3.73	3.87	186061	66377
C 6	3.21	3.31	3.37	3.44	3.52	3.59	3.65	3.80	183023	64606
W 1	3.12	3.21	3.27	3.33	3.41	3.47	3.53	3.66	269520	100670
W 2	3.16	3.25	3.31	3.37	3.46	3.52	3.58	3.72	274443	105639
W 3	3.23	3.32	3.38	3.45	3.53	3.59	3.66	3.80	271184	108707
W 4	3.29	3.38	3.44	3.51	3.59	3.66	3.72	3.87	268168	114340
W 5	3.33	3.42	3.49	3.55	3.63	3.69	3.76	3.90	258756	113663

Notes

- 1 - All water levels shown are in metres and referenced to Ordnance Datum Malin
- 2 - All co-ordinates shown are in Irish Grid (TM65)
- 3 - AEP denotes Annual Exceedance Probability

Prepared By:	RPS	Date:	June 2012
Checked By:	JMC & JR	Date:	June 2012
Table No.:	S/HEFS/WL/1	Revision:	1



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT (1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT (1 in 1000 chance in any given year)
- High Water Mark (HWM)
- Node Point
- S 34 Node Label (refer to table)

USER NOTE :

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Project :
IRISH COASTAL PROTECTION STRATEGY STUDY - PHASE III

Map :
SOUTH COAST FLOOD EXTENT MAP

Map Type : FLOOD EXTENT

Source : TIDAL FLOODING

Map area : RURAL AREA

Scenario : HIGH END FUTURE SCENARIO

Figure By : PJW Date : Sept 2012

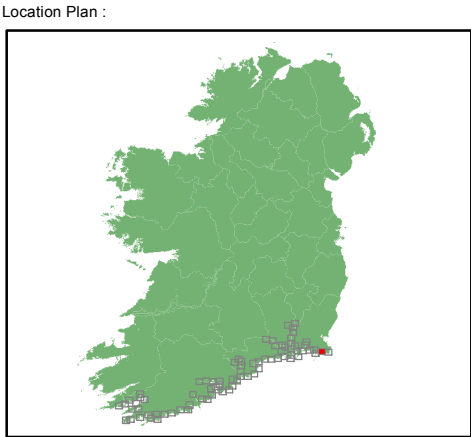
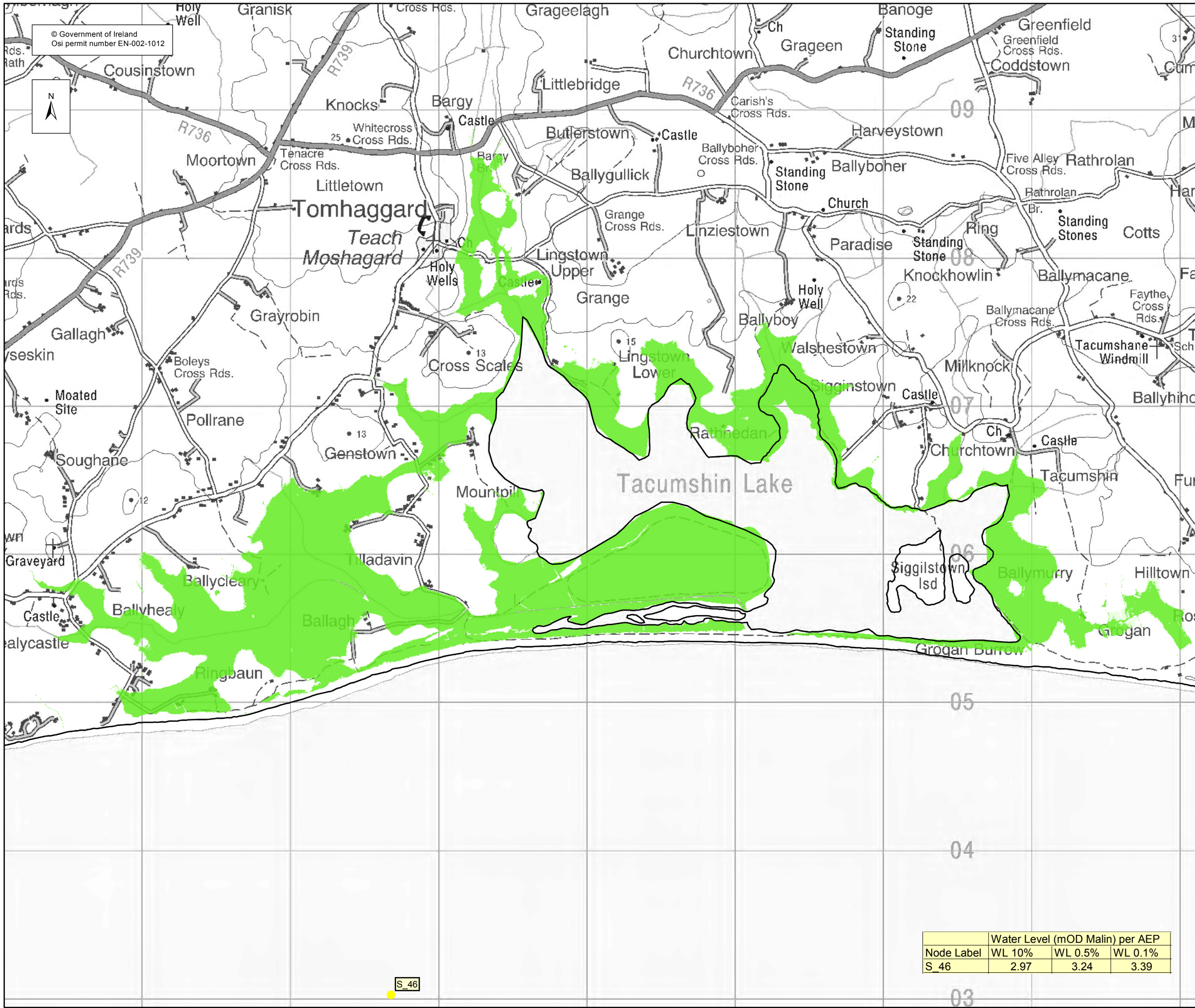
Checked By : JMC & JR Date : Sept 2012

Node Label	Water Level (mOD Malin) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
S 47	2.90	3.20	3.36
S 48	2.73	3.06	3.23

Figure No. :
S / RA / EXT / HEFS / 1

Revision
0

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT (1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT (1 in 1000 chance in any given year)
- High Water Mark (HWM)
- Node Point
- S 34 Node Label (refer to table)

USER NOTE :

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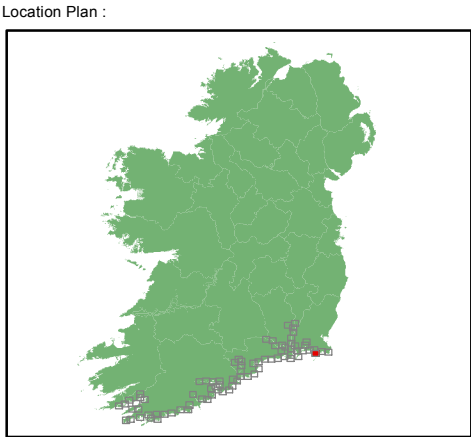
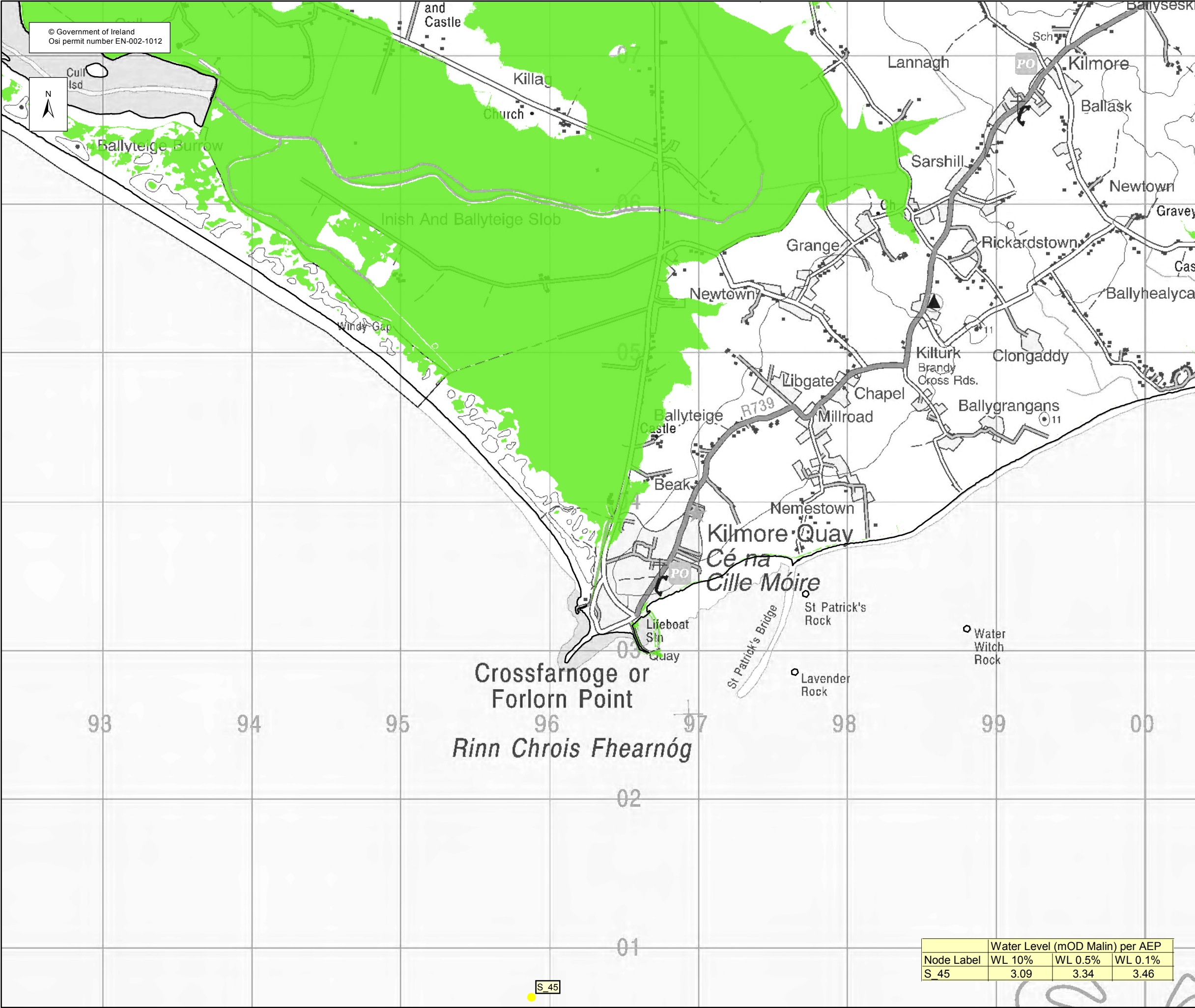
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Project :		IRISH COASTAL PROTECTION STRATEGY STUDY - PHASE III	
Map :		SOUTH COAST FLOOD EXTENT MAP	
Map Type :	FLOOD EXTENT		
Source :	TIDAL FLOODING		
Map area :	RURAL AREA		
Scenario :	HIGH END FUTURE SCENARIO		
Figure By :	PJW	Date :	Sept 2012
Checked By :	JMC & JR	Date :	Sept 2012

	Water Level (mOD Malin) per AEP		
Node Label	WL 10%	WL 0.5%	WL 0.1%
S 46	2.97	3.24	3.39



Figure No. :	S / RA / EXT / HEFS / 2	Revision	0
Drawing Scale :	1:25,000	Plot Scale :	1:1 @ A3



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT (1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT (1 in 1000 chance in any given year)
- High Water Mark (HWM)
- Node Point
- S 34 Node Label (refer to table)

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Project :
IRISH COASTAL PROTECTION STRATEGY STUDY - PHASE III

Map :
SOUTH COAST FLOOD EXTENT MAP

Map Type : FLOOD EXTENT

Source : TIDAL FLOODING

Map area : RURAL AREA

Scenario : HIGH END FUTURE SCENARIO

Figure By : PJW Date : Sept 2012

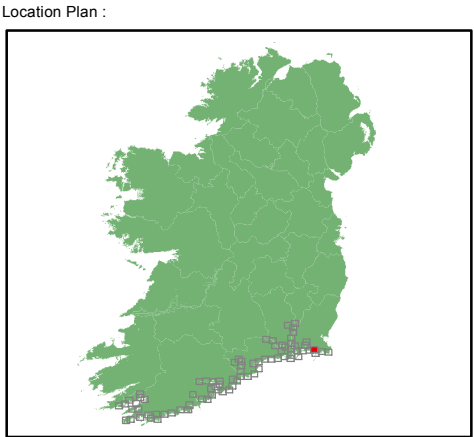
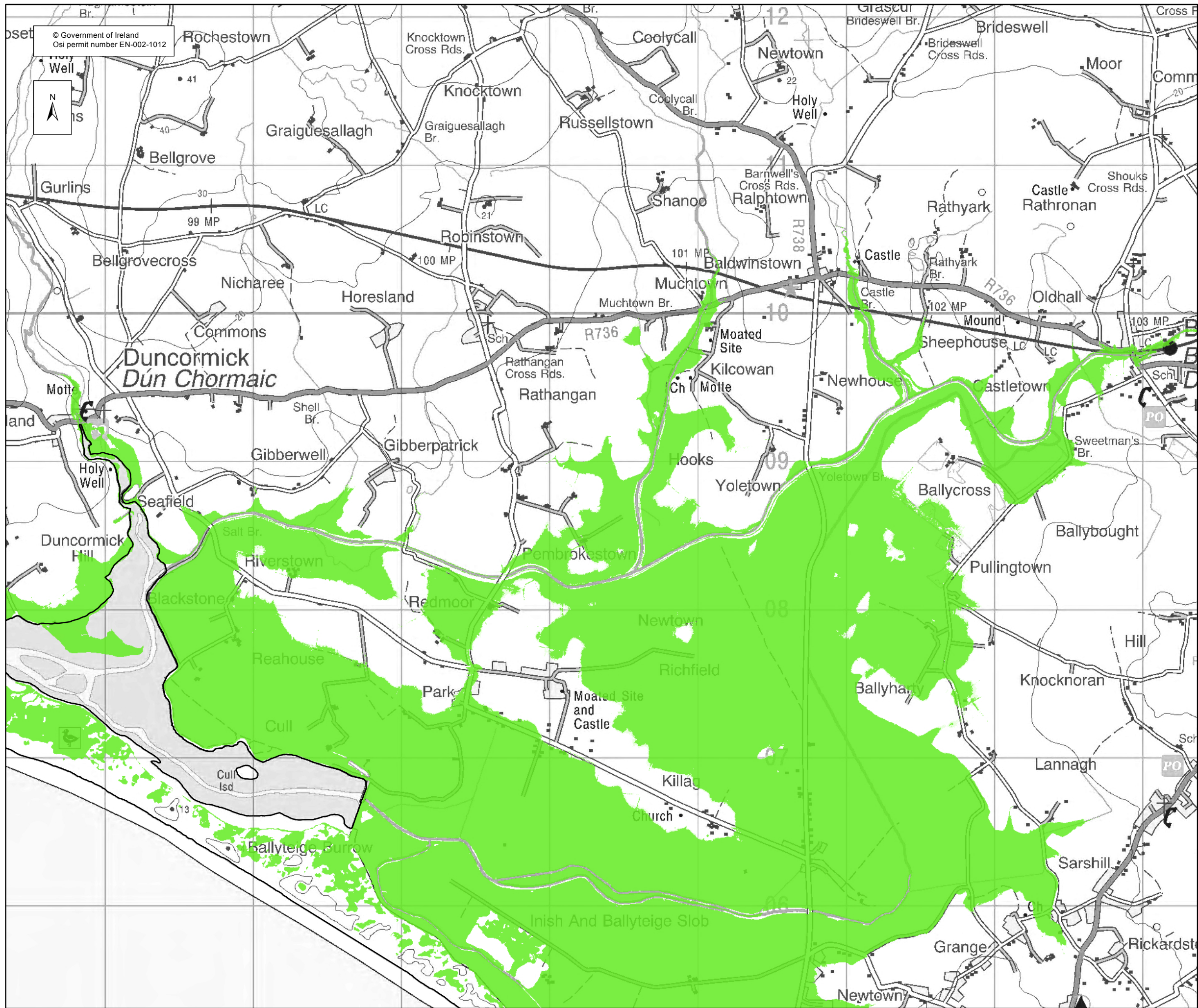
Checked By : JMC & JR Date : Sept 2012

Water Level (mOD Malin) per AEP			
Node Label	WL 10%	WL 0.5%	WL 0.1%
S_45	3.09	3.34	3.46

Figure No. :
S / RA / EXT / HEFS / 3

Revision
0

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT (1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT (1 in 1000 chance in any given year)
- High Water Mark (HWM)
- Node Point
- S 34 Node Label (refer to table)

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Project :
IRISH COASTAL PROTECTION STRATEGY STUDY - PHASE III

Map :
SOUTH COAST FLOOD EXTENT MAP

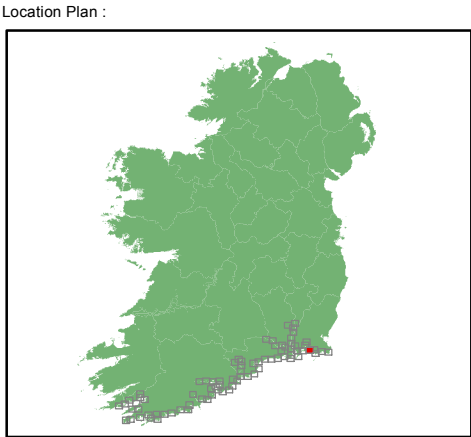
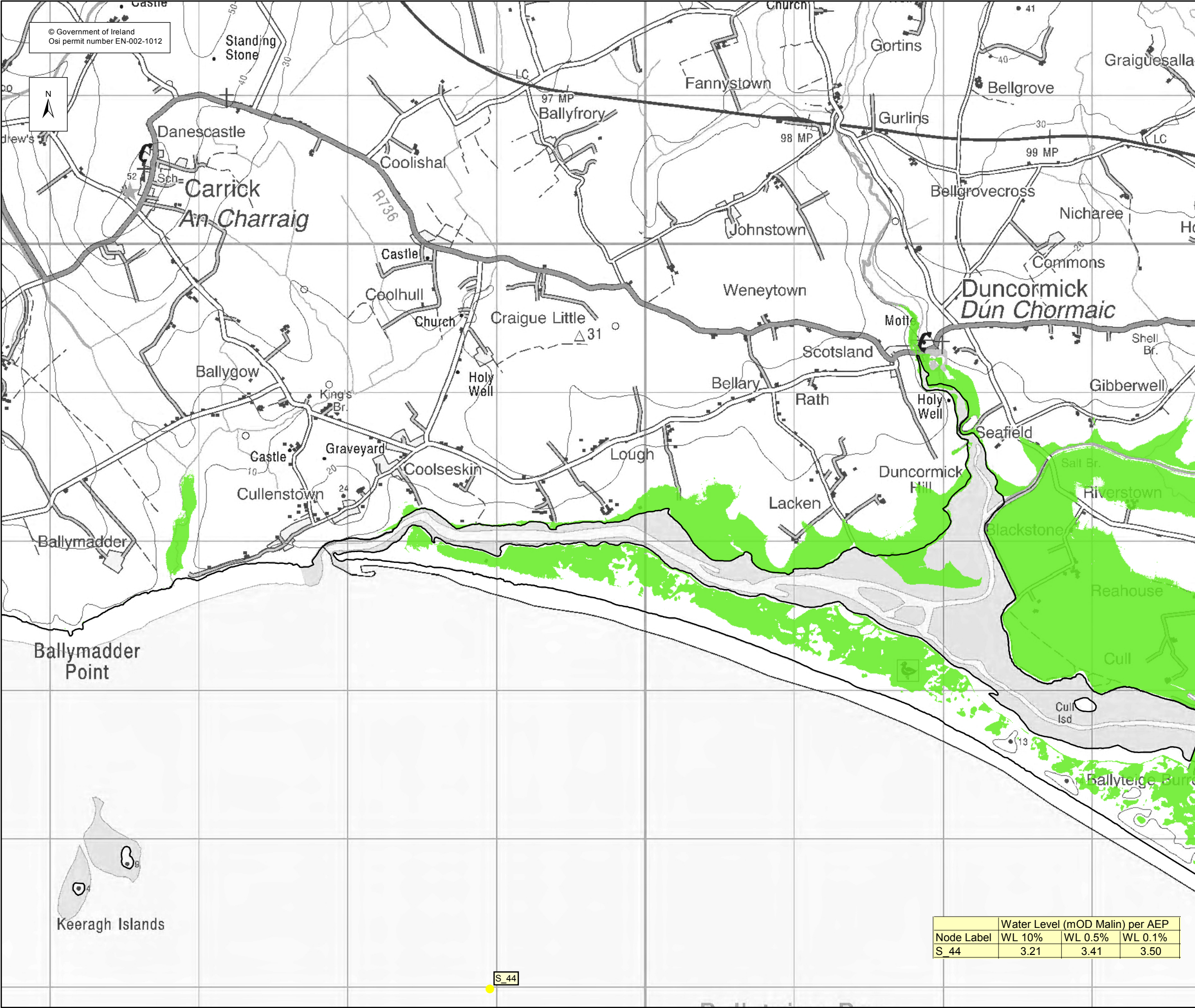
Map Type : FLOOD EXTENT
Source : TIDAL FLOODING
Map area : RURAL AREA
Scenario : HIGH END FUTURE SCENARIO

Figure By : PJW Date : Sept 2012
Checked By : JMC & JR Date : Sept 2012

Figure No. :
S / RA / EXT / HEFS / 4

Revision
0

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT (1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT (1 in 1000 chance in any given year)
- High Water Mark (HWM)
- Node Point
- S 34 Node Label (refer to table)

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

Elmwood House
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Belfast
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Northern Ireland

Office of Public Works
17-19 Lower Hatch Street
Dublin 2
Ireland

Project :
IRISH COASTAL PROTECTION STRATEGY
STUDY - PHASE III

Map :
SOUTH COAST FLOOD EXTENT MAP

Map Type : FLOOD EXTENT

Source : TIDAL FLOODING

Map area : RURAL AREA

Scenario : HIGH END FUTURE SCENARIO

Figure By : PJW Date : Sept 2012

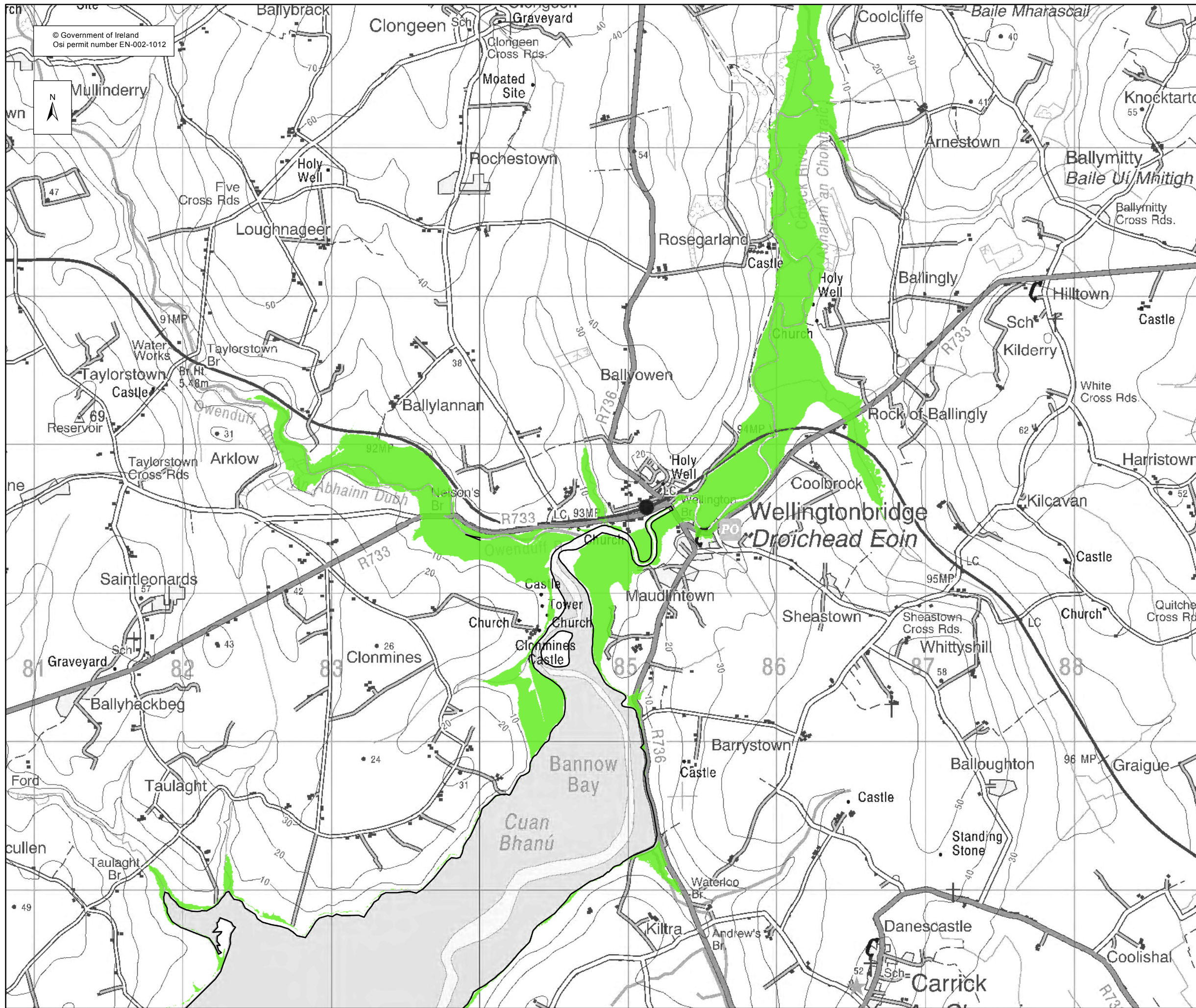
Checked By : JMC & JR Date : Sept 2012

Node Label	Water Level (mOD Malin) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
S_44	3.21	3.41	3.50

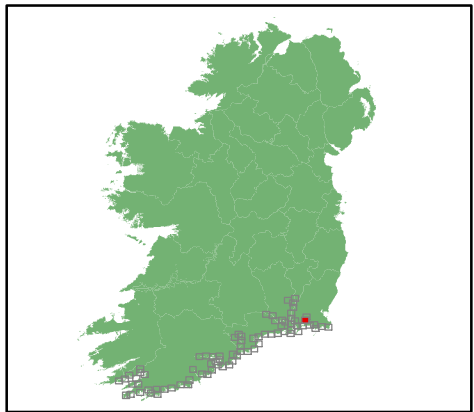
Figure No. :
S / RA / EXT / HEFS / 5

Revision
0

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3



Location Plan :



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT
(1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT
(1 in 1000 chance in any given year)
- High Water Mark (HWM)
- Node Point
- S 34 Node Label (refer to table)

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IRISH COASTAL PROTECTION STRATEGY
STUDY - PHASE III

Map :

SOUTH COAST FLOOD EXTENT MAP

Map Type : FLOOD EXTENT

Source : TIDAL FLOODING

Map area : RURAL AREA

Scenario : HIGH END FUTURE SCENARIO

Figure By : PJW Date : Sept 2012

Checked By : JMC & JR Date : Sept 2012

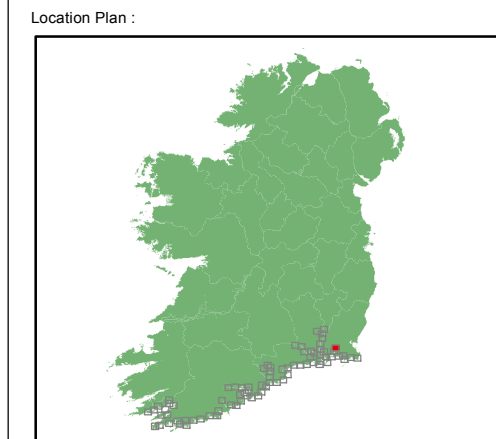
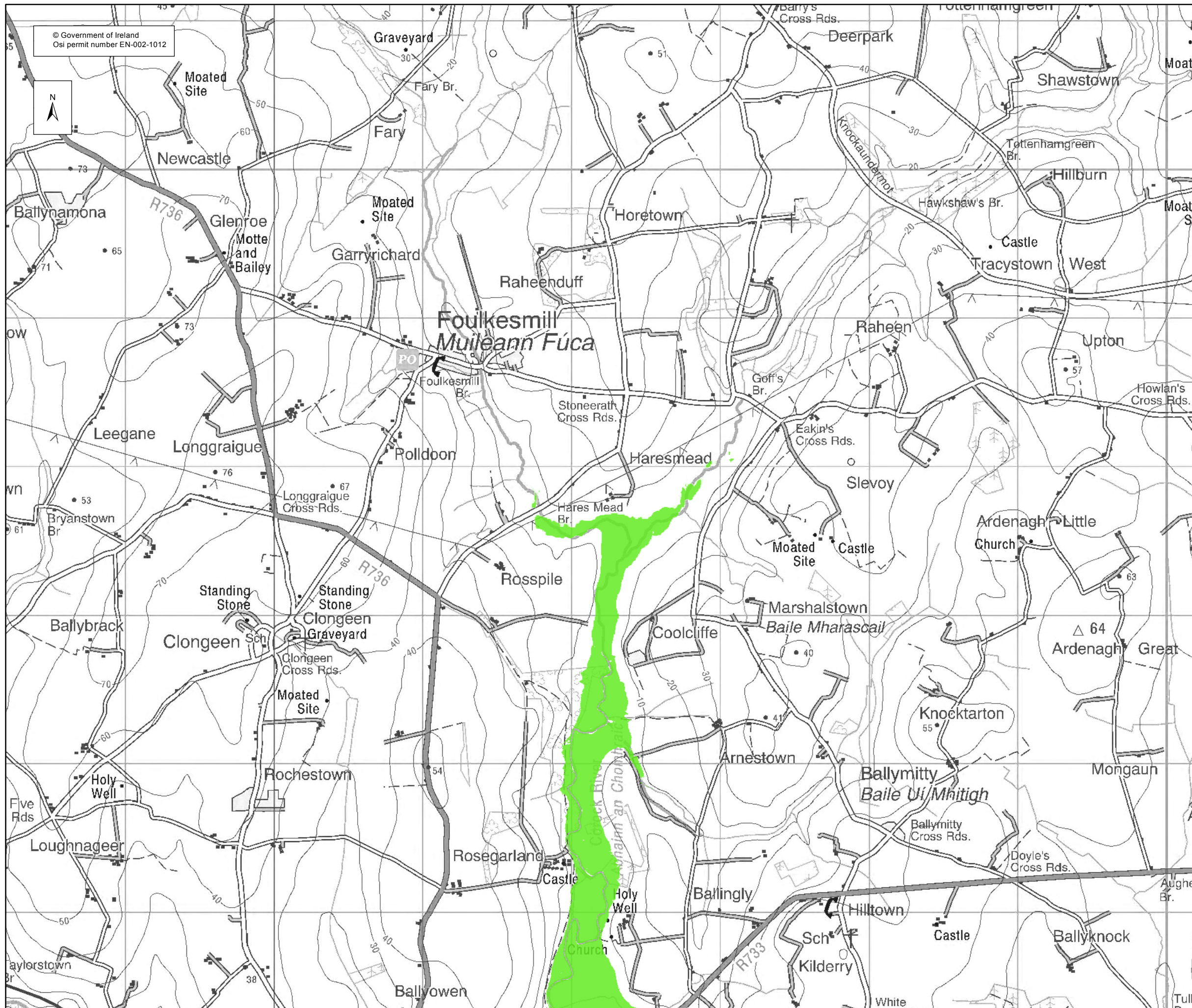
Figure No. :
S / RA / EXT / HEFS / 6

Revision
0

Drawing Scale : 1:25,000

Plot Scale : 1:1 @ A3

0.5 0.25 0 0.5 1 1.5 2 Kilometers



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT
(1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT
(1 in 1000 chance in any given year)
- High Water Mark (HWM)
- Node Point
- S 34 Node Label (refer to table)

USER NOTE :

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STUDY - PHASE III

Map :

SOUTH COAST FLOOD EXTENT MAP

Map Type : FLOOD EXTENT

Source : TIDAL FLOODING

Map area : RURAL AREA

Scenario : HIGH END FUTURE SCENARIO

Figure By : PJW Date : Sept 2012

Checked By : JMC & JR Date : Sept 2012

Figure No. :

S / RA / EXT / HEFS / 6A

Revision

0

Drawing Scale : 1:25,000

Plot Scale : 1:1 @ A3

