Northern Periphery and Arctic Programme 2014–2020
EUROPEAN UNION
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European Regional Development Fund

Climate Risk Management Plan

to assess historic places for climate change impacts and associated adaptation planning

☒ Singular historic place

Name of place

Ballinskelligs Abbey

Figure 1 Aerial photograph of Ballinskelligs Abbey, County Kerry, Ireland, seen from southwest with concrete sea wall in foreground and Ballinskelligs Castle in the background

Assessment details	
Names and affiliations of assessors	Fergus McCormick & Grellan D. Rourke (Office of Public Works) Michael Connolly (Kerry County Council) Carsten Hermann & Vanessa Glindmeier (Historic Environment Scotland)
Version number of the assessment	V1.0 DRAFT
Date of completion of the assessment	26 May 2020
Assessment type	☒ Advanced Level ☐ Standard Level
Comments on assessment process	Thank you to all attendees of the workshops in Ballinskelligs in the summers of 2018 and 2019 and all other contributors to and reviewers of this Climate Risk Management Plan

EXECUTIVE SUMMARY

Overview Historic Place

Name of historic place to be analysed	
Ballinskelligs Abbey	
Description of historic place and its wider surroundings	
Brief description of historic place	Ruin of Augustinian abbey dating from 12th century; mostly upstanding masonry, unroofed; surrounded by a historical graveyard, with masonry boundary wall; mass concrete sea wall to south
Brief description of place's immediate surroundings	fields to east, beach towards historic Ballinskelligs Castle to north, sea and water to south and west.
Brief description of places' wider environs	The place is located on the northern coast of Ballinskelligs Bay, which opens in the southwest to the Atlantic Ocean. The direct view of the place to the ocean is obstructed by Horse Island, forming a barrier to south-westerly storms. The place lies within a Special Area of Conservation, namely Ballinskelligs Bay and Inny Estuary.

Cultural heritage designations	
Designation	**Title**
Record of National Monuments and Places (RMP)	Ballinskelligs Abbey
National Monument Register (NMR) / Monument in state care	Ballinskelligs Abbey
Special Area of Conservation (SAC)	Ballinskelligs Bay and Inny Estuary SAC

Rating of key cultural significance values	
Key value	**Rating**
Medieval place with original material remains associated historiographically with the spread of Christianity in Ireland and Europe	3

Overview Risk Assessment

Summary of Risk Register (incl. Advanced Level)	☐ Standard level: **Risks ratings are 0-16 (inherent risk)** ☒ Advanced level: **Risk ratings are 0-64 (heritage risk)**

List of unacceptable risks

state risks consider as unacceptable at the respective time horizons
ranked by decreasing risk rating

Impact ID	Description	Risk rating *Time horizon 1* Today	*Time horizon 2* 2070	*Time horizon 3* 2100
1	Impact damage to sea wall from wave action	9	9	16
2	Storm impact damage to abbey ruin due to breach in sea wall	12	24	48
3	Storm impact damage to graveyard due to breach in sea wall	9	18	36
5	Impact damage from wave overtopping to grave slabs and stones, incl. breakage due to displacement and toppling	27	27	36
6	Breaking of grave slabs and stones by boulders from the sea	12	24	36
8	Surface abrasion of abbey's masonry surfaces, incl. stonework and mortar joints, due to weathering	24	24	24
9	Spalling of surfaces of the grave crosses where made from concrete with metal reinforcement	12	18	18
10	Structural destabilisation of abbey's masonry due to physical force of root growth, eventually causing partial collapse	16	16	24

Highest-ranked acceptable risks
(state multiple if of the same rating at time horizon #1)

Impact ID	Description	Risk rating *Time horizon 1* Today	*Time horizon 2* 2070	*Time horizon 3* 2100
4	Landward retreat of coastline at either end of the sea wall	9	9	16

Summary of increasing risks

Risk of damage from wave action, wave overtopping, boulder throw etc. is increasing due to sea level rise and increase in storm intensity (although storm frequency might reduce)

Risk of storm impact damage due to breach of sea wall is increasing due to continuous deterioration / repetitive damage to sea wall from wave action

Risk of structure destabilisation of abbey's masonry from root growth is increasing, due to a prolonging growing season

Summary of decreasing risks

Risk of damage from frost weathering is decreasing as the number of days with frost occurrence are decreasing

Effect of occurrence of impacts on key cultural heritage values

Key values	Current rating	Revised rating	Comments
Medieval place with original material remains associated historiographically with the spread of Christianity in Ireland and Europe	3	3 2 1	if abbey ruins damaged slightly if abbey ruin damaged significantly if abbey ruin damaged substantially and/or lost in whole or major parts

Conclusions

Today, three risks are considered as unacceptable, namely

- #5 Impact damage to grave slabs and stones from wave overtopping
- #8 Surface abrasion of abbey's masonry surfaces due to weathering
- #10 Structural destabilisation of abbey's masonry due to physical force of root growth, eventually causing partial collapse

By 2100, ten risks are anticipated to be considered as unacceptable, the highest-ranked of which are

- #2 / #3 Storm impact damage, due to breach in sea, wall to abbey ruin / grave slabs and stones respectively
- #5 / #6 Impact damage to grave slabs and stones from wave overtopping / boulder throw respectively

Overview Adaptation Planning

Summary of Adaptation Measures Register				
Impact / Measure ID	**Adaptation measure** (short title)	**Adaptation type**	**Location** where measure would be installed	**Potential effect on cultural significance** including mitigation example
Impact investigated	Impact damage to sea wall from wave action		**Impact ID**	1
1/P1	Add boulders or ramp to sea wall	Protect	In front of sea wall, seawards	acceptably adverse without mitigation
1/S1	Repairing sea wall	Strengthen	Sea wall	neutral
1/D1	Inspection and responsive maintenance after storms	Respond to Damage	Sea wall	neutral
1/I1	Investigate tidal behaviour at Ballinskelligs Bay, including monitor coastline damage	Manage Uncertainty	not applicable	neutral
Impact investigated	Storm damage to abbey ruin, incl. structural instability, due to breach in sea wall		**Impact ID**	2
2/L1	Develop concepts to communication and cope with loss of historic place in whole or parts	Managing Loss	Not applicable	neutral

Assessment of pathways (Advanced Plus Level)

Pathways roadmap

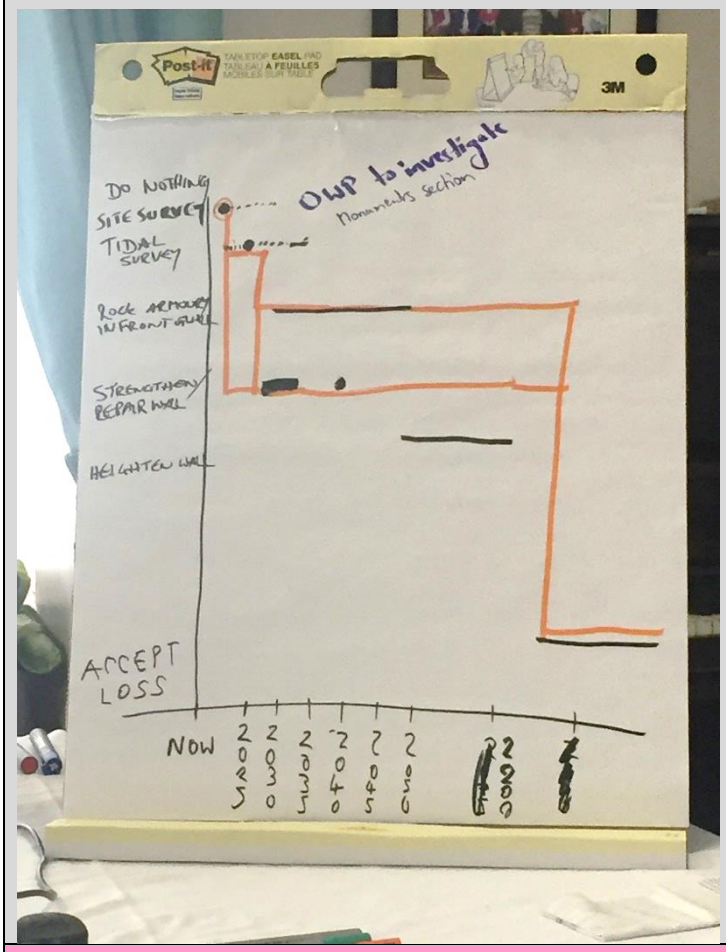

Figure 2

For the risk management assessment of Ballinskelligs Abbey in 2019, the workshop attendees developed two principal adaptation pathway options.

Image © Historic Environment Scotland

Describe each of the created pathways

Loss of the place might eventually need to be considered but for the foreseeable future protection of the place should be technically possible and socioeconomically feasible.

Two principal pathways were established:

1. To protect the seawall and therefore the place by placing rock armoury on the wall's seaward side to reduce the impact (magnitude) of wave action on the wall's surfaces, wave overtopping and boulder throw
2. Repair the concrete sea wall to increase its structural ability to better withstand the above-noted impacts

Performing a tidal survey was also noted as option to develop other pathway options.

Name the preferred pathway, stating the reasons for this preference
No preferred option was yet selected but the Office of Public Works agreed to investigate options further to better understand their feasibility and viability.
State the actions, resources and responsibilities needed to commence the implementation of the preferred pathway
Office of Public Works to allocated responsibility and budget for further investigations
Define timescale for the next review of the adaptation pathways, including reason
Office of Public Works to review results of the additional investigations within the next 3 years, considering the usefulness for further stakeholder engagement

APPENDED ASSESSMENTS

Historic Places and Cultural Significance

Singular place, group of places or place categories

☒ Singular historic place

Geographic information (singular historic place)		
Name of place	**Place's address**	**Place's extent**
Ballinskelligs Abbey	Ballinskelligs, County Kerry, Ireland	Upstanding remains of buildings by graveyard with boundary wall, except for a sea wall to the south

Historic place overview

Geographic information of historic place to be analysed	
Name of place to be analysed	
Ballinskelligs Abbey	
Description of historic place and its wider surroundings	
Brief description of historic place	Ruin of Augustinian abbey dating from 12th century; mostly upstanding masonry, unroofed; surrounded by a historical graveyard, with masonry boundary wall; mass concrete sea wall to south
Brief description of place's immediate surroundings	fields to east, beach towards historic Ballinskelligs Castle to north, sea and water to south and west.
Brief description of places' wider environs	The place is located on the northern coast of Ballinskelligs Bay, which opens in the southwest to the Atlantic Ocean. The direct view of the place to the ocean is obstructed by Horse Island, forming a barrier to south-westerly storms. The place lies within a Special Area of Conservation, namely Ballinskelligs Bay and Inny Estuary.

Place elements

Place elements (Advanced Level)		
Identify place elements e.g. walls, roof, bridge, woodland, building	**Principal material / matter** e.g. live organic matter, peat, stone, timber	**Description / comments** if required
walls of abbey ruin	stone masonry	mortar-bedded
grave slabs / stones	stone or concrete	
graves	organic remains	human remains, cloth and timber coffins
sea wall	mass concrete	

Cultural significance

Conservation policies				
ID	**Document title**	**Author(s)**	**Version**	**Date**
1	Conservation Plan for Ballinskelligs Abbey	Grellan D. Rourke (Office of Public Works)	3.1	2015

Cultural heritage designations			
Designation	**Title**	**Reference**	**Comments**
Record of National Monuments and Places (RMP)	Ballinskelligs Abbey	RMP KE097-036	
National Monument Register (NMR) / Monument in state care	Ballinskelligs Abbey	NMR 168	ownership
Special Area of Conservation (SAC)	Ballinskelligs Bay and Inny Estuary SAC	Site code 335 / Natura 2000 code IE0000335	for wildlife conservation

Rating of key cultural significance values		
Value	**Rating**	**Comments / reasons**
Medieval place with original material remains associated historiographically with the spread of Christianity in Ireland and Europe	3	exceptional due to its European context, especially in connection to the associated UNESCO World Heritage site Skellig Michael

Implications of cultural heritage designations (Advanced Level)		
Designation	**Title**	**Conferred management implications**
RMP	Ballinskelligs Abbey	Protected against interventions other than those carried out by the Office of Public Works
NMR	Ballinskelligs Abbey	Managed by the Office of Public Works in accordance with the place's Conservation Plan
SAC	Ballinskelligs Bay and Inny Estuary SAC	No implications for the historic place itself, but restrictions might apply to the implementation of conservation measures

Cultural significance ratings of place elements (Advanced Level)		
Place elements	**Rating**	**Reasoning for rating**
walls of abbey ruin	4	Medieval construction associated historiographically with the spread of Christianity in Ireland and Europe
grave slabs / stones	3	Important for regional and local communities
graves	3	Important for regional and local communities
sea wall	1	No apparent significance

Climate, hazards and impacts

Site observations, hazards and climate drivers (optional)

Observed damages and deterioration			
Damage and deterioration observed at historic place	**Impact type**	**Environmental hazard** associated with observations	**Climate drivers**
Impact damage to sea wall from wave action	☒ damage ☐ deterioration	Wave action	Water currents
Storm damage to abbey ruin due to breach in sea wall, incl. structural instability of ruin	☒ damage ☐ deterioration		
Storm damage to graveyard due to breach in sea wall, incl. displacement / toppling of gravestones and slabs	☒ damage ☐ deterioration		
Impact damage from wave overtopping to grave slabs and stones, incl. breakage due to displacement and toppling	☒ damage ☐ deterioration	Wave overtopping during storm	Wind speed, tidal currents, sea levels, storm
Breaking of grave slabs and stones by boulders from the sea	☒ damage ☐ deterioration	Boulder deposition on land by sea energy	Wind speed, tidal currents, sea levels
Surface abrasion of abbey's masonry surfaces, incl. stonework and mortar joints, due to weathering	☐ damage ☒ deterioration	Wind & precipitation weathering	Wind speed, precipitation
Spalling of abbey's masonry surfaces due to frost weathering	☐ damage ☒ deterioration	Frost weathering	Precipitation, temperature fluctuations at freezing point
Spalling of surfaces of the grave crosses where made from concrete with metal reinforcement	☐ damage ☒ deterioration	Metal corrosion	Precipitation, temperature

Structural destabilisation of abbey's masonry due to physical force of root growth, eventually causing partial collapse buildings surfaces causing cracking of masonry	☐ damage ☒ deterioration	Physical damage by growth of plant roots	Precipitation, temperature
		Fungus and moss growth on surfaces	Precipitation, temperature
Landward retreat of coastline at either end of the sea wall	☐ damage ☒ deterioration	Coastal erosion	Water currents

Hazard register

Hazard Register								Hazard Register continued (Advanced Level)			
Climate drivers	**Climate trends**		**Environmental hazards**			**Impact on historic place**					
Description of variables	*Observed trends*	*Projected trends*	*Description of observed or potential hazard*	*Change in relevance observed*	*projected*	*Description of observed or potential impacts*	*Impact types*	*Affected location*	*Length of exposure to impact*	*Intensity of impact*	*Likelihood of impact to occur*
Water currents			Wave action	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Impact damage to sea wall from wave action	☒ damage ☐ deterioration	Sea wall	☐ decreasing ☐ increasing ☒ no change	☐decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change
						Storm damage to abbey ruin due to breach in sea wall, incl. structural instability of ruin	☒ damage ☐ deterioration	Walls of abbey ruin	☐ decreasing ☐ increasing ☒ no change	☐decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change
						Storm damage to graveyard due to breach in sea wall, incl. displacement / toppling of gravestones and slabs	☒ damage ☐ deterioration	Grave slabs / stones near sea wall	☐ decreasing ☐ increasing ☒ no change	☐decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change
			Coastal erosion	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Landward retreat of coastline at either end of the sea wall	☐ damage ☒ deterioration	Sea wall, graves	☐ decreasing ☒ increasing ☐ no change	☐decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change
Storms (wind speed, tidal currents) and sea levels	• Storm events seem to have got stronger. • No evidence of sustained long-term trend of storminess over North Atlantic in the past, however, study spanning last four to six decades indicates increased storm activity north over North Atlantic, with negative tendency southward • Wave heights have risen by 20mmdecade across North Atlantic region	• maximum wind gusts are increasing • frequency of storms is projected to decrease, but intensity increasing • indication of increase in winter storm intensity over North Atlantic by 2100 • projected increase in number of high magnitude storms, generating bigger associated surges (>1m) • Sea levels are projected to rise • Primary driver in magnifying impacts of changing storm surge and wave patterns in coastal areas	Wave overtopping during storm	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Impact damage from wave overtopping to grave slabs and stones, incl. breakage due to displacement and toppling	☒ damage ☐ deterioration	Grave slabs / stones near sea wall	☒ decreasing ☐ increasing ☐ no change	☐decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change
			Boulder deposition on land by sea energy	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Breaking of grave slabs and stones by boulders from the sea	☒ damage ☐ deterioration	Grave slabs / stones near sea wall	☐ decreasing ☐ increasing ☒ no change	☐decreasing ☐ increasing ☒ no change	☐ decreasing ☒ increasing ☐ no change

Precipitation, temperature fluctuations at freezing point	• mean annual precipitation increased, with greater increase in west of country • wet days (rainfall greater than 0.2mm) and very wet days (rainfall greater than 10mm) increased in west	• mean annual precipitation projected to decrease • drier summers • wetter winters • increase of dry periods (at least 5 consecutive days with daily precipitation less than 1mm) • increase in frequency of heavy precipitation events projected during winter and autumn	Frost weathering	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Spalling of abbey's masonry surfaces due to frost weathering	☐ damage ☒ deterioration	Walls of abbey ruin	☐ decreasing ☒ increasing ☐ no change	☐decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change
Precipitation, temperature	• mean annual temperature increased • seasonal temperatures increased • number of frost days (temperature below 0°C decreased	• mean annual temperature projected to rise • mean seasonal temperatures projected to rise • winter night-time min temperature projected to increase	Wind & rain weathering	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Surface abrasion of abbey's masonry surfaces, incl. stonework and mortar joints, due to weathering	☐ damage ☒ deterioration	Walls of abbey ruin	☐ decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change
			Metal corrosion	☐ increase ☐ decrease ☒ no change	☒ increase ☐ decrease ☐ no change	Spalling of surfaces of the grave crosses where made from concrete with metal reinforcement	☐ damage ☒ deterioration	Grave slabs / stones	☐ decreasing ☐ increasing ☒ no change	☐ decreasing ☒ increasing ☐ no change	☐ decreasing ☒ increasing ☐ no change
			Physical damage by growth of plant roots	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Structural destabilisation of abbey's masonry due to physical force of root growth, eventually causing partial collapse	☒ damage ☐ deterioration	Walls of abbey ruin	☐ decreasing ☒ increasing ☐ no change	☐ decreasing ☐ increasing ☒ no change	☐ decreasing ☒ increasing ☐ no change
			Fungus and moss growth on surfaces	☒ increase ☐ decrease ☐ no change	☐ increase ☐ decrease ☒ no change	Discolouration of surface in a mostly cosmetic form without causing harm	☐ damage ☒ deterioration	Walls of abbey ruin	☐ decreasing ☒ increasing ☐ no change	☐ decreasing ☐ increasing ☒ no change	☐ decreasing ☒ increasing ☐ no change

Risk register

Risk Register											Risk Register continued (Advanced Level)									
Impact			Place elements			Time horizon #1: Today					Time horizon #2: 50 years from today 2070						Time horizon #3: 80 years from today 2100			
Impact ID	Impact description	Environmental hazard	Place element affected	Significance rating	Vulnerability rating	Intensity rating	Likelihood rating	Severity rating	Inherent risk rating	Heritage risk rating	Intensity rating	Likelihood rating	Severity rating	Inherent risk rating	Heritage risk rating	Intensity rating	Likelihood rating	Severity rating	Inherent risk rating	Heritage risk rating
1	Impact damage to sea wall from wave action	Wave action	Sea wall	1	3 Severe	2 Moderate	3 Likely	3	9	9	3 Major	3 Likely	3	9	9	4 Extreme	4 Very likely	4	16	16
2	Storm damage to abbey ruin due to breach in sea wall, incl. structural instability of ruin	Wave action	Walls of abbey ruin	4	3 Severe	3 Major	1 Very unlikely	3	3	12	3 Major	2 Unlikely	3	6	24	4 Extreme	3 Likely	4	12	48
3	Storm damage to graveyard due to breach in sea wall, incl. displacement / toppling of gravestones and slabs	Wave action	Grave slabs / stones near sea wall	3	3 Severe	3 Major	1 Very unlikely	3	3	9	3 Major	2 Unlikely	3	6	18	4 Extreme	3 Likely	4	12	36
4	Landward retreat of coastline at either end of the sea wall	Coastal erosion	Sea wall	1	3 Severe	2 Moderate	3 Likely	3	9	9	3 Major	3 Likely	3	9	9	4 Extreme	4 Very likely	4	16	16
5	Impact damage from wave overtopping to grave slabs and stones, incl. breakage due to displacement and toppling	Wave overtopping during storm	Grave slabs / stones near sea wall	3	2 Moderate	3 Major	3 Likely	3	9	27	3 Major	3 Likely	3	9	27	3 Major	4 Very likely	3	12	36
6	Breaking of grave slabs and stones by boulders from the sea	Boulder deposition on land by sea energy	Grave slabs / stones near sea wall	3	3 Severe	4 Extreme	1 Very unlikely	4	4	12	4 Extreme	2 Unlikely	4	8	24	4 Extreme	3 Likely	4	12	36
7	Spalling of abbey's masonry surfaces due to frost weathering	Frost weathering	Walls of abbey ruin	4	1 Slight	1 Minor	3 Likely	1	3	12	1 Minor	2 Unlikely	1	2	8	1 Minor	1 Very unlikely	1	1	4
8	Surface abrasion of abbey's masonry surfaces, incl. stonework and mortar joints, due to weathering	Wind & rain weathering	Walls of abbey ruin	4	2 Moderate	2 Moderate	3 Likely	2	6	24	2 Moderate	3 Likely	2	6	24	2 Moderate	3 Likely	2	6	24
9	Spalling of surfaces of the grave crosses where made from concrete with metal reinforcement	Metal corrosion	Grave slabs / stones	3	2 Moderate	2 Moderate	2 Unlikely	2	4	12	2 Moderate	3 Likely	2	6	18	2 Moderate	3 Likely	2	6	18
10	Structural destabilisation of abbey's masonry due to physical force of root growth, eventually causing partial collapse	Physical damage by growth of plant roots	Walls of abbey ruin	4	2 Moderate	2 Moderate	2 Unlikely	2	4	16	2 Moderate	2 Unlikely	2	4	16	2 Moderate	3 Likely	2	6	24
11	Discolouration of surface in a mostly cosmetic form without causing harm	Fungus and moss growth on surfaces	Walls of abbey ruin	4	1 Slight	0 Negligible	2 Unlikely	0	0	0	0 Negligible	2 Unlikely	0	0	0	1 Minor	3 Likely	1	3	12

Summary of risk register

Summary of Risk Register (incl. Advanced Level)	☐ Standard level: **Risks ratings are 0-16 (inherent risk)** ☒ Advanced level: **Risk ratings are 0-64 (heritage risk)**

List of unacceptable risks

state risks consider as unacceptable at the respective time horizons
ranked by decreasing risk rating

Impact ID	Description	Risk rating		
		Time horizon 1	*Time horizon 2*	*Time horizon 3*
		Today	2070	2100
1	Impact damage to sea wall from wave action	9	9	16
2	Storm impact damage to abbey ruin due to breach in sea wall	12	24	48
3	Storm impact damage to graveyard due to breach in sea wall	9	18	36
5	Impact damage from wave overtopping to grave slabs and stones, incl. breakage due to displacement and toppling	27	27	36
6	Breaking of grave slabs and stones by boulders from the sea	12	24	36
8	Surface abrasion of abbey's masonry surfaces, incl. stonework and mortar joints, due to weathering	24	24	24
9	Spalling of surfaces of the grave crosses where made from concrete with metal reinforcement	12	18	18
10	Structural destabilisation of abbey's masonry due to physical force of root growth, eventually causing partial collapse	16	16	24

Highest-ranked acceptable risks
(state multiple if of the same rating at time horizon #1)

Impact ID	Description	Risk rating		
		Time horizon 1	*Time horizon 2*	*Time horizon 3*
		Today	2070	2100
4	Landward retreat of coastline at either end of the sea wall	9	9	16

Summary of increasing risks

Risk of damage from wave action, wave overtopping, boulder throw etc. is increasing due to sea level rise and increase in storm intensity (although storm frequency might reduce)

Risk of storm impact damage due to breach of sea wall is increasing due to continuous deterioration / repetitive damage to sea wall from wave action

Risk of structure destabilisation of abbey's masonry from root growth is increasing, due to a prolonging growing season

Summary of decreasing risks

Risk of damage from frost weathering is decreasing as the number of days with frost occurrence are decreasing

Effect of occurrence of impacts on key cultural heritage values

Key values	Current rating	Revised rating	Comments
Medieval place with original material remains associated historiographically with the spread of Christianity in Ireland and Europe	4	3 2 1	if abbey ruins damaged slightly if abbey ruin damaged significantly if abbey ruin damaged substantially and/or lost in whole or major parts

Conclusions

Today, three risks are considered as unacceptable, namely

- #5 Impact damage to grave slabs and stones from wave overtopping
- #8 Surface abrasion of abbey's masonry surfaces due to weathering
- #10 Structural destabilisation of abbey's masonry due to physical force of root growth, eventually causing partial collapse

By 2100, ten risks are anticipated to be considered as unacceptable, the highest-ranked of which are

- #2 / #3 Storm impact damage, due to breach in sea, wall to abbey ruin / grave slabs and stones respectively
- #5 / #6 Impact damage to grave slabs and stones from wave overtopping / boulder throw respectively

Adaptation Planning

Impact #1: Impact damage to sea wall

Impact to be investigated	
Impact description	Impact damage to sea wall from wave action
Associated hazard	Wave action
Risk rating	9
Impact ID	1
Longlist of adaptation measures	
PROTECT	
P1	Add boulders or ramp in front of sea wall
STRENGTHEN	
S1	Repairing sea wall, e.g. grouting existing cracks
RELOCATE	
R1	Impossible to relocate sea wall
RESPOND TO DAMAGE	
D1	Inspection and responsive maintenance after storms
MANAGING LOSS	
L1	Decide cut-off point
L2	Community awareness
MANANAGE UNCERTAINTY	
I1	Investiage tidal behaviour at Ballinskelligs Bay, including monitor coastline damage
I2	Appraise implications of wave breakers

Adaptation measure appraisal	
Impact / Measure ID	1/P1
Adaptation measure (short title)	Add boulders or ramp to sea wall
Details of measure (brief description)	Add boulders or ramp in front of the existing concrete sea wall to break wave intensity prior to their impact on the wall
Location where measure would be installed (If working at Advanced Level, use *place elements*.)	At calculated distance from sea wall, where boulders/ramp would have desired effect of slowing down waves, instead of maybe even speeding them up. Investigation as to where exactly this is would be required (see #1/I4)

If adaptation type is Protect, Strengthen, Relocate *or* Respond to Damage, *use below table:*

Adaptation measure appraisal: Adjustment of ratings (Advanced Level)

Change to	Scale of change	Adjusting intensity / vulnerability rating	Adjusting heritage risk rating
exposure duration of place to impact	Slightly reduced	**Intensity:** 2-1=1	**Heritage risk:** from 9 down to 6, i.e. 'acceptable subject to monitoring'
magnitude of impact on place	Slightly reduced		
vulnerability of the place to impact	No changes	**Vulnerability:** 3=3	

If the answer to the first query is left unchanged *or* increased, *stop the appraisal of the measure concerned.*

Regardless of adaptation type, continue with the table below:

Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☒ acceptably adverse without mitigation ☐ neutral ☐ beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	

If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.

Regardless of adaptation type, continue with the table below:

Potential economic, environmental and social effects (Advanced Level)	
Descriptive rating of economic effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
Descriptive rating of environmental effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☒ acceptably adverse without mitigation ☐ neutral ☐ beneficial
Comments	Assumed to be minor (possible impact on tidal currents)
Descriptive rating of social effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
If any of the responses above was "subject to mitigation", name examples for how this might be achieved.	
If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.	

Adaptation measure appraisal	
Impact / Measure ID	1/S1
Adaptation measure (short title)	Repair sea wall
Details of measure (brief description)	Repair existing damages in sea wall, for example by • injecting grouting into cracks • protecting damaged surface areas with patch repairs • infilling of new concrete into damaged foundations / existing ramp area in front of the sea wall
Location where measure would be installed (If working at Advanced Level, use *place elements*.)	Sea wall

If adaptation type is Protect, Strengthen, Relocate *or* Respond to Damage, *use below table:*

Adaptation measure appraisal: Adjustment of ratings (Advanced Level)			
Change to	**Scale of change**	**Adjusting intensity / vulnerability rating**	**Adjusting heritage risk rating**
exposure duration of place to consequence	No changes	**Intensity:** 2=2	**Heritage risk:** from 9 down to 6, i.e. 'acceptable subject to monitoring'
magnitude of consequence on place	No changes		
vulnerability of the place to hazard	Slightly reduced	**Vulnerability:** 3-1=2	

If the answer to the first query is left unchanged *or* increased, *stop the appraisal of the measure concerned.*

Regardless of adaptation type, continue with the table below:

Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	

If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.

Regardless of adaptation type, continue with the table below:	
Potential economic, environmental and social effects (Advanced Level)	
Descriptive rating of economic effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
Descriptive rating of environmental effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
Descriptive rating of social effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
If any of the responses above was "subject to mitigation", name examples for how this might be achieved.	
If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.	

Adaptation measure appraisal	
Impact / Measure ID	1/D1
Adaptation measure (short title)	Inspection and responsive maintenance after storms
Details of measure (brief description)	Inspection for damage after extreme weather events, e.g. storms, with an associated responsive / timely maintenance programme: • Monitoring and recording damages from wave action will aid to better understand weaknesses of the sea wall • Timely responsive repair helps to accept that some damage will occur while ensuring that the wall does not become more vulnerable over time
Location where measure would be installed (If working at Advanced Level, use *place elements*.)	Sea wall

If adaptation type is Protect, Strengthen, Relocate *or* Respond to Damage, *use below table:*

Adaptation measure appraisal: Adjustment of ratings (Advanced Level)			
Change to	**Scale of change**	**Adjusting intensity / vulnerability rating**	**Adjusting heritage risk rating**
exposure duration of place to consequence	No change	**Intensity:** 2=2	**Heritage risk:** from 9 down to 6, i.e. 'acceptable subject to monitoring'
magnitude of consequence on place	No change		
vulnerability of the place to hazard	Slightly reduced	**Vulnerability:** 3-1=2	

If the answer to the first query is left unchanged *or* increased, *stop the appraisal of the measure concerned.*

Regardless of adaptation type, continue with the table below:

Potential effects on cultural significance

Descriptive rating of effect on cultural significance of the place	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	

If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.

Regardless of adaptation type, continue with the table below:

Potential economic, environmental and social effects (Advanced Level)

Descriptive rating of economic effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
Descriptive rating of environmental effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
Descriptive rating of social effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	Could involve local community to help better understand issues
If any of the responses above was "subject to mitigation", name examples for how this might be achieved.	

If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.

Adaptation measure appraisal

Impact / Measure ID	1/I1
Adaptation measure (short title)	Investigate tidal behaviour at Ballinskelligs Bay, including monitor coastline damage

Details of measure (brief description)	Perform study on tidal behaviour within Ballinskelligs Bay to
	• Better understand existing current under different weather conditions and how climate change might affect this
	• Monitor damage to coastline to record and understand patterns of impacts
	• Consider coastline change on tidal current and associated erosion damage, including
	  ○ 1930s pier at Ballinskelligs Castle
	  ○ potential loss of beach between Ballinskelligs Abbey and Ballinskelligs Castle
	  ○ Changes to the water passage between the mainland and Horse Islands

Location where measure would be installed (If working at Advanced Level, use *place elements*.)	Not applicable

If adaptation type is Manage Uncertainty*, use below table:*

Manage Uncertainty appraisal

How would the considered measure reduce uncertainty?	The influence of tidal currents on damage from wave action and boulder throw to the sea wall would be better understood, helping to predict with increased certainty the risk associated with this form of damage.
How would the considered measure support other relevant measures?	A study into the tidal behaviour within Ballinskelligs Bay would be beneficially feed into the decision-making process in regard to where to install other adaptation measures.
Are the answers to the two questions above considered sufficiently relevant to explore measure further?	☒ Yes, explore this adaptation measure further ☐ No, file this idea of an adaption measure and proceed to next measure on long-list

If the answer to the last question was no, stop the appraisal of the measure concerned.

Regardless of adaptation type, continue with the table below:

Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	
If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.	

Regardless of adaptation type, continue with the table below:

Potential economic, environmental and social effects (Advanced Level)	
Descriptive rating of economic effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
Descriptive rating of environmental effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☐ neutral ☒ beneficial
Comments	potentially also beneficial for other places, e.g. nearby harbour
Descriptive rating of social effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
If any of the responses above was "subject to mitigation", name examples for how this might be achieved.	
If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.	

Adaptation measure appraisal	
Impact / Measure ID	1/I2
Adaptation measure (short title)	Appraise implications of wave breakers
Details of measure (brief description)	Investigate the implication of installing wave breakers in front of the sea wall on • the sea wall itself, to identify the best position and shape of the wave breakers to reduce damage to sea wall from wave action • damage to abbey ruin and grave slabs / stones from boulder throw • erosion damage to the coastline adjacent to the historic place • submarine terrain and vegetation, which might also affect erosion processes (e.g. sea grass reducing submarine ground erosion and slowing tidal movement; or aggregate accrual / depletion)
Location where measure would be installed (If working at Advanced Level, use *place elements*.)	Not applicable

If adaptation type is Manage Uncertainty*, use below table:*

Manage Uncertainty appraisal	
How would the considered measure reduce uncertainty?	Understanding the implications of installing wave breakers will help to prevent unintentional damage to the historic place and its immediate surroundings and wider environs and, therefore, also help to prevent maladaptation.
How would the considered measure support other relevant measures?	This measure would, as a feasibility study, inform the installation of wave breakers (or a ramp) in front of the sea wall (#1/P1).
Are the answers to the two questions above considered sufficiently relevant to explore measure further?	☒ Yes, explore this adaptation measure further ☐ No, file this idea of an adaption measure and proceed to next measure on long-list

If the answer to the last question was no, stop the appraisal of the measure concerned.

Regardless of adaptation type, continue with the table below:

Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	
If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.	

Regardless of adaptation type, continue with the table below:

Potential economic, environmental and social effects (Advanced Level)	
Descriptive rating of economic effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
Descriptive rating of environmental effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☐ neutral ☒ beneficial
Comments	potentially also beneficial for other places, e.g. marine / wildlife reserve
Descriptive rating of social effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
If any of the responses above was "subject to mitigation", name examples for how this might be achieved.	
If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.	

Impact #2: Storm damage to abbey ruin due to sea wall breach

Impact to be investigated	
Impact description	Storm damage to abbey ruin, incl. structural instability, due to breach in sea wall
Associated hazard	Wave action
Risk rating	12
Impact ID	2
Longlist of adaptation measures	
PROTECT	
P1	Maintain and improve sea wall (see Impact #1)
STRENGTHEN	
S1	
RELOCATE	
R1	Impractical to relocate abbey ruin as only few parts of the former monastic complex survive to allow meaningful reconstruction outside its original context
RESPOND TO DAMAGE	
D1	
MANAGING LOSS	
L1	Develop concepts to communication and cope with loss of historic place in whole or parts
MANANAGE UNCERTAINTY	
I1	

Adaptation measure appraisal	
Impact / Measure ID	2/L1
Adaptation measure (short title)	Develop concepts to communication and cope with loss of historic place in whole or parts

Details of measure (brief description)	To aid accepting that, in the distant future, Ballinskelligs Abbey will eventually be lost to the sea, concepts should be developed to
	• help communities cope with the loss, including
	  ○ the local community
	  ○ religious community
	  ○ scholarly communities
	• record the historic place for future educational and research benefits
	• communicate and live through loss, including
	  ○ artistic projects' interpreting the place
	  ○ collecting memories of the place
	  ○ explorations into socioeconomic effects and mitigation options

Location where measure would be installed (If working at Advanced Level, use *place elements*.)	Not applicable

If adaptation type is Managing Loss*, use below table:*

Managing Loss appraisal	
How would the measure support communities?	Through developing an early understanding about the inevitability of the loss of the place longer term and by identifying coping strategies.
Which specific communities would be supported?	the local community; religious community; scholarly communities
Are the answers to the two questions above considered sufficiently relevant to explore measure further?	☒ Yes, explore this adaptation measure further ☐ No, file this idea of an adaption measure and proceed to next measure on longlist

If the answer to the last question was no, stop the appraisal of the measure concerned.

Regardless of adaptation type, continue with the table below:	
Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	
If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.	
Regardless of adaptation type, continue with the table below:	
Potential economic, environmental and social effects (Advanced Level)	
Descriptive rating of economic effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☐ neutral ☒ beneficial
Comments	To develop alternative economic opportunities
Descriptive rating of environmental effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☒ neutral ☐ beneficial
Comments	
Descriptive rating of social effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☐ neutral ☒ beneficial
Comments	To develop alternative social opportunities
If any of the responses above was "subject to mitigation", name examples for how this might be achieved.	
If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.	

Impact #3: Storm damage to graveyard due to sea wall breach

Impact to be investigated	
Impact description	Storm impact damage to graveyard, due to breach in sea wall
Associated hazard	Wave action
Risk rating	9
Impact ID	3
Longlist of adaptation measures	
PROTECT	
P1	Maintain and improve sea wall (see Impact #1)
STRENGTHEN	
S1	
RELOCATE	
R1	Impractical to relocate graveyard due to its size
RESPOND TO DAMAGE	
D1	
MANAGING LOSS	
L1	Develop concepts to communication and cope with loss of historic place in whole or parts (see Impact / Measure #2/L1)
MANANAGE UNCERTAINTY	
I1	

Adaptation Measures Register

Adaptation Measures Register						(Advanced Level)		
Impact investigated	Impact damage to sea wall from wave action			**Impact ID**	1			
Impact / Measure ID	**Adaptation measure** (short title)	**Adaptation type**	**Location** where measure would be installed	**Potential effect on cultural significance** including mitigation example	**Include in summary**	**Potential economic effects** including mitigation example	**Potential environmental effects** including mitigation example	**Potential social effects** including mitigation example
1/P1	Add boulders or ramp to sea wall	Protect	In front of sea wall, seawards	acceptably adverse without mitigation	☒ include	neutral	neutral (assumed to be minor (possible impact on tidal currents)	neutral
1/S1	Repairing sea wall	Strengthen	Sea wall	neutral	☒ include	neutral	neutral	neutral
1/D1	Inspection and responsive maintenance after storms	Respond to Damage	Sea wall	neutral	☒ include	neutral	neutral	neutral (could involve local community to help better understand issues)
1/I1	Investigate tidal behaviour at Ballinskelligs Bay, including monitor coastline damage	Investigate	not applicable	neutral	☒ include	neutral	beneficial (potentially also beneficial for other places, e.g. nearby harbour)	neutral
1/I2	Appraise implications of wave breakers	Investigate	not applicable	neutral	☐ include	neutral	beneficial (potentially also beneficial for other places, e.g. marine / wildlife reserve)	neutral
Impact investigated	Storm damage to abbey ruin, incl. structural instability, due to breach in sea wall			**Impact ID**	2			
Impact / Measure ID	**Adaptation measure** (short title)	**Adaptation type**	**Location** where measure would be installed	**Potential effect on cultural significance** including mitigation example	**Include in summary**	**Potential economic effects** including mitigation example	**Potential environmental effects** including mitigation example	**Potential social effects** including mitigation example
2/L1	Develop concepts to communication and cope with loss of historic place in whole or parts	Managing Loss	Not applicable	neutral	☒ include	beneficial (to develop alternative economic opportunities)	neutral	beneficial (to develop alternative economic opportunities)

Summarising the adaptation measures

Summary of Adaptation Measures Register				
Impact / Measure ID	**Adaptation measure** (short title)	**Adaptation type**	**Location** where measure would be installed	**Potential effect on cultural significance** including mitigation example
Impact investigated	Impact damage to sea wall from wave action		**Risk ID**	1
1/P1	Add boulders or ramp to sea wall	Protect	In front of sea wall, seawards	acceptably adverse without mitigation
1/S1	Repairing sea wall	Strengthen	Sea wall	neutral
1/D1	Inspection and responsive maintenance after storms	Respond to Damage	Sea wall	neutral
1/I1	Investigate tidal behaviour at Ballinskelligs Bay, including monitor coastline damage	Manage Uncertainty	not applicable	neutral
Impact investigated	Storm damage to abbey ruin, incl. structural instability, due to breach in sea wall		**Risk ID**	2
2/L1	Develop concepts to communication and cope with loss of historic place in whole or parts	Managing Loss	Not applicable	neutral

Feasibility & viability

Feasibility & viability of adaptation measure (Advanced Plus Level)	
Feasibility	
Complexity *describe the complexity involved in the design, implementation and operation of the measure*	☐ extremely complex ☐ highly complex ☐ moderate complexity ☒ simple ☐ very simple
Expertise / knowledge *describe the availability and level of expertise and knowledge required to design and implement the measures*	☐ readily available ☒ readily available but specialist ☐ not available but can be developed short term ☐ not available but might be developed mid-term ☐ not available and unlikely to be developed longer term
Responsible organisation *identify the principal organisation responsible for the measure*	Office of Public Works (in collaboration with Kerry County Council)
Viability	
Investment cost *describe cost estimate for design, implementation and start-up of the measure*	☐ very high cost ☐ high cost ☒ moderate cost ☐ low cost ☐ very low cost
Operation cost *describe cost estimate for future operation and longer-term maintenance of the measure*	☐ very high cost ☐ high cost ☐ moderate cost ☐ low cost ☒ very low cost
Timeframe *describe suitable period or point in time to implement the measure*	Implementation time of ca. 4 weeks, excluding planning, ideally installed within a decade

Barriers & limits and prerequisites, maladaptation & dependencies

Barriers & limits (Advanced Plus Level)		
Restrictions *Identify restrictions which might prevent the measure's design and implementation*	***Mitigation activities*** *Identify activities to overcome the restriction*	***Barrier or limit?***
Environmental concerns due to the place (element) lying in a wildlife conservation area	Liaise early with relevant officials at Department of Culture, Heritage and the Gaeltacht and Kerry County Council	☒ barrier ☐ limit
Environmental impacts on coastline near the historic place is not well understood (namely, the measure could cause increased erosion on adjacent stretches of coastline)	Investigate submarine tidal system in Ballinskelligs Bay and associated coastal erosion (in collaboration with Department of Communications, Climate Action & Environment and Office of Public Works)	☒ barrier ☐ limit

Prerequisites, maladaptation & dependencies (Advanced Plus Level)	
Prerequisites *Identify any activities or conditions required to design and implement measure*	• Liaison with neighbouring landowners required to gain access to the seawards side of the sea wall for the implementation of the measure • Liaison with members of the general public would be advisable, especially due to the large scale of the measure
Maladaptation *Identify how, in future, the measure might hinder the implementation of other measures*	• Measure could cause increased costal erosion of nearby stretches of coastline which might also, in the end, affect the historic place itself • Implementation of this measure could hinder measure Repairing sea wall (#1/S1)
Dependencies *List any measure(s) which could be beneficially combined with the measure investigated*	#1/I1 Investigate tidal behaviour #1/I3 Coastline damage monitoring #1/I4 Investigate implications of wave breakers on wider Ballinskelligs Bay coastline

Adaptation pathways

Assessment of pathways (Advanced Plus Level)

Pathways roadmap

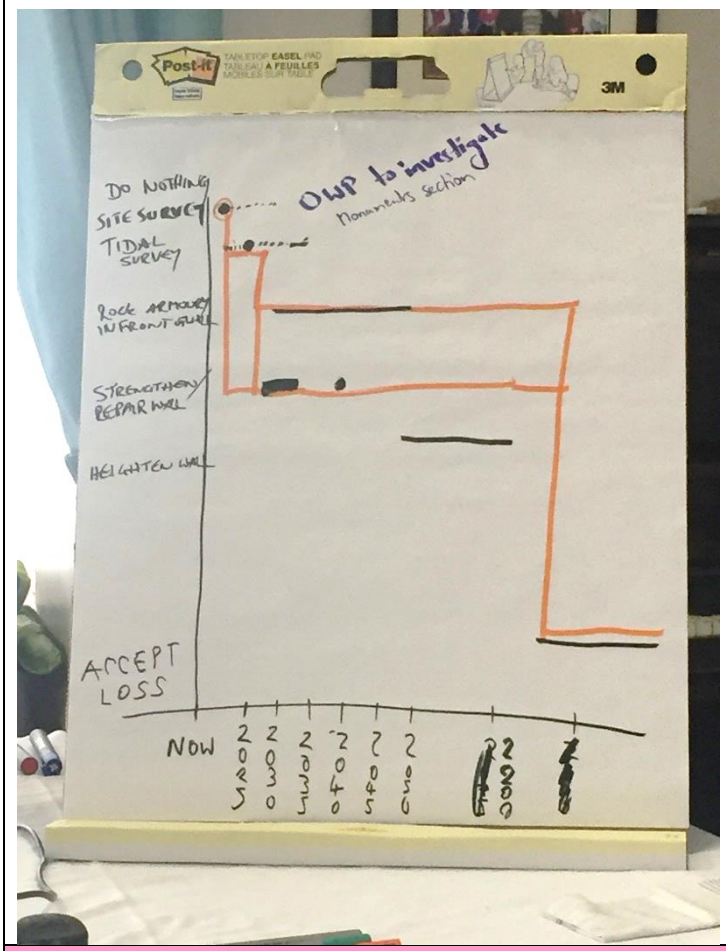

Figure 2

For the risk management assessment of Ballinskelligs Abbey in 2019, the workshop attendees developed two principal adaptation pathway options.

Image © Historic Environment Scotland

Describe each of the created pathways

Loss of the place might eventually need to be considered but for the foreseeable future protection of the place should be technically possible and socioeconomically feasible.

Two principal pathways were established:

3. To protect the seawall and therefore the place by placing rock armoury on the wall's seaward side to reduce the impact (magnitude) of wave action on the wall's surfaces, wave overtopping and boulder throw
4. Repair the concrete sea wall to increase its structural ability to better withstand the above-noted impacts

Performing a tidal survey was also noted as option to develop other pathway options.

Name the preferred pathway, stating the reasons for this preference
No preferred option was yet selected but the Office of Public Works agreed to investigate options further to better understand their feasibility and viability.
State the actions, resources and responsibilities needed to commence the implementation of the preferred pathway
Office of Public Works to allocated responsibility and budget for further investigations
Define timescale for the next review of the adaptation pathways, including reason
Office of Public Works to review results of the additional investigations within the next 3 years, considering the usefulness for further stakeholder engagement