ADAPT
NORTHERN HERITAGE
TOOLKIT

Assessing risks and planning adaptation

Guidance on managing the impacts of climate change on northern historic places

Northern Periphery and Arctic Programme
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Cover image

The historic mining settlement of Hiorthhamn lies on the northern site of the Adventfjorden, opposite of Longyearbyen, the administrative centre of Svalbard. Many historic places on this large archipelago in the Arctic Sea are threatened by extreme climate change. Taken in 2011, the photograph depicts a locomotive on the beach, which has mostly sunk into the beach to date, due to reductions in permafrost and sea ice cover. The building in the background is a terminal to load coal from an aerial cable way system into barges. Constructed from timber, dramatically rising temperature are accelerating the decay of these wooden structures.

1 INTRODUCTION

Climate change, risk management and cultural heritage

Climate change and cultural heritage

In the northern regions of our world, the climate is generally getting warmer and wetter, and extreme weather events are often more forceful and frequent. These changes can cause accelerated deterioration of materials exposed to the weather and more frequent and/or severe damage caused by natural hazards. Of course, this effects our historic places.

Conservation of historic places aims at reducing or preventing damage to and deterioration of those parts of a place that are considered important culturally. Our changing climate makes this task ever more challenging. To help those managing historic places, the planning of conservation actions needs to incorporate the consequences of climate change more consciously and systematically.

This guidance, developed by the project Adapt Northern Heritage[1], is a tool to support conservation planning, by integrating a process of risk management, so that decisions can be made in a more informed, objective and strategic manner. The tool is part of a set, produced by the project with the aim of supporting northern communities to understand better the impacts of climate change on their historic places and plan for their adaptation. Information about the project is available in the publication *The Adapt Northern Heritage Project*.

Cultural heritage, the historic environment and historic places

In this publication, we use the term historic places to refer to locations in the outdoor environment which today's society considers important and which are also likely to be considered important by future generations. They are a form of our cultural heritage and part of the historic environment.

We are using the term historic places to be inclusive. A historic place can be an ancient monument, a historic bridge, an old building ensemble, a designed garden, a cultural landscape, a spiritual place. Some historic places are designated statutorily as cultural heritage, for example by *inscription*, *listing*, *scheduling*. Others are not.

This guide is specifically developed for use with historic places. Which place is a historic place, is the choice of the user of the guide. The process described in the guide can be applied to any form of place, regardless of age, material or spatial manifestation or formal designations.

[1] Information about the project is available online at: http://adaptnorthernheritage.interreg-npa.eu/

Environmental hazards and historic places

Climate change affects historic places in many ways, directly and indirectly. To mitigate climate change, the energy performance of many historic buildings must be improved and renewable energy generation systems will need to be sited in some historic landscapes. The changing climate (and other human interventions) is also changing how places are being used and by whom. Increased development and touristic pressures have effects on historic places.

Although all of these are important considerations, which must be accounted for in conservation planning, the focus of this guide is on the environmental impacts of climate change on terrestrial historic places. This is simply a limitation chosen to make the three-year Adapt Northern Heritage project and its outputs manageable. This guide is concerned with adaptation to climate change and not climate change mitigation. The guide focusses on places on land (and coast) and not on submarine cultural heritage.

We consider neither indoor environments nor intangible heritage in this guide, except for its relationship to a historic place. The cultural practices of reindeer herding, for example, are an integral part of the cultural heritage of Sámi communities. Although this guide is not meant for assessing climate change impacts on reindeer herding, where it effects the communities' use of historic places, the guide is of course useful, as we illustrate with the project's case study site Bartjan, a Sámi summer camp in mid-Sweden (Figure 1). Details of the case study sites are published in the Adapt Northern Heritage toolkit as *Project Case Study* series. We will also introduce one of them shortly as our guide's illustrative example.

Figure 1 Stakeholders met as part of the project at its Swedish case study site, Bartjan. This place is used by the local Sámi community when its reindeer are grazing in this area in summertime. The place is particularly important to the community as they are marking their calves here. Due to climate change, the animals' migratory patterns are changing, and the place could lose its meaning, significance and use, and the camp's traditional tipis, made from turf and wood (seen on the left of the photo), fall into disuse and deteriorate quickly.

– Image © Riksantikvaren | photographer: Marte Boro

Hazard and risk

When using the guide's assessment process, we will investigate the effects of environmental hazards on historic places. A hazard is the potential to cause harm, which, in the context of this guide, means damage to or deterioration of a historic place, which, in turn, will adversely affect its cultural significance. Deterioration is a slow, gradual, progressive process, which affects all historic places in some form, such as the weathering of material surfaces. By damage, we mean a rapid, sudden impact, for example cause by a natural hazard, such as flooding or a wildfire. We will explore both, damage and deterioration, within this guide.

In common language, the terms hazard and risk are often used interchangeably. They are not the same though. While hazard is the potential to cause damage or deterioration, risk is the likelihood of this damage or deterioration to occur *in defined circumstances*.[2]

What is risk management?

Risk, in other words, can be described as the chance of something happening that will have adverse consequences on our historic places. Thus, risk refers to the future and to something that may happen. For historic places, this means that we are trying to understand how damage and deterioration might affect the places in future, so that we can better care for them.

Risk management is everything we do to understand and deal with the adverse impacts. This includes the identification, analysis and prioritisation of risk. We can think of these activities as risk assessment. Then, we can act to avoid, eliminate or reduce the risks we consider unacceptable. This is referred to as adaptation. Finally, we can monitor and evaluate the results of our adaptation measures to establish whether they have reduced the risks as planned.

Although we could think of risk management as a linear process, a circular approach is more commonly used, with the aim to continuously reduce the risks. This also allows the effective use of risk management in an environment changing over time. But why should we bother using risk management when conserving historic places?

Managing the risks to cultural heritage

Heritage managers often must make choices about how to use the available resources to conserve a historic place. This can mean, for example, choosing between improving building maintenance, constructing flood protection, increasing the size of rainwater goods, monitoring masonry deterioration, and developing wildfire fighting responses. How to prioritise the resources available to achieve the best conservation of a historic place?

Risk management can help us answer this question, by enabling us to consider risks relative to each other in order to establish priorities and plan our resources better. This also applies of course to the risks influenced by climate change, which is the subject matter of this guide. (If you are interested in assessing risks to cultural heritage more generally, we recommend the

[2] For an introduction to hazard and risk, we recommend the short video *Hazard, Risk & Safety: Understanding Risk Assessment, Management and Perception*, published by GreenFacts.org on YouTube online at: https://youtu.be/PZmNZi8bon8 (accessed on 01 May 2020).

free online publication *A Guide to Risk Management of Cultural Heritage*, which has been an inspiration for the Adapt Northern Heritage guide.)[3]

How to use this guide?

Overview of the risk management process

The risk management process, described in this guide, has been designed for the use with historic places and is based on a circular approach. The process consists of the eight steps, which are grouped into the four overarching areas: risk management preparation / review, risk assessment, adaptation planning and adaptation action (Table 1). The circular approach of the risk management process is illustrated in Figure 2.

Risk management preparation / review (part 1)	
1. **Define historic place(s)** for assessment, including cultural significance	*Chapter 2*
Risk assessment	
2. **Establish hazards and impacts** and relationship to climate change	*Chapter 3*
3. **Analyse and rate risks** and consider effect on cultural significance	*Chapter 4*
Adaptation planning	
4. **Identify adaptation measures**, including evaluation and appraisal	*Chapter 5*
5. **Develop adaptation strategy**, including collation of Climate Risk Management Plan	*Chapter 6*
Adaptation action	
6. **Design adaptation measures**	*not covered in this guide*
7. **Implemented adaptation measures**	*not covered in this guide*
Risk management preparation / review (part 2)	
8. **Evaluate adaptation progress**	*not covered in this guide*

Table 1 Overview of the eight steps of the Adapt Northern Heritage risk management process, grouped into four overarching areas. Steps 1 to 5 are covered in this guide, in the chapters stated; steps 6 to 8 are not covered. (Figure 2 illustrates the process's circular approach.)

[3] Canadian Conservation Institute & International Centre for the Study of the Preservation and Restoration of Cultural Property, 2016. *A guide to risk management of cultural heritage*. Available online: https://www.iccrom.org/wp-content/uploads/Guide-to-Risk-Managment_English.pdf (accessed 01 May 2020).

Figure 2 The risk management process described in this guide uses a circular approach, of which only the right half depicted in the figure is described in this guide (see also Table 1).

This guide provides a practical process, a procedure, to work through the first five steps of this risk management process, from preparing the risk management to adaptation planning. The guide covers neither the design and implementation of adaptation measures nor the evaluation of adaptation progress.

We will start our assessment by preparing the risk management. For this, we will select and describe a historic place to be investigated (or a group of places and place categories). We will also describe what makes it culturally significant.

For the risk assessment, we will establish the hazards which might affect the place in future (or are already affecting the place) and explore the impacts of the hazards on the historic place and how climate change has and will in future influence them. This step will form the basis for our risk analysis, in which we will evaluate, descriptively and with numbers, the potential impact on our place. We will thereby be able to compare and rank risks, identifying those we consider unacceptable. We will also consider the cultural significance of the place.

Finally, we will delve into the adaptation planning, by, firstly, identifying and evaluating adaptation measures, which we will group into six types. We will then appraise some of the measures and develop them into a strategy. And, secondly, we will summarise the risk management process, by collating the information produced into a Climate Risk Management, a report which can be used to inform the conservation planning of the historic place.

Aims of this guide

This guide will lead through a practical process to assess climate-related risks to historic places and to plan their adaptation in order to reduce these risks. The steps of this process are explained chapter by chapter, each offering tables to record the data gathered and the results produced. (Collated versions of the tables are provided in the Adapt Northern Heritage toolkit as the *Workbook for Risk Assessment and Adaptation Planning*). The result of the process is the creation of a *Climate Risk Management Plan* which can inform making decisions about a place's management, considering longer term planning horizons.

Through the risk management process, we will explore how climate change influences the environmental hazards which affect a historic place, to (crudely) quantify and prioritise the associated risks and identify and evaluate adaptation measures to reduce these risks. Thereby, the process will also offer a systematic and transparent assessment approach, engagement opportunities to involve stakeholders and a way to constructively communicate with them about how our changing climate will affect a historic place and how they can help to protect it.

Users of the guide

The guide is for anyone involved in managing historic places, including owners, care-takers, developers, conservation consultants and competent public authorities in the field of cultural heritage at local, regional and national levels. Using the guide will take some time and require some knowledge about climate change and conservation of cultural heritage.

The principal users of the guide, as the assessors of a historic place, will need to engage with relevant stakeholders during the assessment process. Interdisciplinary working and sharing of knowledge will also be beneficial. No one knows everything. And this guide provides support for organising such engagement, for example in the form of stakeholder workshops.

Working levels: Standard, Advanced and Advanced Plus

Users of this guide will have different goals, responsibility and available resources. Using the guide can therefore be scaled regarding the time invested, amount of information assessed, and number of stakeholders involved. To help users with this, the guide offers three working levels, which built on each other: Standard, Advanced and Advanced Plus. (Figure 3)

Standard Level

This level is useful for both initial and/or simple assessments and can be understood as a screening exercise, providing a general overview of the hazards, risks and adaptation measures relevant for a place. Using this level to start an assessment is recommended, especially for users not familiar with this guide. Therefore, the main body of the guide describes working with the Standard Level. The other two levels, Advanced and Advanced Plus, are additional and are clearly marked as such in the text and highlighted with a blue (Advanced) and purple (Advanced Plus) page background.

Even for more experienced users, the Standard Level can be a good starting point, as not all historic places need the more resource-consuming Advanced or Advanced Plus assessments. These use the Standard Level as their basis and, if considered useful for a historic place, its completed Standard Level assessments can easily be developed further to the Advanced or Advanced Plus Levels.

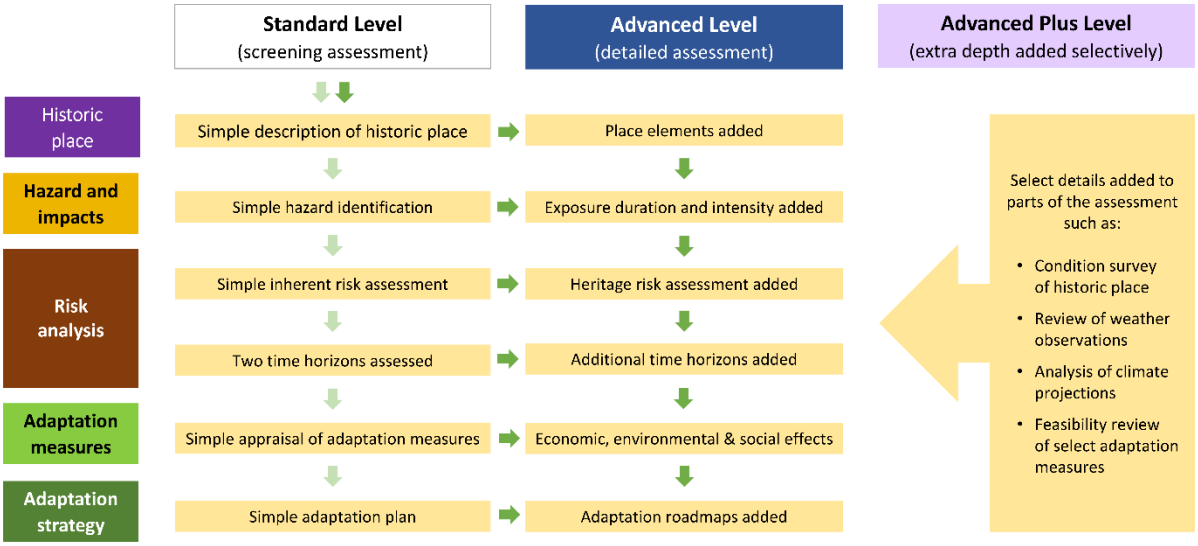


Figure 3 Overview of the three working levels, Standard, Advanced and Advanced Plus, and the associated activities in the different steps of the risk management process.

Advanced Level

The Advanced Level is clearly marked as such in the text and highlighted with a page background in blue.

The Advanced Level adds considerable detail, making assessments more complex but also allowing us to investigate larger place in more depth. Advanced Level assessments are a continuous workflow through the assessment process. The Advanced Level sections are not electives but built up on each other and must be completed one after another.

At the Advanced Level, for example, we can split places for assessment purposes into place elements, for which separate hazards, risks and adaptation measures can be investigated. Such detail is not suitable for users new to this risk management process and might be too onerous for historic places of low complexity.

Although we can start an assessment directly from the Advanced Level, generally assessing a place at Standard Level first is beneficial. If required, this Standard Level assessment can subsequently be developed into an Advanced Level assessment.

Advanced Plus Level

The Advanced Plus Level is also clearly marked in the text and highlighted with a page background in purple.

At Advanced Plus, we have the option to explore specific topics in more detail, when and where we think that they would add benefits to our assessment. The sections of this level are optional. We can use some Advanced Plus section and skip others. This level allows us to explore, for example, climate change data in more detail or describe better the historic place under investigation.

Example Ballinskelligs Abbey

To help the user understand the steps of the risk management process, the example assessment of Ballinskelligs Abbey has been inserted into this guide, clearly marked in the text and highlighted with page backgrounds in yellow. This historic place in County Kerry, Ireland, has been one of the case studies of the Adapt Northern Heritage project. For these case studies, Risk Management Plans have been produced, based on this guide and published as *Climate Risk Management Plan*.

The ruins of the priory of Ballinskelligs Abbey stand on the Atlantic coast of Ireland's Iveragh peninsular, in County Kerry. Sited within a historic graveyard and protected from coastal erosion by a massive sea wall, the monument is today in state care. Here, the Project Partner Historic Environment Scotland worked with the Office of Public Works, which looks after the monastic ruin, the project's Associated Partner Kerry County Council, which maintains the graveyard, and the local population to assess this beautiful and remote place, using the guide's Advanced Level.

Figure 4
Ballinskelligs Abbey lies, protected by a concrete sea wall, on the coast of Ballinskelligs Bay, which opens westwards to the Atlantic Ocean. In the background, along the beach, is Ballinskelligs Castle, which was also a case study in the Adapt Northern Heritage project.
– Image © The Discovery Programme | Interreg Ireland-Wales project CHERISH

Before starting an assessment

Goals, resources and time scales

Before commencing the risk management process, we should consider our goals, resources and time scales. A sole expert might be a suitable assessor for a single historic place of low complexity. More often though we will require a small team, engaged throughout the process, and a broader group of advisors and/or stakeholders, who are brought in at key points to provide specific expertise. This project team should be scaled to suit the complexity of the project, as well as the need for expertise. We should also ensure that we have the support from the managers and key stakeholders of the historic place. They must be engaged in and supportive of the assessment process.

We should also clarify the reasons for using this risk management process. These will vary for different organisations. Defining our intentions and the goals will be helpful, also with regard to planning our resources. The goals might vary depending on the historic place considered, our relationship to the place, its current physical state and the damages and deterioration observed there in the recent past, our available financial, human and technical resources and how the results are to be used after completion of the assessment.

To give examples: The owners of a historic place might simply want to plan their future maintenance and repair, taking into account climate change. An organisation caring for a portfolio of historic places might want to compare how climate change might affect its places so that informed decisions can be made on how to distribute the organisation's resources. And a municipality might want to establish a funding scheme for privately owned historic places to support their climate-related adaptation.

We might also want to consider the time scales to which we want to work. When do we want to have the adaptation plan completed? When do we have to involve stakeholders, for example by holding a workshop? How long will it take to obtain specialist advice?

Having clear goals, knowing the available resources and having a realistic time-table will help us when using the guide, as it gives us choices of different work levels and optional focus areas.

Stakeholder workshops

We should consider stakeholders as essential contributors to the risk management process. They will complement the assessors' experience and expertise, especially when engaging with interdisciplinary stakeholders. On one hand, we want to consider professional specialist advice, which could include the fields of climate change, geology, environmental monitoring, and conservation and heritage management practice. On the other hand, we require knowledge about the historic place, its immediate surrounds and wider environs and how these have changed in the past. Gathering place-specific knowledge by engaging with local people and with those who used to be local, such as former building users or site managers, can be immensely useful. Environmental knowledge and place-relevant cultural practices passed on over generations can bring significant insights, such as the *traditional knowledge* of indigenous communities. Reaching out to these different forms of stakeholders and bringing them together for collaborative working, albeit sometimes a challenging and daunting undertaking, can bring rewarding and astounding results, influencing how the risk management process develops.

We can of course also use written communication, interviews and commissioned reports were suitable, but holding a stakeholder workshop can bring immense benefits to the risk management process. A workshop is a method for gathering people with different knowledge to produce assessments and option appraisals collaboratively. The working should be scaled according to the scope and complexity of the project and the size of the attending stakeholder group.

We will see that the risk management process consists of several steps. The risk assessment and adaptation planning are those most likely benefitting from the input obtained at a stakeholder workshop. Gathering the information for both risk assessment and adaptation planning at a single workshop on a single day can be challenging. We might need to allow time for two workshops, building on each other.

Planning the workshop

A good workshop requires preparation and structure. Be clear about the aims and expected results of the workshop. Developing a time table for the workshop, which details the different steps and results you want to achieve by a certain time can be helpful. Be realistic about what can be achieved, allowing that the diverse and larger the attendee group, the more time is likely required. There are several methods for involving people and for varying how to work during a workshop. A visit to the site might be a good idea. It makes people better acquainted with the place and it is easier to understand the challenges.

Choosing the attendees

Establish who should ideally attend the workshop to achieve the best results. What qualifications do you need and have access to? Local knowledge will usually be essential. Do you need to obtain expertise on climate, damages, craftsmanship to contribute during the visit to the site and the assessment? Consider involving people that will be responsible for the following up afterwards. Are there any other stakeholders who should be involved?

Involving the same people at both workshops can be beneficial. The group will be familiar with the topic, what has been done and therefore make it easier to start up the next workshop avoiding having to repeat too much.

Holding the workshop

Start with a clarification of the purpose and framework of the workshop. What is the topic for the workshop? What should we work on, and what are the expected results? Make sure that the group has the needed common knowledge and understanding. Do you need to send out information beforehand and/or start up with a short presentation? Or should you start with a visit to the place?

When finishing the workshop, summarise what has been accomplished and discuss if and what further documentation is required for the next step. There should also be an expectation of what will happen next.

Obtaining background information

Finally, a few words about finding and sourcing background information for the assessment. This will be a task for the assessor, ideally prior to the first workshop. Asking stakeholders for background information is also a good opportunity to engage with them, but the requested information should relate specifically to their field of expertise. Information required for the assessment includes material on the historic place and any conservation policies and statutory heritage designations, about observed weather data and climate projection (as specific to the historic place as possible) and information about natural hazards (for example in the form of online hazard maps). We need to generally accept that we might not – and most likely will not – be able to gather all the desired information. Especially with regard to climate data, we will experience a lack of relevant data, either because they are not available at the required resolution, or because the specific data to describe a hazard is simply not available. However, this must not stop us from applying the risk management process to our historic place!

Useful information sources

To help find relevant information, please refer to the Adapt Northern Heritage tool *Information Sources for Climate Risk Management of Northern Historic Places*, which lists international and national information sources, most of which are freely accessible online.

Climate change projections to be used

This above-mentioned publication also provides information about the specific climate change projections recommended for use in a particular country. In the end, however, the assessor must decide on what climate change assumption the assessment is to be based.

Climate impacts tables

To help us explore the impacts of hazards and associated climate drivers, we will also use the publication *A Guide to Climate Change Impacts*[4], published by Historic Environment Scotland. Although this publication is focussed on Scotland, its contents can be easily adapted to other locations countries.

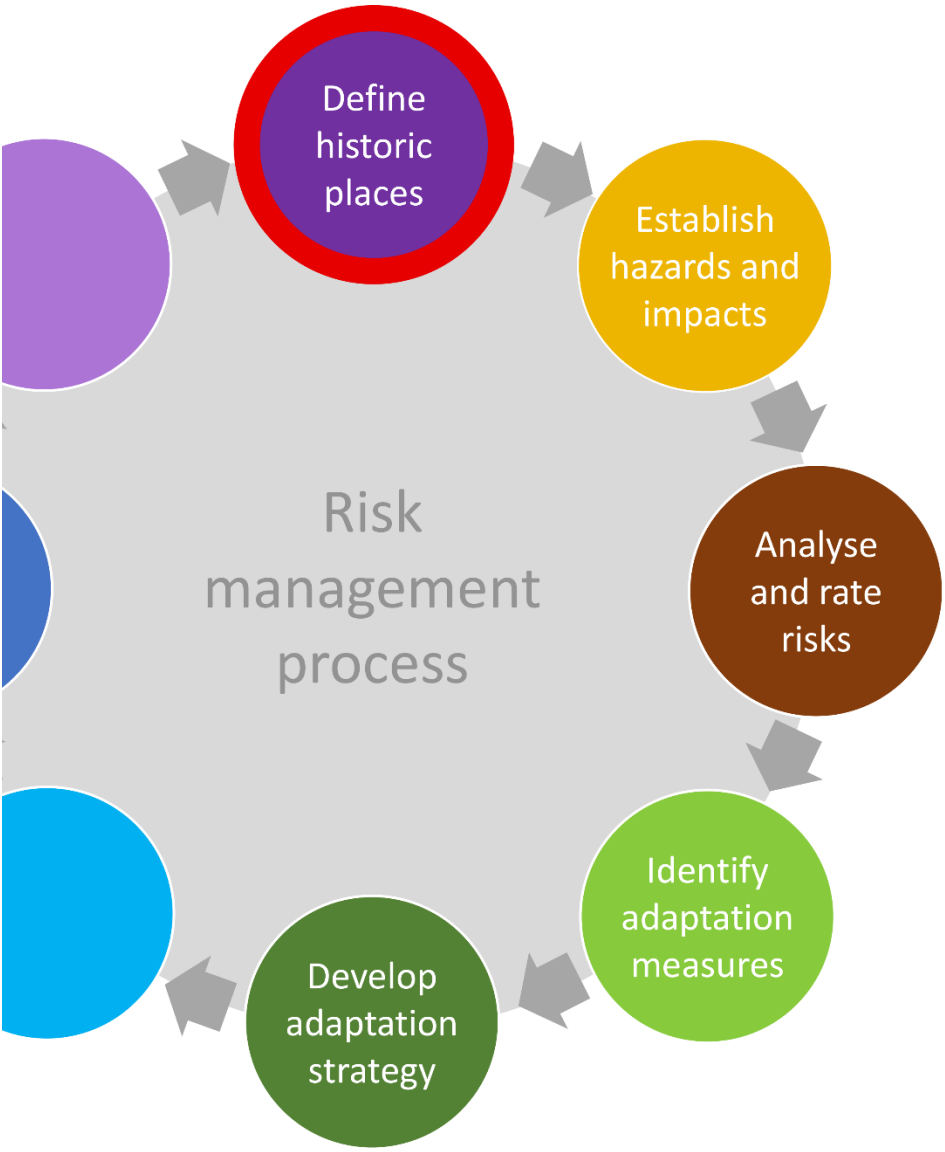
Other Adapt Northern Heritage tools

This guide for risk management and adaptation planning is a tool in the Adapt Northern Heritage toolkit. We have already mentioned a few of the other tools, which are listed in Table 2. Using them in conjunction with each other will be immensely helpful.

Tools in the Adapt Northern Heritage toolkit
Adaptation stories: *Examples of risk assessments, adaptation planning and conservation management of northern historic places*
Assessing risks and planning adaptation*: Guidance on managing the impacts of climate change on northern historic places*
Conservation factsheets *for managing northern historic places affected by climate change*
Information sources *for climate risk management of northern historic places*
Climate Risk Management Plans *for several project case study sites*

Table 2 The Adapt Northern Heritage toolkit consists of several tools, which can be used in conjunction with each other.

[4] Harkin, D., et al., 2019. *A guide to climate change impacts on Scotland's historic environment*. Available at: https://pub-prod-sdk.azurewebsites.net/api/file/40e3b1f5-05c9-417a-a5e3-aae0008d342d (Accessed 26 May 2020).


Define historic places
Establish hazards and impacts
Analyse and rate risks
Identify adaptation measures
Develop adaptation strategy
Risk management process

2 DEFINE HISTORIC PLACES

In this chapter of the risk management process, we will select and describe the historic places, for which we would like to assess climate-related risks and plan associated adaptation measures. This will help us to gain a good understanding of the places so that our risk assessment and adaptation planning starts from an informed basis.

By the end of this chapter, we will have created a *Historic Place Register* summarising the basic information of the place or places, to which we will use this risk management process.

If using the Advanced Level, we will introduce place elements to look in more detail at our historic place, including its cultural significance. At this stage, no additional steps are required for an Advanced Plus assessment.

Selecting historic places for investigation

To decide on the place or places we would like to investigate, we have three options: We can either choose a single historic place, select a group of historic places or use one or more place categories. (Figure 5)

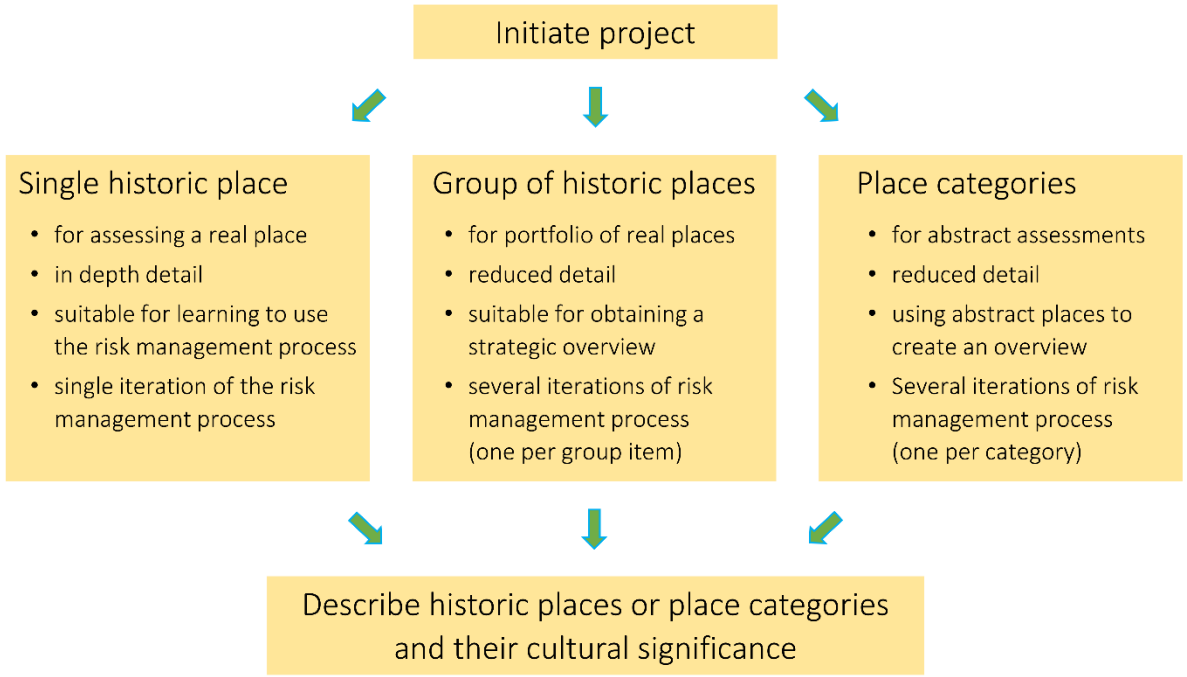


Figure 5 The risk assessment process can be used for a singular historic place, for a group of historic places, or for place categories.

If you are using the risk management process for the first time, choosing a single historic place is a good way to learn about the process. Working with groups of historic places and place categories is useful for organisations, such as municipal administrations and National Trusts,

responsible respectively for developing and implementing conservation policies or for managing portfolios of historic places.

Selecting a single historic place

If we select a single historic place, our first step is to note the name and address of the place and briefly describe its extent. For this, we can use Table 3.

☐ Singular historic place

Geographic information (of a singular historic place)		
Name of place	Place's address	Place's extent

Table 3 In this table, we can define a single historic place, by stating its name, address and extend.

Selecting a group of historic places

To assess a group of historic places, we can simply use an extended version of the above table which allows us to enter the details of several places. We can then use the risk management process in an iterative way: For each place we list in the table, we are going to assess the climate-related risks and plan associated adaptation measures. And we are going to do this one place at a time.

Which places we include in the group is our choice. Such a group could, for example, comprise all places managed by a specific organisation, or it could be all places statutorily designated as cultural heritage in a specific region. To create suitably accepted groups, liaising with relevant stakeholders can be beneficial.

Once we have chosen the historic places we would like to include in the (subset of) the group, we can enter their details in Table 4.

☐ Group of historic places

Geographic information (of a group of historic places)			
ID	Name of place	Place's address	Place's extent
1			
2			

Table 4 In this table, we can define a group of several historic places, by stating their names, addresses and extends.

Selecting place categories

If a group consists of many historic places and assessing all of them would be impractical, we can categorise the group's places and work with the thus created place categories. Criteria for the categorisation could be:

- place typologies (e.g. church, house, monument)
- cultural heritage designation (e.g. listed building, scheduled monument)
- construction forms (e.g. timber logs, stone masonry, earth wall)
- geographic locations (e.g. at a river, on a mountain slope, in an urban settlement)

Once we have chosen how to categorise, we can enter names and brief descriptions of the place categories, using Table 5. We can think of each category either as an abstract imaginary or real representative place.

☐ Place categories

Geographic information (of place categories of historic places)

ID	Name of category	Description of category
1		
2		

Table 5 In this table, we can define place categories of historic places, by naming and describing the categories.

Akin to working with groups of historic places, we can choose to either investigate only one of the listed place categories or assess several, by working iteratively through the risk management process, one category at a time. To keep the risk management process simple, we are referring hereafter only to historic place(s). If you are assessing a place category, henceforth read *place category* whenever *historic place* is mentioned.

Describe historic places and their cultural significance

Having decided on what to investigate, we can add a brief description of the place(s), its immediate and wider surroundings and any heritage designations, including cultural significance. With immediate surroundings, we mean the area directly around the historic place. The wider environs is the larger area in which the place is located. For example, if our historic place is a manor house, its immediate surrounds might be the garden it is sited in, and its wider environs could be its estate. This information often already exists, and we should use it where available. Suitable information sources are legal documents and conservation policies. Information can also be obtained by inspecting the place concerned and engaging with relevant stakeholders. We will now add some basic descriptions about the historic place and its immediate and wider surroundings, using Table 6.

Geographic information of historic place to be analysed	
Name of place to be analysed	
Description of historic place and its wider surroundings	
Brief description of historic place	
Brief description of place's immediate surroundings	
Brief description of places' wider environs	

Table 6 In this table, we can describe the historic place, its immediate surrounding and its wider environs. (Grey shaded table cells contain information from a previous table.)

Advanced Level: Define place elements

If you are not working at Advanced Level, please skip this section and proceed to the chapter Cultural significance. *(Guidance on using the Advanced Level is provided in chapter INTRODUCTION)*

To capture more details of the place, we will divide it into elements. A building, for example, has floors, a foundation, roofs and walls. If this appears too detailed, we could think of a building and its surroundings as a place encompassing, by example, a main wing, two side wings, an outbuilding and a garden. A landscape might consist of a meadow, a pond, paths and a woodland.

We can divide any place into several place elements, which we are free to define. To start, it is useful to choose only a few place elements. Even choosing just two could be fine. If, at a later stage in the assessment process, we find that a finer division into place elements would be helpful, we can come back here and add and amend them. Once we have defined our place elements, we can describe their materiality. What are they made from and how? We can record this information in Table 7.

Place elements		
Identify place elements e.g. walls, roof, bridge, woodland, building	**Principal material / matter** e.g. conifers, rhododendron, organic matter, peat, stone, timber	**Description / comments** if required

Table 7 In this table, we can record the place elements chosen and of what they are principally made

Example Ballinskelligs Abbey: Defining the historic place

How historic places can be selected and described is illustrated with the example of Ballinskelligs Abbey. As Ballinskelligs Abbey can be easily understood as an entity, it was considered for purpose of the risk management process to be a singular historic place. How it could be described is shown in Table 8, Table 9 and Table 10.

☒ Singular historic place

Geographic information (of a 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

Table 8 This table helps selecting the historic place Ballinskelligs Abbey, by identifying it as a singular historic place and recording the place's name, address and extent.

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 surrounding	fields to east, beach towards historic Ballinskelligs Castle to north, sea and water to south and west.
Brief description of place's 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.

Table 9 This table shows how a description of Ballinskelligs Abbey could look like. (Grey table cells are a data transfer from Table 8.

Place elements (Advanced Level)		
Identify place elements e.g. walls, roof, bridge, woodland, building	**Principal material / matter** e.g. conifers, rhododendron, 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	

Table 10 This table shows how a description of Ballinskelligs Abbey could look like. (The identification of place elements is part of the Advanced Level of the risk management process.)

On this coastline lies also Ballinskelligs Castle, only about 500 metres from the Ballinskelligs Abbey and connected by a beach. Both abbey and castle could therefore have been considered as a group of historic places. However, as they are of different periods, in different ownerships and have somewhat different conservation challenges, assessing them as separate places was considered the better option. As the abbey and graveyard are in the care of Ireland's Office of Public Works and Kerry County Council respectively, both organisations had an interest in exploring the risk management process at Advanced Level.

Figure 5
Discussion at site visits at Ballinskelligs Abbey were used by locals and specialists to better understand the sites context, its place elements and their current physical condition.

Cultural significance

List cultural heritage designations

As this risk management process is specifically for use with historic places, we also want to capture what makes the place a *historic place*. What constitutes this cultural significance? What makes it important to the public?

We will capture this in two ways: On one hand, we will summarise its cultural significance, and, on the other hand, we will list applicable cultural heritage designations, which generally reflect the place's cultural significance.

Significance, generally, is the combination of all the aspects which make a place important to society – both today and in the future. These values can be of different intangible and tangible types, such as artistic, commemorative, economic, historical, scientific, social, spiritual, symbolic and technological. With cultural significance, we are capturing not only the place's importance today but are also considering its importance for future generations. Understanding the (cultural) significance of a historic place enables us to make effective decisions about its future.

Defining the cultural significance of a historic place can be challenging and controversial. Where possible, we can utilise existing descriptions for heritage designations, statements of significance, conservation policies etc. We will therefore first list authoritative conservation documents and cultural heritage designations, before summarising the place's cultural significance.

Cultural significance

Conservation policies

We should firstly establish if conservation policies, including conservation (management) plans and other relevant place management documents, exist for the historic places. Such documents are a management tool for developing and coordinating conservation measures and often contain information about the place's cultural significance and cultural heritage designations.

If conservation policies exist, we should acknowledge this by noting in Table 11 the document's author(s) and title, as well as the version number and publication date of the current version. The conservation policies will help us in the next sections.

Conservation policies				
ID	Document title	Author(s)	Version	Date

Table 3 In this table, we can record any existing conservation policies, such as conservation (management) plans.

Cultural heritage designations

By designating historic places as cultural heritage, they are formally recognised, either statutorily or not. Forms of designations and the underlying processes vary from country to country and can implemented at local, regional, national or international levels. Examples of such designations are *UNESCO World Heritage sites*, *listed buildings*, *scheduled monuments*, inventoried *designed landscapes and gardens* and declared *conservation areas*.

Most countries maintain their data on cultural heritage designations digitally. We can access it using online databases and geographical information systems. To find data sources for your geographic area, please refer to the Adapt Northern Heritage tool *List of Information Sources*.

Using these resources, we should identify the cultural heritage designations applicable to the historic places we investigate and list these designations in Table 12.

Cultural heritage designations			
Designations	Titles	References	Comments

Table 4 In this table, we can record any existing cultural heritage designations, such as UNESCO World Heritage sites, listed buildings, scheduled monuments, designed landscapes and gardens, and conservation areas.

Key cultural heritage values

Finally, we want to summarise the cultural significance of our historic places by describing and rating their key values. This can be a single value or a set of values. We should be able to extract these from existing conservation policies and designation descriptions. However, such information might not be available, or we might disagree with it. In those cases, we need to define the key value ourselves, consulting relevant guidance by authoritative sources (see Adapt Northern Heritage tool *List of Information Sources*) and liaising with relevant experts where required as well as using our own judgement.

In addition to describing the values, we also want to give them a rating. Cultural significance is often evaluated using categories such as *exceptional*, *outstanding*, *major*, *minor* and *neutral/negative*. Notwithstanding the national guidance available, we could think of the cultural significance using the rating scale detailed in Table 13.

We can record the identified key values and their rating in Table 14. (If we assign the terms *minor* and *neutral/negative* to a value, we should consider omitting the value from the table, since a value ranked such could not be considered a *key* value.)

Significance rating scale		
Rating	**Description**	**Examples**
0 Neutral / negative	no value	
1 Minor	some value in a local context, potentially recognised by local designation as cultural heritage	building noted as cultural heritage in municipal conservation area appraisals or urban zoning plans
2 Major	considerable value in a regional context, often recognised by regional/or local designation as cultural heritage	Listed Building through declaration by the regional competent authority
3 Outstanding	special value in national context, often recognised by national and/or regional designation as cultural heritage	Listed Building through declaration by the national or regional competent authority
4 Exceptional	extraordinary and unique value in an international context, generally recognised by national and/or international designation as cultural heritage	UNESCO World Heritage or as Listed Building assigned the highest listing category by the national competent authority

Table 5 This table lists the five scales, from 0 to 4, to later, in the risk assessment process at Advanced Level, rate the likelihood of an impact to occur and associated examples of damages and deterioration.

Rating of key cultural significance values		
Key values	**Ratings**	**Comments / reasons**

Table 6 In this table, we can record the key values of a historic place and rate them using the five-point scale detailed in Table 13.

Advanced Level: Cultural significance

If you are not using the Advanced Level, please skip this section and proceed to chapter 3, namely ESTABLISH HAZARDS AND IMPACTS*. Advanced Level users are to note that, in order to continue, the related Advanced Level section earlier in this chapter must have been completed.*

For using the risk management process at Advanced Level, we will add more detail to the cultural heritage designations and key values, both of which we have already identified in the preceding Standard Level step, and explored what these mean for the place elements, identified in the preceding Standard level step.

Cultural heritage designations

At Standard Level, we have identified the cultural heritage designations, applicable to the historic places. We will now describe briefly how these impacts directly or indirectly on the place's conservation management. Some designations confer some protection from prohibited alterations. Depending on the applicable laws, altering a *listed building* might be illegal, unless formal approval is obtained from the government's competent authorities for cultural heritage.

We can add our description to Table 15.

Implications of cultural heritage designations		
Designation	**Title**	**Conferred management implications**

Table 7 In this table, we can describe the implications on the management of the historic place due to its designation as cultural heritage. (Grey shaded table cells contain information from a previous table.)

Place elements

Having identified place elements earlier, we can also describe their contribution to the place's cultural significance, using the same rating system from *exceptional* to *neutral / negative*. Ideally, an existing Statement of Significance already identifies this degree of importance for the different elements. This identification of the character-defining elements will show which parts of the place are more important than others and should therefore be better protected. The identification will also inform which parts of the place we would preferably like to retain unaltered, which parts can be altered, and which parts could even be lost or replaced without adversely affecting the place's cultural significance.

Using the same assignment categories as for key values, we will rate the significance of the different place elements, entering our results in Table 16. (In the case that we would like to assign different significances to a single place element, we can simply split it into two or more elements.)

Cultural significance ratings of place elements		
Place elements	**Rating of cultural significance**	**Comments / reasons**

Table 8 In this table, we can add to the already identified key values a rating from 1 to 5 of its cultural significance. (Grey shaded table cells contain information from a previous table.)

Figure 6Workshop attendee exploring, how the the cultural significance rating of place elements is incorporated in the guide's risk assessment. The Stakeholder Workshop Workbook *was used during workshops held by the Adapt Northern Heritage project and is now part of its toolkit.*

Example Ballinskelligs Abbey: Identifying cultural significance

In Ireland, each monument is entered in the Record of Monuments and Places (RMP) as established under Section 12 of the National Monuments (Amendment) Act 1994 and, when a monument is taken into state care, its details are added to a National Monuments Register (NMR). The monument is located in a Special Area of Conservation (SAC), a designation for wildlife conservation.

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

Key cultural significance values		
Key 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

Table 9 This table details the cultural significance of Ballinskelligs Abbey in terms of existing conservation policies, cultural heritage designations and key cultural heritage values. For the latter, a five-point scale from 0 to 4 is used as detailed in Table 13.

Implications of cultural heritage designations (Advanced level)		
Designation	**Title**	**Conferred management implications**
Record of National Monuments and Places (RMP)	Ballinskelligs Abbey	Protected against interventions other than those carried out by the Office of Public Works
National Monument Register (NMR) / Monument in state care	Ballinskelligs Abbey	Managed by the Office of Public Works in accordance with the place's Conservation Plan
Special Area of Conservation (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

Table 10 This table provides further details to Table 17 by adding, firstly, a description of the implications the cultural heritage designations confer on the place management (top part of the table) and, secondly, a rating of the cultural significance of the place elements (bottom part of the table). For the latter, a five-point scale from 0 to 4 is used as detailed in Table 13.


Define historic places
Establish hazards and impacts
Analyse and rate risks
Identify adaptation measures
Develop adaptation strategy
Risk management process

3 ESTABLISH HAZARDS AND IMPACTS

In this chapter of the risk management process, we will identify the environmental hazards and their associated impacts which might affect our historic place in the future and examine how climate drivers are influencing these hazards. Optionally, we can review the damages and deterioration already observed at our historic place. We will develop causal chains from climate drivers via hazards to the impacts to understand how changes in this chain will affect our historic place.

By the end of this chapter, we will have created a *Hazard Register* for our historic place, which we will use in the next chapter to analyse and rate the risks associated with the impacts registered.

If using the Advanced level, we will expand the Hazard Register *by adding details about the development of the relevant hazards and their associated impacts and identify the affected place elements.*

At Advanced Plus level, we will explore in more detail topics of particular relevance to our historic place.

Climate and hazards: Where to start?

'We don't know enough about climate change to make decisions' is an often-heard excuse when discussing how climate change affects historic places. At the same time, most conservation practitioners know from experience that the environmental hazards effecting historic places have been changing over the past decades because of our changing climate.

A hazard to a historic place is any source of actual or potential damage or deterioration. Flooding is obviously a hazard, as flood water can quickly cause considerable damage. Rainwater might not be seen by many as a hazard. However, if entering for example the uncapped head of a free-standing stone wall, the water will penetrate the masonry and –slowly but surely– wash out its mortar, leading to structural instability and probable collapse of the wall. Hence, rainwater can be a hazard too.

Both damage from flood water and deterioration due to rainwater penetration depend on the quantities of precipitation. If rainfall and snowfall quantities increase, more flooding and rain water penetration will occur. In many places in northern Europe, climate change is leading to increases in precipitation, at least seasonally. The link here between climate change and the hazards of flooding and rainwater penetration are obvious. Often though, the links are far more complex.

As the climate influences environmental hazards, we could obviously start with exploring how the climatic is changing at our historic place. However, the expertise of conservation practitioners, the principal user group of this risk management process, lies in understanding how environmental hazards affect historic places, rather than in assessing climate change. Starting with a review of the damages and deterioration already observed at the place can therefore lead to more constructive investigations. Nonetheless, we will also of course need to explore the climatic changes.

This risk management process therefore gives us the options (Figure 7) to start either by reviewing the observed damages and deterioration, before examining climate drivers, (hazard-based approach) or by exploring the climate drivers and their influence on environmental hazards (climate-based approach). The recommendation for conservation practitioners is to use the intermediary step of a of review of damages and deterioration. Both approaches will eventually look at climate change and environmental hazards. The choice of approach is ours.

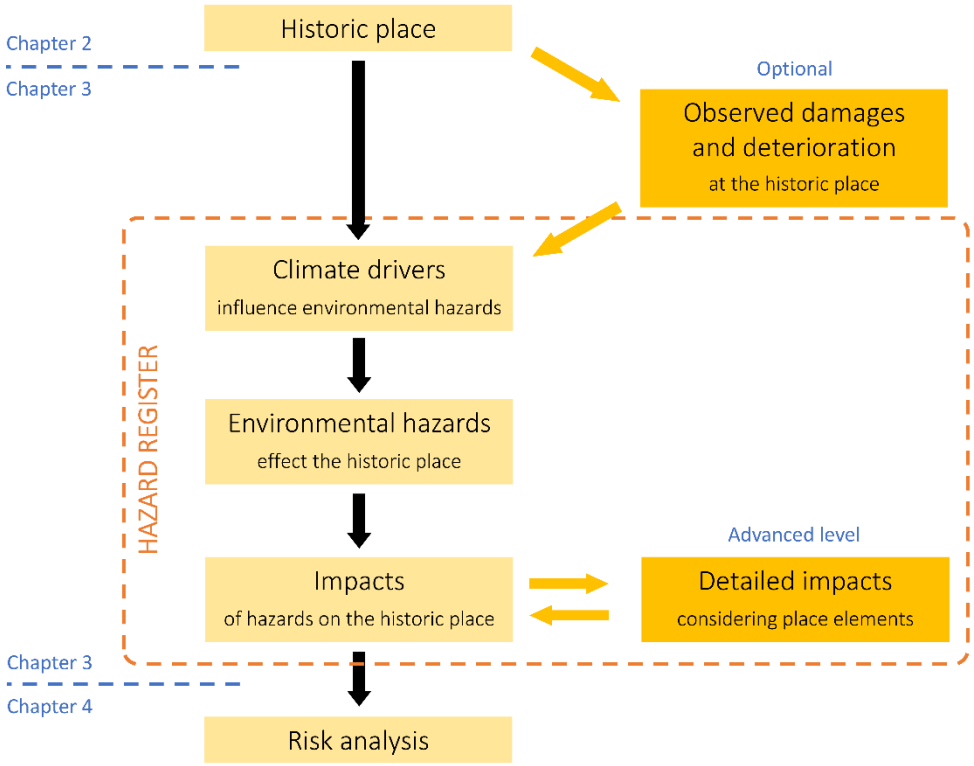


Figure 7 In chapter 3, we will explore climate drivers, environmental hazards and their associated impacts on historic places. Starting with a review of climate drivers is suitable for strategic assessments (climate-based approach). For conservation practitioners, reviewing first the damages and deterioration observed at a historic place can be beneficial (hazard-based approach). At the end of this chapter, we will have produced a Hazard Register.

If we choose to use the hazard-based approach, in the next section, we will review the damages and deterioration already observed at our historic place. If we want to use the climate-based approach, in order to first explore the climate drivers relevant at our historic place, we should go straight to the section *Climate-based approach (Climate drivers)*.

Hazard-based approach: Observed damages and deterioration

To identify the environmental hazards to our historic place, we will use our expertise and knowledge of the place to review the damages and deterioration that have occurred in the past. Where appropriate, we should also liaise with other relevant stakeholders to benefit from their professional expertise and/or knowledge of the place. Such stakeholders can include former managers, owners or users of the place, and their knowledge can be professional

and/or practical. Discussions about the place's past damages and deterioration and the resulting conservation challenges can be a good starting point to engage these stakeholders.

To start, we will review the damage events and deterioration processes which have affected the place in the more recent past. We are aiming to find a variety of both sudden damages and progressive deterioration, which might have affected the whole historic place or parts thereof or affect the place's immediate surroundings or wider environs. We consider the immediate surrounding and wider environs here, as hazards affecting them might also affect our historic place in the future.

In Table 19, we can record the observed damages and deterioration together with as much background information as we deem necessary to describe our observations. If we find that our table is mostly filled with impacts in the form of damages, we should try to find more deterioration processes, affecting the place; and vice versa.

Observed damages and deterioration			
Damage and deterioration observed at historic place	**Impact type**	**Environmental hazard** relevant to observation	**Climate drivers**
	☐ damage ☐ deterioration		
	☐ damage ☐ deterioration		

Table 19 In this table, we can record the damages and deterioration observed at the historic place in the more recent past. We also want to reference the environmental hazards, associated with an observation, and their key climate drivers, which are the geological, hydrological or meteorological variables predominantly influencing the hazards.

Within the table, we will then try to name the environmental hazards that have caused or are still causing the observed damages and deterioration. We might find that damages or deterioration can be caused by multiple hazards. For each hazard, we also want to add the associated climate drivers to the table. These drivers are the geological, hydrological or meteorological variables which predominantly influence a hazard. These variables can include air temperature, extreme weather, precipitation, sea level change, seismic or volcanic activity, soil moisture and wind speed. We can simply note in the table a single variable relevant to the hazard or a combination of several variables. As we have already noted earlier, flooding depends on the amounts of rain falling or snow melting. Wind erosion is influenced by wind speed. For frost weathering, we could note 'cycles of temperature changes around freezing point combined with intense and/or prolonged precipitation periods.

For each identified impact, we can check if its occurrence, in turn, might cause damage or deterioration not yet listed. For example, a building inundated with flood water for weeks on end is likely to suffer subsequent fabric deterioration, for example in the form of fungal decay of timber. We should also list such damages and deterioration to ensure that they are considered appropriately in the assessment process.

To help with the identification of hazards, the Adapt Northern Heritage tool *Conservation Factsheets* and the publication *A Guide to Climate Change Impacts* provide a systematic overview of environmental hazards relevant to northern historic places, and conservation insights of common forms of damage to and deterioration of historic places, respectively.

Example Ballinskelligs Abbey: Damages and deterioration

At Ballinskelligs, the assessors of the place (i.e. the users of the risk management process) organised two workshops in the summers of 2018 and 2019 to engage with the relevant stakeholders and make use of their expertise (Figure 8). The stakeholders included an unusually wide range of international, national and regional experts as well as representatives of the local population. The stakeholders included archaeologists, architects, flood management advisors, heritage managers and structural engineers. The assessors also reached out to the wider public, by organising a public evening of lectures and a photographic exhibition.

Figure 8 *At a stakeholders' workshop in Ballinskelligs, County Kerry, Ireland, local, national and international stakeholders met in 2019 to test the risk management process. Over two days, the stakeholders examined the impacts of climate change on Ballinskelligs Abbey and Ballinskelligs Castle. The resulting Risk Management Plans for these two places are included in the Adapt Northern Heritage tool* Climate Risk Management Plan.

For Ballinskelligs Abbey, the hazard-based approach was used to identify environmental hazards and the applicable climate drivers and the associated impacts relevant to this historic place. The workshop participants discussed the damages and deterioration observed at the place over the past years and decades, as recorded in Table 20.

Observed damages and deterioration			
Damage and deterioration observed at historic place	**Impact type**	**Environmental hazard** relevant to observation	**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

Table 20 *This table records the damages and deterioration observed at Ballinskelligs Abbey over the past years and decades. The entries illustrate how such information can be recorded for further use in the risk management process.*

Climate-based approach (Climate drivers)

Understanding how climate change influences environmental hazards helps us to investigate the impacts that these hazards will have on our historic place. With climate change, we refer to longer-term changes in geological, hydrological and meteorological patterns. To give examples: Loss of sea ice can cause coastal erosion through the wave action which the ice cover had previously averted. And more frequent events of extreme rainfall can result in more landslides.

In the following, we will develop an understanding of the climatic changes which affect our historic place. We can make use of the Adapt Northern Heritage tool *Information Sources* and the publication *A Guide to Climate Change Impacts*. The former includes international and national sources of information on weather observations, climate change projections and natural hazards. Where local observed data is available, for example from a weather station near a historic place, these should also be considered. The latter tables examples of how climate drivers can be linked to environmental hazards and how these, in turn, can be linked to potential impacts on our historic place.

From the list in *A Guide to Climate Change Impacts*, we can select those climate drivers which we consider relevant to our historic place and record them in Table 21. If we have worked through the previous section of this guide though, we should start by using the climate drivers we have recorded in Table 19 and add thereafter other climate drivers from *A Guide to Climate Change Impacts* which we consider applicable. And we can of course also add our own climate drivers, as required to investigate our historic place.

Climate drivers and environmental hazards					
Climate drivers	**Climate trends**		**Environmental hazards**		
Description of variables	*Observed trends*	*Projected trends*	*Description of hazards*	*Increase in relevance observed*	*projected*
				☐ increase ☐ decrease ☐ no change	☐ increase ☐ decrease ☐ no change
				☐ increase ☐ decrease ☐ no change	☐ increase ☐ decrease ☐ no change

Table 21 In this table, we can record climate drivers and describe the associated observed and projected climate trends. From this, we identify associated hazards and establish if we think that they have / will become more relevant for our historic place. (The grey table cells are data transfers from Table 19, if used. Delete and add table rows and sub-rows, as required.)

We can now review the climate drivers listed in the table by indicating in descriptive form how these drivers have changed in the more recent past (climate trends observed) and how we expect them to change in future (climate trends projected). For this, we can refer to national climate information, sources of which are listed in the Adapt Northern Heritage tool *Information Sources*. We can also note our decision basis, such as information sources used.

Thereafter, we will brainstorm what hazards we can associate with the listed (combination of) climate drivers and climate trends. In other word: How could the described climate change lead to less or more damage at our historic place? Could the climate change accelerate or decelerate the place's deterioration? For each climate driver, we should identify at least one hazard. Often, we will find several hazards per climate driver. (If we cannot identify a hazard, the climate driver is irrelevant to our historic place, and we can omit it from the table.) If we have already identified hazards in the previous section, filling in the table's last column should be a simple data transfer. However, we might also find additional hazards, which we did not consider previously and can add now to our risk management investigation.

Finally, keeping the observed and projected climate trends in mind, we will add to the listed hazards a statement about how the hazards have developed in the past and will develop into the future. Do we think that the hazard has become more relevant during the recent decades? Are we expecting the hazard to become more relevant in future, compared to today?

Identifying impacts

The table above links climate drivers to environmental hazards. We will expand on this by adding to each environmental hazard one or several impacts it has on the historic place. These impacts can be either damages or deterioration. An impact is the potential consequence of a hazard if it occurred. By describing an impact, we want to give specific details about a hazard's effect on a historic place (or its immediate surroundings or wider environs).

For example, a changing temperature might prolong the period in which wood-boring beetles are active. These insects cause timber decay, which would be a concern if our historic place was a timber log building, as the ones in Aurlandsdalen (Figure 9). The temperature change is our climate driver and the timber decay due to beetle attack is our hazard. As an associated impact we can define: 'timber decay causing damage to the building fabric so substantial that it will require repair'.

Figure 9
Discussion about the effect of temperature rise on attack by Hylotrupes bajulus, a wood-boring insect also known as European House Borer, on the timber log buildings of Otternes, a historic farmstead in the Aurland Municipality.

Image © Riksantikvaren | photographer: Marte Boro

Another example is, which we have already mentioned earlier, is that, if rainwater penetrates an uncapped free-standing stone wall, the mortar can be washed out from the masonry. In this case, the climate driver is the *increase in precipitation*, the hazard is *rainwater penetration of uncapped stone walls*, and the impact could be *structural instability and eventual collapse of masonry due mortar being washed out*.

We can record our investigation into hazards and their associated impacts in Table 22. The reason for having to consciously choose if the impact is either a damage or deterioration is to ensure that we explore both forms of impacts from hazards. We do not only want to capture the dramatic, sudden hazard events, but also the slow, progressive ones, the effects of which we will only see in the more distant future.

Impacts on historic place		
Environmental hazard	**Impacts on historic place**	
Description of hazard	*Description of observed or potential impacts*	*Impact type*
		☐ damage ☐ deterioration
		☐ damage ☐ deterioration
		☐ damage ☐ deterioration
		☐ damage ☐ deterioration

Table 22 In this table, we can record the impacts the environmental hazards might have on our historic place. (If we have worked through the previous section, we should be able to derive some impacts from the observed damages / deterioration in Table 19.) (The grey table cells are data transfers from Table 21. Delete and add table rows and sub-rows, as required.)

Hazard Register

With the previous two tables, we have now created a list of environmental hazards relevant to our historic place and how they impact on the place. This is our, which states the various impacts on the historic place, as a causal combination of climate driver, environmental hazard and its associated impacts. This *Hazard Register* will form the basis for our *Risk Register* in the next chapter.

Example Ballinskelligs Abbey: Hazard Register

Hazard Register							
Climate drivers	**Climate trends**		**Environmental hazards**			**Impact on historic place**	
Description of variables	*Observed trends*	*Projected trends*	*Description of observed or potential hazard*	*Increase in relevance observed*	*projected*	*Description of observed or potential impacts*	*Impact types*
Water currents			Wave action	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Impact damage to sea wall from wave action	☒ damage ☐ deterioration
						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
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
			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
Precipitation, temperature, 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 temperature increased • seasonal temperatures increased • number of frost days (temperature below 0C) decreased	• 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 • mean annual temperature projected to rise • winter night-time min temperature projected to increase	Frost weathering	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Spalling of abbey's masonry surfaces due to frost weathering	☐ damage ☒ deterioration
			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
			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

Table 23 This table is the Hazard Register *for our example case study Ballinskelligs Abbey. The tabled information will be evaluated in the risk assessment to prioritise the hazards and its impacts mostly likely to affect the historic place.*

Advanced Level: Expanding the Hazard Register

If you are not using the Advanced Level, please skip this section and proceed to chapter 4, ANALYSE AND RATE RISKS. Advanced Level users are to note that, in order to continue, the related Advanced Level sections of the chapter Historic Places *must have been completed.*

In the following, we will analyse and add to the hazards and associated impacts which we have listed in the *Hazard Register*. We will firstly review which parts of our historic place are affected and secondly try to extrapolate from the hazard trends how, in future, the relationship between hazards and impacts might change.

Affected place elements

Often, impacts do not affect every part of a historic place. They might today only affect the place's immediate surroundings and/or its wider environs. Yet all of this might change in the future. To better understand where impacts occur, we will add to the Hazard Register the place elements affected, using Table 24. For this we will use the place elements as previously defined. We can group them and, if we find that place elements are not suitably detailed for this purpose, we can subdivide them, as required.

Impacts on historic place with affected place elements		
Environmental hazards	Impacts on historic place	Place elements affected

Table 24 In this table, we can record the locations affected by the impacts of a hazard. (The grey table cells indicate data transfers from Table 22)

To give an example: Fluvial flooding might affect the basement and ground floor of a historic building of four storeys, as well as its immediate surroundings. We might therefore record the latter in one table cell and the basement and ground floor in another. (As the flooding doesn't affect the building upper floors, we do not have to note them.)

With this, we should have clarified for each row in the *Hazard Register* which locations are affected locations. We should be able to read each table row using the following patterns:

Hazard causes *Impacts* at *Place elements*

Let's look next at how we can use the climate trends to learn more about the future development of our impacts.

Projection details of hazards

The Hazard Register states whether we expect a hazard to have become more relevant in the past for managing our historic place, or will do so in future. We want to establish now how the relationship of hazard and impact is going to change, by exploring three parameters:

- **exposure duration** of impact on affected place elements
- **impact intensity** on affected place elements
- **impact likelihood** at affected place elements

In other words, if a hazard and its associated impacts occurred in the future: Would it last for longer or shorter? Would it be stronger or weaker? Would it occur less or more often?

The aim here is simply to get an idea of the trends to be expected. This can be based on the knowledge and experience of the assessors and/or stakeholders or on relevant climate project research. We want to make a simple, qualitative statement about the development trend of the hazard. We will assess the trends numerically in the Advanced Level section of the next chapter to be able to incorporate them into our risk analysis, when we will also discuss the involved terminology in more detail.

Impacts on historic place with affected locations					
Environmental hazards	**Impacts on historic place**	**Place elements affected**	**Exposure duration** of impact	**Impact intensity**	**Impact likelihood**
			☐ decreasing ☐ increasing ☐ no change Comments:	☐ decreasing ☐ increasing ☐ no change Comments:	☐ decreasing ☐ increasing ☐ no change Comments:
			☐ decreasing ☐ increasing ☐ no change Comments:	☐ decreasing ☐ increasing ☐ no change Comments:	☐ decreasing ☐ increasing ☐ no change Comments:

Table 25 In this table, we can record how we expect the impacts listed in the Hazard Register *to develop in terms of exposure duration and impact intensity and likelihood. (The grey table cells are data transfers from Table 24)*

Example Ballinskelligs Abbey: Extension of Hazard Register (including Advanced Level)

Hazard Register (Advanced Level)								
Environmental hazards			**Impact on historic place**					
Description of observed or potential hazards	*Increase in relevance* observed	*Increase in relevance* projected	*Description of observed or potential impact*	*Impact types*	*Place elements affected*	*Exposure duration to impact*	*Impact intensity*	*Impact likelihood*
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
Wave action	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ 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
Wave action	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ 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
Wave overtopping during storm	☒ increase ☐ decrease ☐ no change	☒ increase ☐ decrease ☐ no change	Impact damage due to wave force to grave slabs and grave stones, including 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
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
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

Table 11 This table is an extension of the Hazard Register *for our example case study Ballinskelligs. This extension is only used when working at the Advanced Level. The additional information records the affected place elements and how the impacts will develop in future in terms of exposure duration to impact, and impact intensity and likelihood. (Grey table cells contain data transfers from Table 25.)*

Advanced Plus Level: Advanced hazard assessment

If using the risk management process only at Standard or Advanced Levels, please skip this section and proceed to the chapter ANALYSE AND RATE RISKS.

At the Advanced Plus level, we will explore those specific topics concerning climate change, hazards and their impacts on our historic place in more detail, which we consider especially relevant to our historic place. We might only discover over the course of our assessment which topics these might be. Advanced Plus level assessments are normally performed by specialists. A whole range of topics might benefit from further investigation, including those listed below.

Climate related challenges

Will more detailed knowledge on climate related challenges be useful to assess the impacts of hazards? For example: If we know that precipitation is increasing, should we investigate this climate trend with regard to its distribution over the yearly seasons? Will temperature changes cause other hazards, such as rain on frozen ground, or flooding in periods when precipitation usually fell as snow?

Past climate trend

Will more information on past climate trend give us more needed knowledge? Can we, for example, establish the following?

- Quantify the change for three time horizons, say 1960, 1990 and today
- Assess how the length of exposure of the deterioration process / frequency of the hazard events changed over time
- Establish if additional expertise is needed to develop this knowledge

Future climate trends

Will more information on future climate trend give you more needed knowledge? Can we, for example, establish the following?

- Quantify the change for the three time horizons, say 2030, 2060 and 2100
- Assess how has the length of exposure of the deterioration process / frequency of the hazard events changed over time
- Establish if additional expertise is needed to develop this knowledge

Other topics

Other examples of inquiries can include detailed assessments of geological hazards, such as landslides (e.g. rock fall, soil creep, solifluction, stone avalanche), hydrological hazards, such as costal storms or tidal wave overtopping, and cryospheric hazards, such as snow avalanches and ice storms.


Define historic places
Establish hazards and impacts
Analyse and rate risks
Identify adaptation measures
Develop adaptation strategy
Risk management process

4 ANALYSE AND RATE RISKS

In this chapter, we will analyse the risks to our historic place, using the hazards and impacts identified in the previous chapter. We will consider the likelihood of impacts occurring and the severity they would have, in order to establish inherent risks. For this, we will assign numerical ratings, using a risk matrix to rank our results. We will calculate the risk for the current situation (today) and for at least one additional time horizon.

By the end of this chapter, we will have created a *Risk Register* and a *Summary of Risks*, which we will use to review if the occurrence of the impacts would cause us to revise the previously defined key cultural heritage values. We will also use the register and summary in the next chapter to identify and evaluate adaptation measures which can reduce the risks registered.

If using the Advanced Level, we will use a more complex process to rate the severity of an impact occurrence and factor into our risk analysis the place's cultural significance, by calculating heritage risks.

From hazards to risks

We have already noted that a hazard is the possibility of something causing harm, which, in the context of this guide, could be in the form of damage to or deterioration of a historic place. Risk is the likelihood of such harm to occur in defined circumstances. In the previous section, we have identified the environmental hazards which we expect to affect our historic place in future. In our *Hazard Register*, we have also described the impacts which could occur. Therefore, we have already established suitably *defined circumstances* for each impact to allow us to now analyse the associated risks.

The risk analysis is a process in which we assign ratings and calculate results, which allow ranking and prioritisation. We will use the severity of an impact and its likelihood to occur to calculate, using a matrix, the inherent risk of an impact. Finally, we can record all risk ratings in a *Risk Register* and review whether they would cause us to revise the key cultural heritage values, we had earlier defined when describing our place. (Figure 10)

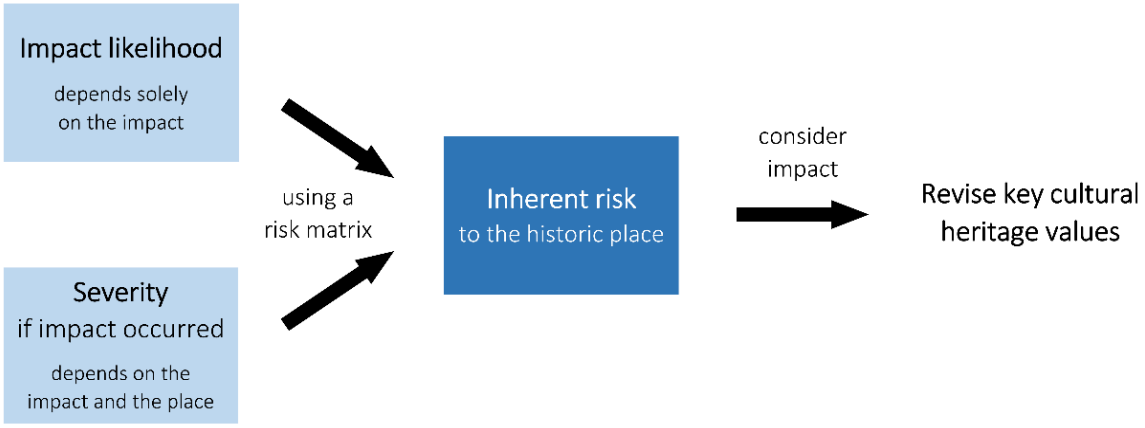


Figure 10 Using a risk matrix, we calculate the inherent risk as a result of the severity an impact on a historic place and the likelihood of the impact to occur. Afterwards, we will consider if the calculated risk rating would cause us to revise our key cultural heritage values.

Impact likelihood

We firstly want to understand the likelihood of an impact to occur. This is obviously linked to a hazard event happening, but might not be the same, as not every hazard event might cause the investigated impact. We will review the previously identified impacts and assign each of them a likelihood rating, using a five-point scale, as detailed in Table 27. The scale ranges from 0 to 4, with a value of 0 indicting that an impact is *essentially impossible to* occur, like damage caused by a flood with a return period of 1000 years. The value 4 stands for *very likely to occur*, which could be damage caused by a 5-year flood or deterioration caused by continuous weathering due to wind and rain abrasion.

Rating scores for impact likelihood		
Rating	**Description of impact likelihood**	**Examples of damage and deterioration**
0 Essentially impossible	Essentially impossible to occur annual chance of less than 0.2%	Damage caused by *1000-year* flood [not applicable to deterioration]
1 Very unlikely	Very unlikely to occur Annual chance of 0.2% or more	Damage caused by *200-* or *500-year* flood [not applicable to deterioration]
2 Unlikely	Unlikely to occur Annual chance of 1% or more	Damage caused by *50-* or *100-year* flood Deterioration caused by *occasional* weathering due to wind and rain
3 Likely	Likely to occur Annual chance of 5% or more	Damage caused by *10-* or *20-year* flood Deterioration caused by *frequent* weathering due to wind and rain
4 Very likely	Very likely to occur Annual chance of 20% or more	Damage caused by *2-* or *5-year* flood Deterioration caused by (near) *continuous* weathering due to wind and rain abrasion

Table 27 This table lists the five-point scale, from 0 to 4, to rate the likelihood of an impact to occur and associated examples of damages and deterioration.

We can record the likelihood ratings which we would like to assign to each impact in Table 28, noting also any comments or the reasons for our rating decision.

Likelihood		
Specific impact	**Likelihood rating**	**Reasons / comments**

Table 28 In this table, we can record the likelihood ratings for each impact and note any comments or reasons and comments concerning our rating decision. (The grey table cells are data transfers from Table 23. The scores of the likelihood rating are defined in Table 27.)

Severity

If using the Advanced Level, we can skip this section and continue instead with the section Advanced Level: Calculating severity.

In the context of this guide, we want to describe the severity of the devastation an impact, if it occurred, would have on the historic place. The impact description should help us understand the force and scale of the impact on the historic place and its ability to withstand this impact.

We can rate the severity of an impact occurrence, using the five-point scale detailed in Table 29. If considered beneficial, we could split our impact to consider different magnitudes of an impact. For example, we could distinguish between the same hazard event causing damage to a wall or causing its collapse.

Severity rating scale		
Rating	**Description**	
0 Insignificant	Deterioration so slow that is remains hardly noticeable This severity score is not applicable to sudden damage.	Trace fraction of place element is affected; damage or deterioration is hardly noticeable; no cracking
1 Minor	Slow deterioration or small damage	Tiny fraction of place element is affected; minor deterioration or damage to exposed surfaces; no cracks or hair line cracks in fabric
2 Moderate	Medium deterioration or medium damage	Small fraction of place element affected; significant deterioration or damage to exposed surface; minor cracks in fabric
3 Major	Rapid deterioration or large damage	Large fraction of place element affected; substantial cracks in fabric with signs of fabric movement; loss of some structural integrity; substantial loss of surface features
4 Catastrophic	Disastrous rapid damage This severity score is not applicable to progressive deterioration.	All or most of place element is affected; partial or total collapse or destruction; fabric deterioration on a massive scale

Table 29 The severity rating uses a five-point scale to describe the severity of an impact.

Let's explore this with two examples: Firstly, the medieval towerhouse Threave Castle was erected on a small island in a river. This location was chosen to protect the castle from attacks. The island floods regularly, and the castle was constructed with this in mind. Today, substantial flooding occurs regularly. It is not particularly forceful but might last for a few days. That said, it has little effect on the tower. Therefore, the severity of this impact might be *Minor* (rating 1).

To contrast this, we will look at the historic farm Stöng in South Iceland, as our second example. Stöng consists of the exposed remains of a Viking long-house near the active volcano Hekla. The specific impact description could be: Volcano eruption causing lahar, a violent flow of volcanic mud or debris, burying the house remains. Such an event would not only cover the remains completely but last for a long time and cause substantial damage in the form of displacement. This event might have a severity rating of 4 (*catastrophic*).

Using the severity rating scale, we can assign each impact a rating. In Table 30, we can record our severity ratings for each previously identified impact, based on our own expertise or discussions with suitably experienced stakeholders. We would firstly transfer the impact descriptions and associated environmental hazards, so we can use them as our baseline, and then add the severity rating and any comments and/or reasons for our rating decision.

Severity of impact			
Impact on historic place	Environmental hazard	Severity rating	Comments / reasons

Table 30 In this table, we can record the severity rating of each previously identified impact on our historic place, using the rating scale in Table 29. (Grey table cells are data transfers from Table 23.)

Advanced Level: Calculating severity

If you are not using the Advanced Level, please skip this section and proceed to the section Inherent risks. Advanced Level users are to note that, in order to continue, the related Advanced Level sections in previous chapters must have been completed.

In the following, we will develop a more detailed understanding of the severity of an impact on our historic place by investigating the place's vulnerability to the impact and an impact's intensity. The intensity can be thought of as a combination of the exposure duration to the impact and its magnitude. From this, we will calculate first a severity rating and subsequently an inherent risk rating (as done in the Standard Level assessment). At a later stage, we will also factor into the risk analysis the place's cultural significance, by calculating heritage risks. The risk analysis process for the Advanced Level is illustrated in Figure 11.

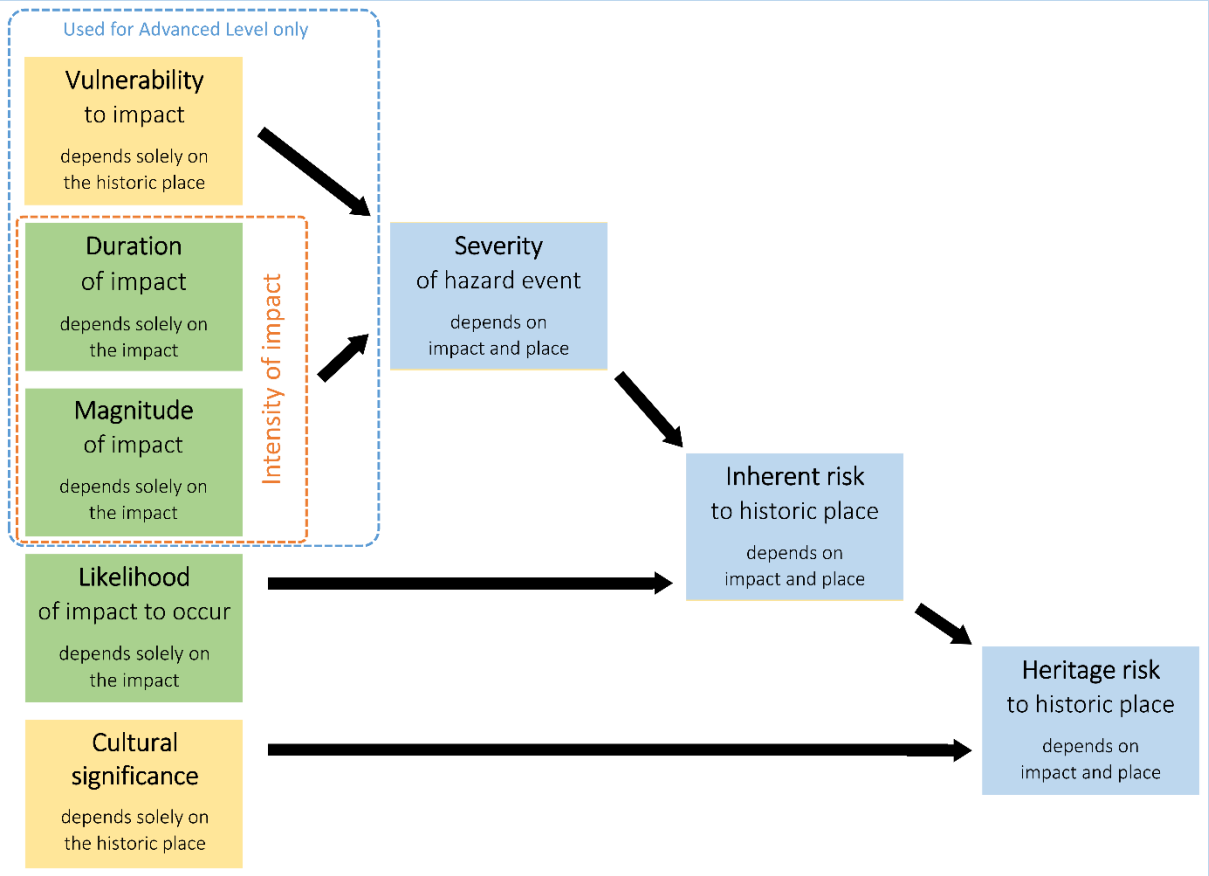


Figure 11 Overview of the Advanced Level process of the risk analysis. We will firstly explore severity as a combination of impact duration and impact magnitude and the place's vulnerability to the impact. We will then calculate from severity and impact likelihood the inherent risk (as done at Standard Level assessment). Finally, we will factor in the place's cultural significance, by calculating heritage risks. (The yellow boxes indicate sole dependency on the historic place, green sole dependency on the impact and blue is a combination of both.)

Vulnerability

By vulnerability, we mean the susceptibility of the historic place or parts thereof to the impacts we had identified in the previous chapter. How easily can the place withstand these impacts? To answer the question, we need to consider an impact strictly as we have defined it, asking ourselves of what the place is made and in what way, and in what physical condition the place is today. A building constructed with earthen walls, for example, is far more vulnerable to the impacts caused by flooding than a wall made from stone masonry.

We are going to assign each identified impact a rating to indicate the place's vulnerability to this impact. We will again use the five-point scale, as detailed in Table 30. We will record our vulnerability ratings together with our intensity rating, which we will discuss in the next section.

Rating scores for vulnerability		
Rating	**Description**	
0 Negligible	Not vulnerable	Can easily withstand the impact
1 Slight	Slightly vulnerable	Can mostly withstand the impact, with only minor damage / deterioration
2 Moderate	Moderately vulnerable	Can withstand the impact, with some damage / deterioration
3 Severe	Severely vulnerable	Can hardly withstand the impact, with major damage / deterioration and/or some collapse / destruction
4 Extreme	Extremely vulnerable	Cannot withstand the impact, with collapse / destruction / loss

Table 30 The vulnerability rating uses five scores, from 0 to 4, to describe the place's susceptibility to an impact.

Intensity of Impact

As already noted, the intensity of an impact is a combination of its exposure duration and magnitude, which together describe the impacts force and scale. We will evaluate both jointly, assigning each impact a single intensity rating.

When considering an impact's duration, we are trying to understand the length of time during which our historic place is affected by the impact. In some situations, we might find that a place (element) is not exposed to an impact at all. A lighting strike has a length of exposure of less than a second. A resulting fire might last several hours. The weathering of a stone surface in an exposed, windy location is a process of continuous deterioration.

The magnitude of an impact describes its momentary force. A tornado is an extremely forceful hazard, which can have a tremendously destructive impact. Whereas the intensity of wind contributing to stone weathering is relatively small, when considered over a short period. (What makes weathering a destructive deterioration process is the combination of relatively low-intensity wind affecting material surfaces essentially continuously over a longer period.)

Instead of assigning separate ratings for an impact's exposure duration and magnitude, we will consider these parameters together and assign a single rating for impact intensity. For this, we will use the five-point scale detailed in Table 31.

Rating scale for impact intensity	
Rating	**Description** for damages and deterioration respectively *The impact can cause …*
0 Insignificant	[This rating does not apply to damages.] … *only negligible deterioration, even over a period of several decades.*
1 Minor	… *minor damage in one day.* … *minor deterioration in a year.*
2 Moderate	… *moderate damage in a day or progressively minor damage in a few days.* … *moderate deterioration caused in a year.*
3 Major	… *major damage in a day or progressively minor or moderate damage in a few days.* … *major deterioration in a year.*
4 Extreme	… *extreme damage in a day or progressively moderate or major damage in a few days.* [This rating does not apply to deterioration.]

Table 31 To describe the intensity of an impact, which is its combined duration and magnitude, we will use this five-point rating scale.

Calculating the Severity Rating

Next, we will calculate the severity rating as a combination of the previously assigned intensity and vulnerability ratings. For this, we will simply look up the values in the severity rating matrix in Table 32, which will return the severity rating. We can record in ratings of intensity and vulnerability in Table 33, together with the resulting severity rating.

We have already discussed the scale of the severity rating in the Standard Level assessment (Table 29) and we should check now that the rating we have applied fits into this scale. If it does not, we should reconsider the ratings we have assigned to intensity and/or vulnerability.

Matrix for severity rating						
Intensity rating	4	0	4	4	4	4
	3	0	2	3	3	4
	2	0	1	2	3	4
	1	0	1	1	2	4
	0	0	0	0	0	0
		0	1	2	3	4
		Vulnerability rating				

Table 32 With this matrix, we can calculate the severity ratings, using the previously assigned intensity and vulnerability ratings.

Calculating severity scores				
Impact on historic place	Affected place element	Intensity rating	Vulnerability rating	Severity rating

Table 33 In this table, we can record, for each identified impact, the associated vulnerability and magnitude ratings and then add the resulting severity rating, taken from the matrix in Table 32. (The grey table cells are data transfers from Table 26 in the previous chapter. The yellow cells are results from the severity rating matrix in Table 32.)

Inherent risks

Calculating inherent risks

The inherent risk can be described as a combination of an impact's likelihood and severity, for which, in the previous section, we have already assigned / calculated ratings. We can use those ratings to calculate the associated inherent risk ratings. To do this, we multiply for each impact the impact likelihood and severity ratings. Alternatively, we can use the matrix in Table 34.

Inherent risk rating matrix						
Severity rating	4	0	4	8	12	16
	3	0	3	6	9	12
	2	0	2	4	6	8
	1	0	1	2	3	4
	0	0	0	0	0	0
		0	1	2	3	4
		Likelihood rating				

Table 34 Matrix to calculate the rating of inherent risks, using the previously assigned / calculated severity and likelihood ratings. (For rating definitions and colour coding, see Table 36.)

We can record the calculated inherent risk ratings in Table 35, which also lists the information required to calculate the risks, namely the impact and its associated likelihood and severity ratings. The meanings of the numerical results are defined in Table 36, using four rating ranges. Each range has a definition –from *insignificant risk* to *extreme risk*– and associated statement of acceptability and recommendations for action.

Inherent risk ratings			
Impact	Likelihood rating	Severity rating	Inherent risk rating

Table 35 In this table, we can record the inherent risk ratings, which we assign to each specific impact. (The grey table cells are data transfers from Tables 28 and 30 in the previous section. The yellow cells are results from the inherent risk rating matrix in Table 34.)

Rating scale for inherent risk with acceptability of risks and recommendations				
Rating ranges	**Colour coding**	**Rating definitions**	**Acceptability of risks**	**Recommendations for action**
0 to 3		Insignificant risk	Acceptable risk level	no action required
4 to 7		Minor risk	Acceptable risk level subject to monitoring	consider active risk monitoring
8 to 11		Major risk	Unacceptable level of risk	consider timely adaptation action
12 to 16		Extreme risk	Unacceptable level of risk requiring immediate attention	consider immediate adaptation action

Table 36 This table lists the four ranges used for risk ratings, stating the colour coding, range definitions, levels of risk acceptability and recommendations for actions.

Adding a further time horizon

We have now established the risks currently applying to our historic place. Since this risk management process is interested in understanding climate change, we also need to investigate the future. How will our risks change going forward?

For this, we will rerun the risk analysis, for which we will change from using *today*, as previously used, to a point in the future. Although we can choose our time horizon freely, 50 years from now is a good starting point. Considering the information on climate and hazard trends in our Hazard Register, how are our rating values going to change? What effect will this have on the risk interpretation?

We can record the results of our reassignment of likelihood and severity ratings and subsequent inherent risk calculation directly in the *Risk Register*, as described in the next sections.

We can also add further time horizons if deemed beneficial for the assessment. Many organisations only use short- to mid-term time horizons for planning purposes. For assessments relating to climate change and historic place, however, understanding the longer-term prospects of a place is useful, as conservation planning generally aims at minimising interventions at a place. We could, for example, investigate the time horizons of 10 years to consider the more immediate risks, of 50 years to account for significant change of existing and new impacts, and of 100 years to gain an understanding of the general outlook for the future of the historic place.

Risk Register

We can now collate the information gathered from the previous sections in this chapter to create a *Risk Register* (Table 37), to which we can also add one or more time horizons.

Risk register for multiple time horizons												
Impact	**Time horizon #1: Today**						**Time horizon #2:**					
Impact ID and description	Likelihood rating	Severity rating	Inherent risk rating	Inherent risk rating definition	Acceptability of risk	Recommendations for action	Likelihood rating	Severity rating	Inherent risk rating	Inherent risk rating definition	Acceptability of risk	Recommendations for action

Table 37 This table is our Risk Register, *summarising the established inherent risk ratings, together with a risk interpretation. (The grey table cells are data transfers from Table 35. The yellow cells are results from the risk rating scale in Table 36.)*

Rating matrix for heritage risk

Significance rating										
4	0	4	8	12	16	24	32	36	48	64
3	0	3	6	9	12	18	24	27	36	48
2	0	2	4	6	8	12	16	18	24	36
1	0	1	2	3	4	6	8	9	12	16
0	0	0	0	0	0	0	0	0	0	0
	0	1	2	3	4	6	8	9	12	16

Inherent risk rating

Table 38 Matrix to calculate the heritage risks ratings, using the inherent risk rating calculated in the previous section, and the cultural heritage rating, which we had assigned earlier in the section Key cultural heritage values *in a previous chapter.*

Rating scale for heritage risk, with acceptability of risks and recommendations

Rating ranges	Colour coding	Rating definitions	Acceptability of risks	Recommendations for action
0 to 5		Insignificant risk	Acceptable risk level	no action required
6 to 15		Minor risk	Acceptable risk level subject to monitoring	consider active risk monitoring
16 to 35		Major risk	Unacceptable level of risk	consider timely adaptation action
36 to 64		Extreme risk	Unacceptable level of risk requiring immediate attention	consider immediate adaptation action

Table 39 This table lists the four ranges used for risk ratings, stating the colour coding, range definitions, levels of risk acceptability and recommendations for actions. (The colour coding is also used in the related matrix in Table 38.)

Risk register for multiple time horizons (Advanced Level)																				
Impact	**Place elements**			**Time horizon #1: Today**					**Time horizon #2:**					**Time horizon #3:**				
Impact ID and description	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

Table 40 In this table, we can record, for multiple time horizons the assigned intensity and likelihood ratings and the resulting ratings for severity, inherent risk and heritage risk. (The grey table cells are data transfer from Table 37. The yellow cells are results from the ratings matrices for severity, inherent risk and heritage risk in Table 32, Table 34 and Table 38 respectively.)

Advanced Level: Heritage risks

Calculating heritage risks

The inherent risk ratings, we have calculated in the last section, do not consider the cultural significance of our historic place. To give an example, perhaps the place consists of a manor house and a garden pavilion. When reviewing cultural significance (in chapter DEFINE HISTORIC PLACES), we might have declared the house to be of *outstanding* cultural significance, while the pavilion is of *negative / neutral* significance. Losing the pavilion, therefore, would not adversely affect the key heritage values of our historic place. Losing the house certainly would.

To account for the cultural significance of the different place elements, we are going to use the inherent risk ratings to establish the heritage risk ratings. For this, we are going to multiply the inherent risk rating with the cultural significance rating of our place elements. Alternatively, we can read the calculation results from the matrix in Table 38.

To interpret the heritage risk ratings, we are going to use the same table as for the inherent risk ratings, except that our rating ranges have changed to accommodate the rating scale of 64 points (from 0 to 64) used for the heritage risks. The details of the heritage risk rating scale are given in Table 39. We can record the calculated ratings of the heritage risks to each impact in Table 40, which also lists the information required calculate the risks, namely the impact, its associated place elements and the element's cultural significance and inherent risk ratings. And, as for the Standard Level assessment, we can calculate heritage risks for multiple time horizons, as deemed beneficial.

Example Ballinskelligs Abbey: Risk Register

For the example of Ballinskelligs Abbey, the impact descriptions and the associated environmental hazards, were transferred from previous tables into the place's *Risk Register* (Table 41). Since we are assessing the place using the Advanced Level, also transferred were the affected place elements and their cultural significance ratings. Thinking of the current situation today, we could then establish the vulnerability rating of the place (element) to each impact and each impact's intensity and likelihood rating. From there, we could calculate the ratings of severity, inherent risk and heritage risk.

We have then repeated the same assessment for a further two time horizons: 2070 and 2100. For this, we assume that the place's vulnerability and significance remain unchanged and explore if and how the intensity and/or likelihood of the impact will change into the future.

By comparing the risk rating results of the different time horizons, we can gain an understanding of how risks will change into the future and, therefore, how the impact might change.

Risk register (including Advanced Level)

Risk Register											Risk Register continued (Advanced Level)									
Impact				Historic place		Time horizon #1: Today					Time horizon #2: 2070					Time horizon #3: 2100				
Im-pact ID	Impact description	Environmental hazard	Place element affected	Signifi-cance 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

Table 41 Example Risk Register *for Ballinskelligs Abbey, using the Advanced Level assessment and the three time horizons of today, 2070 and 2100. (The grey table cell are data transfers from previous tables; yellow cells are rating calculations, using the matrices of this chapter of the guide.)*

Summary of Risks

Our *Risk Register* might consist of only a few table rows, or it might be long. Regardless of its length, we should examine the results, by ranking them and comparing them to each other and the key cultural heritage values we have identified earlier.

Ranking risks

We can sort our table by descending risk ratings. If we have worked with the Advanced Level, we will sort by heritage risk ratings, otherwise we use inherent risk ratings. This will help us identify the highest rated risks and how many of those are to be considered *unacceptable* as per our rating definitions and associated recommendations for action.

Comparing risks

Our *Risk Register* might surprise us. Some risks might be rated more highly than we would have expected or might develop more strongly into the future. We might consider others as being too lowly rated. We should take the time to compare the risks, reflecting on what has created the differences in the ratings.

If needed, we can adjust the rating values from which we have calculated the risks, keeping in mind that this might influence the calculation of the other risks. For Standard Level assessments, likelihood and severity ratings can be amended, at Advanced Level, we should not change the severity rating.

Development of risks

Starting with the risks ranked highest in the *Risk Register*, we should also review how the risks develop over time. Which risk ratings are we expecting to decrease, which are increasing most steeply? Does the register list any risks the impact of which are not considered relevant as observed or potential risks today?

Impact on key cultural heritage values

When describing our historic place, we have defined its key cultural heritage values and rated them, using a descriptive scale. Considering the risks, we should now review if the occurrence of impacts of *unacceptable* risks would reduce the key cultural heritage values. We should also consider the concurrence of multiple impacts.

Risk register summary

We can summarise our examination of the risks using Table 42.

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

List of unacceptable risks
ranked by decreasing risk rating

Impact description	Risk rating	
	Time horizon 1	*Furthest horizon*
	Today	

Highest-ranked acceptable risks
(state multiple if of the same rating)

Impact description	Risk rating	
	Time horizon 1	*Furthest horizon*
	Today	

Summary of increasing risks

Summary of decreasing risks

Effect of occurrence of impacts on key cultural heritage values

Key values	Current rating	Revised rating	Comments

Conclusions

Table 42 In this table, we can interrogate the results of the Risk Register*, by naming the most important risks, summarising the development into the future and record how the impacts of the highest rated risks would influence the key cultural heritage values. (The grey table cells are data transfers from Table 37 or Table 40 and from chapter* DEFINE HISTORIC PLACES*.)*

Example Ballinskelligs Abbey: Risk register summary

Summary of Risk Register (Advanced Level)

List of unacceptable risks
state risks consider as unacceptable at time horizon #1, #2 and #3

Impact ID	Description	Heritage risk rating *from 16 to 64*		
		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

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

Impact ID	Description	Heritage risk rating *from 0 to 15*		
		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

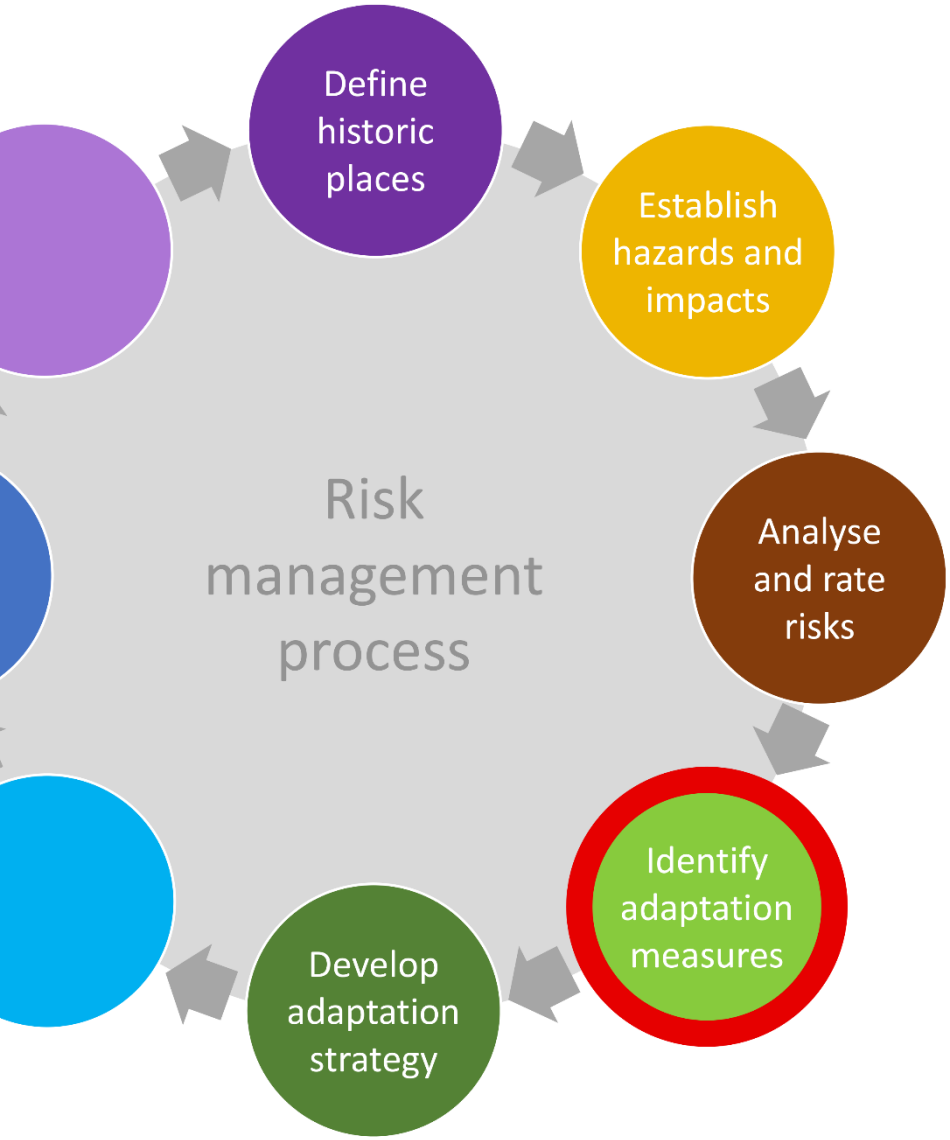
Today, three risks are considered as unacceptable, namely

- #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

Table 43 Risk Register Summary *for Ballinskelligs Abbey, used as an example in this guide. (The first part of this table –on the previous page– is a sole data transfer from Table 41; hence, the grey table cells. The information in the table part above is mostly a qualitative summary of the risk ratings.)*


Define historic places
Establish hazards and impacts
Analyse and rate risks
Identify adaptation measures
Develop adaptation strategy
Risk management process

5 IDENTIFY ADAPTATION MEASURES

In this chapter, we will find, evaluate and appraise potential adaptation measures to respond to the risks we have previously identified. We will firstly create longlist of measures, using six adaptation types, and then evaluate the measures, reducing our longlist into an *Adaptation Measures Register*. In this process, we will recalculate our risk rating and review the measures impact on the place's cultural significance to ensure that a measure is suitable. We will repeat this process until we have identified measures for each risk, which we consider important to our historic places.

By the end of this chapter, we will have produced an *Adaptation Measures Register*, which summarises options for reducing the risks identified as relevant to our historic place. This will help with making informed decisions about the place's future development.

If using the Advanced Level, we will evaluate the adaptation measures identified by recalculating our heritage risks. We will also review the measure's economic and social effects on relevant communities and effects on the environment.

At Advanced Plus Level, we will appraise the feasibility and viability of the identified adaptation measures and collate them strategically by producing an Adaptation Pathways Roadmap.

From risks to adaptation measures

In the previous chapter, we have performed a risk assessment, resulting in a *Risk Register* for our historic place. This register details the risks of environmental impacts occurring on site, including the associated environmental hazards and the climate trends influencing them. In this chapter, we are going to identify and evaluate adaptation measures which can reduce those risks to a level which we consider acceptable. To do this, we will consider the (more important) risks listed in the register and repeat for each risk the adaptation planning process outlined below. Planning adaption measures for all listed risks might be too resource consuming, particularly for long Risk Registers. We can therefore limit ourselves to the more important risks, which are usually those with a higher risk rating. Planning adaptation for all risks considered unacceptable is recommended. Let's start with the rated highest risk.

Process for identifying adaptation measures

To explore a wide range of adaptation measures for each risk, we will firstly create a longlist, in which we want to identify as many measures as possible. They should respond to the investigated risk, but do not have to be realistic. The aim is to brainstorm to create a good pool of different idea for adaptation. Thereafter, we will review the ideas collected, appraising them in several steps to distil a shortlist of realistic adaptation measures. This forms our *Adaptation Measures Register*, which might be suitable for implementation at the historic place at some point in the future. (Figure 12) Utilising specialist knowledge and/or stakeholder engagement, including local stakeholders, to identify and appraise the adaptation measures is recommended. To seek expert knowledge, interviews and meetings with experts are helpful. For stakeholder engagement, we recommend holding a workshop (see chapter 1).

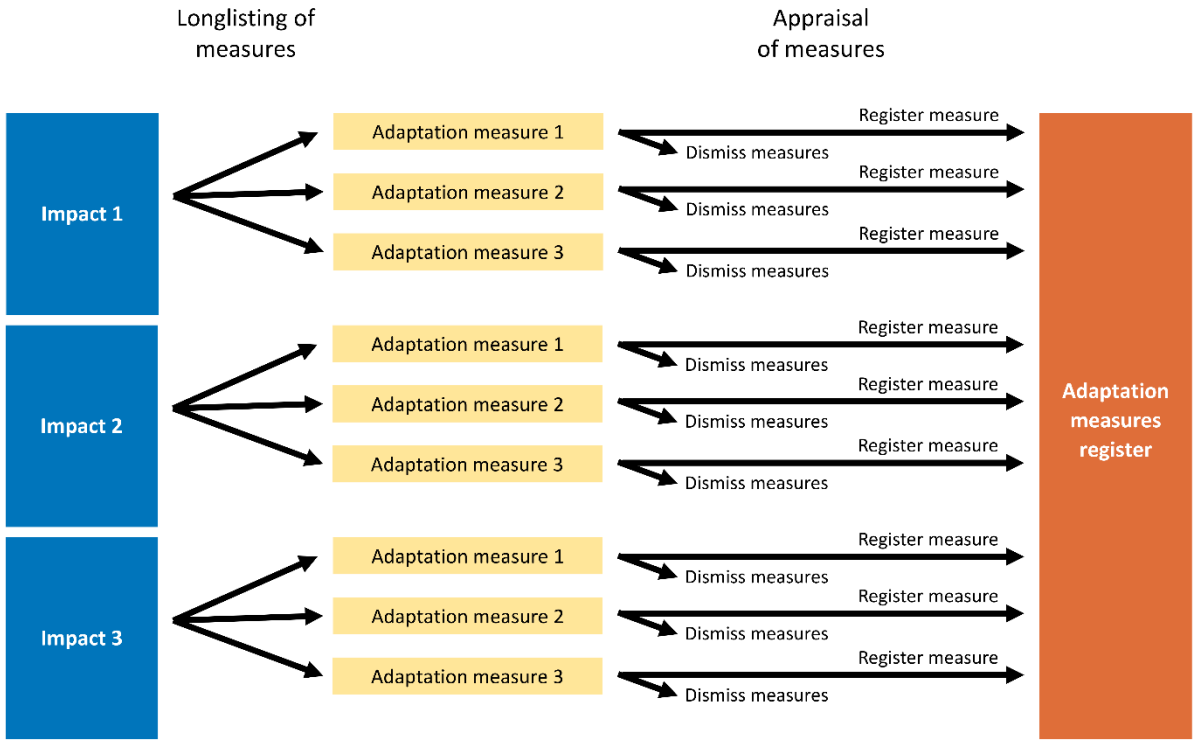


Figure 12 Overview of the process used for identifying adaptation measures (longlisting) and appraising them (shortlisting). The process will result in an Adaptation Measures Register *of suitable adaptation measures, which could potentially be implemented at the historic place to reduce its risk to the climate-related impacts considered.*

Identifying adaptation measures

Choose impact for investigation

To start, we can transfer the basic details of the impact (description, time horizon and scenarios, and hazard source) that we want to investigate into Table 44.

Impact to be investigated	
Impact description	
Associated hazard	
Risk rating	
Impact ID	

Table 44 Transfer the basic details of the specific risk under investigation from the Risk Register *into this table.*

Types of adaptation measures

To help identify a wide variety of options, we will use six types of adaptation measures, which will help us to explore systematically different approaches and options to adaptation. Relating to the different parameters used in the risk analysis, the categories are Protect, Strengthen, Relocate, Respond to Damage, Manage Loss and Manage Uncertainty (Figure 13).

Figure 13 Six types of adaptation measures are used to help create a shortlist which offers a large variety of potential measures.

These adaptation types can be described as follows:

- PROTECT historic place from impact, by reducing the impact's severity. Such a *protect* adaptation measure will not be installed to the material fabric of the place (element) affected by the impact. The measure will be installed (to the adjacent place element,) in the place's immediate surrounds or its wider environs. The measure, thereby, protects the concerned place (element) from the impact because the impact occurs at the place for a shorter span of time, is weaker or does not reach the place at all.

  (If working at Advanced Level, measures of this category will reduce the place's length of exposure to the impact, including eliminating its exposure completely, and/or reduce the impact's magnitude at the place. This will in turn reduce the impact's intensity and therefore its severity.)

  Examples: A seawall installed at the boundary of a historic place can protect it from coastal erosion. A flood barrier installed on a river near a historic place can protect it from damage caused by fluvial flooding. Erecting a sheltering structure around an ornately carved standing stone can protect its carvings from deterioration by reducing the effects of weathering. Installing signage to request visitors of a place to not damage it, e.g. by not climbing onto walls is a further measure.

- STRENGTHEN historic place's material fabric to withstand the impact better, by reducing the impact's severity. Such a *strengthen* adaptation measure will be install to the historic place to be protected and will therefore alter it. The hazard's impact will remain unchanged but the place (element affected) will resist the impact either completely or at least for longer.

  (If working at Advance Level, measures of this category will reduce the place's vulnerability to the hazard, including eliminating the vulnerability. This will in turn reduce the impact's severity.)

  Examples: Installing additional load-bearing posts in a historic place can strengthen it to withstand collapse due to increased weight from extreme snow load. Fitting additional rainwater goods at a historic place can *strengthen* it to better cope with

extreme rainfall events. Mounting external weather boarding to a timber log wall to better withstand precipitation.

- RELOCATE historic place to remove it from the impact, either completely or partially. This means, in other words, preventing the impact. *Relocation* is a preventive adaptation measure, which consists of removing the historic place from its current context and location, transporting it to a new location and re-erecting it. *Relocation* always risks damaging the historic place and some loss of authenticity and material fabric.

  Examples: To relocate a fishing station on a coastline landwards can eliminate the (immediate) exposure to coastal erosion. To relocate an ornate standing stone to an indoor museum can prevent its surfaces from deterioration by reducing the effects of weathering.

- RESPOND TO DAMAGE to the historic place to compensate for the impacts of the hazard event on the historic place. For *respond* adaptation measures, we accept that the impacts might damage the historic place and that some loss of authenticity and material fabric might occur. *Respond* adaptation measures aim at remedying damage to the place and reducing the losses, by rebuilding, repair, salvaging and temporary stabilisation, and/or of damaged material fabric, and can include preparatory action.

  Examples: Installing structural support to damaged upstanding material fabric to reduce further damage or loss by enabling the fabric to be salvaged or kept in situ for later rebuilding or repair. Preparing and implementing emergency response plans to increase the preparedness and response capacity for the impacts of a hazard event. Digital recording of material fabric to aid faithful rebuilding and repair.

- MANAGING LOSS of historic place accepts that loss of either the complete place or some of its parts will eventually occur. This loss can happen suddenly or over a prolonged period. *Managing loss* adaptation measures are not concerned with retaining the material fabric of the place and aim instead at providing an opportunity for people to engage constructively with the loss. These measures include bereavement counselling for affected communities, creating and making accessible replicas, recording of the intangible aspects of the historic place, such as memories and stories, and the conscious do-nothing approach.

  Examples: Creating and making accessible a digital reconstruction of the material fabric to be lost. Running an art project concerned with the threatened historic place to support affected communities in coping with the loss. Marking the footprint of a former historic object on the ground to visualise the lost place in its original context.

- MANAGE UNCERTAINTY at the historic place to support the evaluation of, decision-making regarding and design and implementation of other adaptation measures. *Manage uncertainty* adaptation measures will help to reduce the uncertainty of the place's future and can meaningfully inform decision-making processes. *Manage uncertainty* adaptation measures include place-specific climate change modelling, environmental monitoring, documenting and surveying to create baseline data for decision-making, conservation plans and similar policies, feasibility studies for other adaptation measures.

Examples: Archaeologically recording a coastal site of historic remains can help to understand the remains, before losing them. Environmental site monitoring can inform adaptation planning, e.g. to establish real-world rates of deterioration. Climate change modelling can add further knowledge on when and how relevant impacts of a hazard event might affect a place. Producing conservation policies, such as a Conservation Plan, to identify how a historic place is to be better managed, including the assignment of responsibilities. This can also include undertaking fabric condition surveys to reduce the uncertainty of maintenance and repair work needed and risk analysis and setting up stakeholder engagement systems.

Identifying adaptation measures

We want to identify as many adaptation measures as we can think of, regardless of how realistic they are. However, each identified measure should respond to the investigated risk. We can record the measures as our longlist in Table 45, sorting them by types of adaptation measures. We aim to find at least one adaptation measure for each of the six types.

Longlist of adaptation measures	
PROTECT	
P1	
P2	
STRENGTHEN	
S1	
S2	
RELOCATE	
R1	
R2	
RESPOND TO DAMAGE	
D1	
D2	
MANAGING LOSS	
L1	
L2	
MANAGE UNCERTAINTY	
I1	
I2	

Table 45 In this table, we can list all the adaptation measures we can think of, which could respond to the risk investigated, grouping them into the given six types of adaptation measures.

If you are holding a workshop, you can organise this as a group discussion, using brainstorming as a stakeholder engagement technique and recording ideas for each adaptation measure on sticky notes, which, at the end of the discussion, can be group by measure types. A flip chart or white board can be helpful to visualise the grouping of the recorded results.

Appraising adaptation measures

Adaptation Measures

Have created a longlist of adaptation measures, we will appraise each of them. During this process, we will rule out some measures, amend others and finally end with a shortlist of measures, deemed suitable for implementation at our historic place.

Describe adaptation measure

To start, let's choose an adaptation measure from our longlist and transfer it onto the card. (see Table 46), also stating its Measure ID, adaptation type and the location(s) where the measure would be installed. The implementation location could be a place element or a location in the place's surroundings.

Adaptation measure appraisal	
Impact / Measure ID	
Adaptation measure (short title)	
Details of measure (brief description)	
Adaptation type	
Location where measure would be installed (If working at Advanced Level, use *place elements*.)	

Table 46 In this table, we can record basic information about the adaptation measure to be investigated. (Grey table cells indicated data transfer from Table 45.)

Re-evaluate or respond to risk

To appraise the adaptation measures, we will use a different approach for, on one hand, the measures of the adaptation types *Protect*, *Strengthen*, *Relocate* and *Respond to Damage* and, on the other hand, the measures of the type *Manage Loss* and *Manage Uncertainty*. For the former, we will re-evaluate the risk and its rating. For the latter, we will explore ways to

respond to the risk, as measures of the type *Manage Loss* and *Manage Uncertainty* do not (directly) influence the risk.

Re-evaluate risk

If working at Advanced Level, we will use the process described in section Advanced Level: Re-evaluate risk.

For adaptation measures of the types *Protect*, *Strengthen*, *Relocate* and *Respond to Damage*, we can review how the measure would influence the risk we are investigating. Was the measure to be implemented? Would the risk be eliminated, reduced or remain unchanged? To describe this change, we will use the definitions in Table 47. The measure should change the severity rating of the impact of a hazard event, which, in turn, would change the risk rating. Table 47 also lists the effect of our decision on the severity rating. We can record our decision in Table 48.

Risk adjustment scale	
Description of change in risk The risk would be ...	**Associated effect on severity rating** The severity rating would be ...
completely eliminated	set to nil
substantially reduced	reduced by 5 points
slightly reduced	reduced by 2 points
left unchanged or increased	*not applicable, as the adaptation measure is considered unsuitable*

Table 47 This table defines four levels of change to risk to help re-evaluate the risk through adjustment of the severity rating of the impact of the hazard event.

Adaptation measures appraisal: Adjustment of severity rating	
Effect of measure on risk: ***The risk would be...*** Complete sentence by using answer from Table 47	
Associated effect on severity rating *The severity rating would ...*	

Table 48 In this table, we can record the effect that the adaptation measure would have on the risk, by using one of the predefined answers in Table 47. (Yellow table cells indicate an associated result of our decision to be transferred from the same table.)

If our decision results in the risk to be either *left unchanged* or *increased*, we can try to amend the description of the measure to make it more acceptable. Failing that, we will have to file the measure as unacceptable and proceed to appraising the next adaptation measure from our

longlist. If the measure would cause the risk to be *completely eliminated*, *substantially reduced* or at least *slightly reduced*, we will continue with our appraisal below, considering the measures effect on the place's cultural significance.

Advanced Level: Re-evaluate risk

If working with the Advanced Level, our risk re-evaluation, to appraise an adaptation measure of the types *Protect*, *Strengthen*, *Relocate* and *Respond to Damage* can be more detailed, considering the impact's intensity (which is a combination of exposure duration to impact and its magnitude) and the place's vulnerability, all of which are variables of our risk calculation. We will use a risk adjustment scale (Table 49) like that of the Standard Level.

In Table 50, we can record separately the effects of the adaptation measure on the ratings of impact intensity and the place's vulnerability. We should keep in mind that a *Protect* type measure should change the exposure duration to an impact, and/or its magnitude, and therefore its intensity rating. *Strengthen* and *Respond to Damage* type measures should change the vulnerability rating. A *Relocated* type measure should ideally eliminate exposure completely, setting the exposure duration rating to nil.

Risk adjustment scale (Advanced Level)	
Scale of change	**Associated effect on rating of intensity / vulnerability**
completely eliminated	set to nil
substantially reduced	reduced by 25 points
slightly reduced	reduced by 10 point
left unchanged or increased	*not applicable, as the adaptation measure is considered unsuitable*

Table 49 This table defines four levels of change to risk to help re-evaluate the risk through adjustment of the rating of exposure duration / magnitude and vulnerability.

Adaptation measure appraisal: Adjustment of ratings (Advanced Level)			
Change to	**Scale of change** using refined responses of Table 49	**Adjusting intensity / vulnerability rating** using data from Table 49	**Adjusting heritage risk rating**
exposure duration of place to impact			
magnitude of impact on place			
vulnerability of the place to impact			

Table 50 In this table, we can record the effects that the adaptation measure would have on the risk, by using one of the predefined answers in Table 49. (Yellow table cells indicate an associated result of our decision to be transferred from the same table.)

If our decision results in the reduction of at least one of the ratings of exposure duration, magnitude and vulnerability, we will continue our appraisal below, to consider the measure's effect on the place's cultural significance.

If none of the ratings have been reduced, we can try to amend the description of the measure to make it more acceptable. Failing that, we will have to file the measure as unacceptable and proceed to appraising the next adaptation measure from our longlist.

Respond to risk

Adaptation measures of the types *Managing Loss* and *Manage Uncertainty* do not (directly) influence the risk rating. To appraise them, we will explore the ways in which such measures respond to the risk by reducing uncertainty and supporting other relevant adaptation measures and/or supporting communities and the environment in coping with loss. We will use a descriptive format for this appraisal, responding to specific questions.

For adaptation measures of the type of *Managing Loss*, we will review how the adaptation measure would support communities and which specific communities would be supported. The aim is to establish whether the measure has a clear focus. We are consciously avoiding any quantitative assessment here, such as size of community or distance of community to historic place. We can record our assessment in Table 51.

Managing Loss appraisal	
How would the measure support communities?	
Which specific communities would be supported?	
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

Table 51 In this table, we can appraise adaptation measures of the type Managing Loss *in a descriptive form, by considering the meaning of the measures for specific communities.*

For adaptation measures of the type of *Manage Uncertainty*, we will review how the adaptation measure would reduce the uncertainty of assessing risks to historic places due to climate change impacts and of planning associated adaptation measures? We also want to establish how the relevant *Manage Uncertainty* measures would support other relevant measures of other adaptation types. Again, we are consciously avoiding any quantitative assessment, such as the number of other measures supported. We can record our assessment in Table 52.

Manage Uncertainty appraisal	
How would the measure reduce uncertainty?	
How would the measure support other relevant 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 longlist

Table 52 In this table, we can appraise adaptation measures of the type Managing Uncertainty *in a descriptive form, by considering the ability of the measure to reduce uncertainties and thereby support other adaptation measures.*

Both Table 51 and Table 52 end with knock-out criteria: We need to decide if the questions asked in these tables have been answered relevantly and sufficiently enough to explore the measure further. If this is the case, we will proceed with our appraisal, to consider the measure's effect on the place's cultural significance. Otherwise, we will have to stop appraising the measure and proceed to the next adaptation measure from our longlist.

Effect of measure on cultural significance

Imagining that the adaptation measure investigated would be implemented, we can describe the anticipated effect the measure would have on the cultural significance of the place, its elements and its surroundings. For this, we will simply describe the effect by using the following values: unacceptably adverse, acceptably adverse subject to mitigation, acceptably adverse without mitigation, neutral, or beneficial. We can record the result in Table 53.

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.	

Table 53 This table records any anticipated effects on the cultural significance an implementation of the adaptation measure investigated would have.

If we have considered the effect of the adaptation measure on the place's cultural significance as *unacceptable*, we will stop exploring the measure. If we have considered it as *acceptably adverse subject to mitigation* and we have been unable to find any sensible examples for how such mitigation could be achieved, we will also stop exploring the measure.

If we are working with the Advanced Level, we will also review, in the next section, the measure's economic, environmental and social effects.

Advanced Level: Economic, environmental and social effects of measure

This section is only for Advanced Level assessments. If you are not using the Advanced Level, please proceed to the section Adaptation Measures Register.

Finally, we want to review the anticipated effects the measure, if implemented, would have on the economies and environment at and around the historic place, and on the communities concerned with it. For this, we will describe the effect by using the same values as for the assessment of impacts on cultural significance. We can record the result in Table 54.

Potential economic, environmental and social effects	
Descriptive rating of economic effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☐ neutral ☐ beneficial
Descriptive rating of environmental effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☐ neutral ☐ beneficial
Descriptive rating of social effects	☐ unacceptably adverse ☐ acceptably adverse subject to mitigation ☐ acceptably adverse without mitigation ☐ neutral ☐ beneficial
If any of the responses above was "subject to mitigation", name examples for how this might be achieved.	

Table 54 This table records any anticipated economic, environmental and social impacts an implementation of the adaptation measure investigated would have.

Using the same approach as in the previous sections, we will stop exploring the measure, if we have considered its effect on the place's cultural significance as either *unacceptable* or as *acceptably adverse subject to mitigation*, without being able to find any sensible examples for how such mitigation could be achieved. Otherwise, we will proceed to the next sections.

Adaptation Measures Register

In the previous section, we have appraised adaptation measures for their suitability to reduce a specific risk to the historic place being investigated. If an adaptation measure has not been rejected through the process described in the section above, we can record the measure's details in the *Adaptation Measures Register*, under the heading of the impact investigated (Table 55). Thereafter, we will continue by assessing the next adaptation measures from the longlist for that specific impact.

Adaptation Measures Register					
Impact investigated				**Impact ID**	
Impact / Measure ID	**Adaptation measure** (short title)	**Adaptation type**	**Location** where measure would be installed	**Effect on significance** incl. mitigation example	**Include in summary**
					☐ include
					☐ include
Impact investigated				**Impact ID**	
Impact / Measure ID	**Adaptation measure** (short title)	**Adaptation type**	**Location** where measure would be installed	**Effect on significance** incl. mitigation example	**Include in summary**
					☐ include
					☐ include

Table 55 This table records all the adaptation measures, which we have identified in our appraisal as generally acceptable. (Grey table cells indicate data transfers from previous tables.)

Once all longlisted adaptation measures associated with a specific impact have been appraised and accepted measures recorded in the *Adaptation Measures Register*, we can repeat this process for the next impact from our *Risk Register* that we want to investigate. We should keep in mind that we do not necessarily want to investigate all impacts registered.

If we are using the Advanced Level, a slightly more detailed approach is discussed below. If we want to explore specific measures in more detail, for example to better understand their feasibility, viability and aby barriers or limits associated with their implementation, we can explore this in the Advanced Plus Level section below.

Adaptation Measures Summary

To produce an *Adaptation Measures Summary*, we simply decide which of the measures in the *Adaptation Measures Register* we would like to include by ticking the box in the last column of Table 55. An example for this is given in Table 63.

Iteration and summary of Group of Historic Places / Place Categories

If assessing a *Group of Historic Places* or a set of *Place Categories*, we can finally also compare our findings for each investigated place / category and draw conclusions from this for the whole group / set. We can record these conclusions in Table 56 or Table 57 for a *Group of Historic Places* or a set of *Place Categories* respectively.

Geographic information (group of historic places)			
ID	Name of place	Place's address	Place's extent
1			
2			
3			
Summary of assessment of group of historic places			

Table 56 In this table, illustrates the Overview Group of Historic Places. *(The grey table cells are a data transfer from Table 4.)*

Geographic information (place categories)		
ID	Name of category	Description of category
1		
2		
3		
Summary of assessment of place categories		

Table 57 In this table, illustrates the Overview Place Categories. (The grey table cells are a data transfer from Table 5.)

Advanced Level: Adaptation Measures Register

When working at Advanced Level, the *Adaptation Measures Register* is extended with information about the economic, environmental and social effects which the measures could reasonably be expected to have.

Adaptation Measures Register						(Advanced Level)		
Impact investigated				**Impact ID**				
Impact / Measure ID	**Adaptation measure** (short title)	**Adaptation type**	**Location** where measure would be installed	**Effect on significance** incl. mitigation example	**Include in summary**	**Potential economic effects** incl. mitigation example	**Potential environmental effects** incl. mitigation example	**Potential social effects** incl. mitigation example
					☐ include			
					☐ include			
Impact investigated				**Impact ID**				
Impact / Measure ID	**Adaptation measure** (short title)	**Adaptation type**	**Location** where measure would be installed	**Effect on significance** incl. mitigation example	**Include in summary**	**Potential economic effects** incl. mitigation example	**Potential environmental effects** incl. mitigation example	**Potential social effects** incl. mitigation example
					☐ include			
					☐ include			

Table 58 This table records all the adaptation measures, which we have identified in our appraisal as generally acceptable.

Example Ballinskelligs Abbey: Adaptation Measures Register

For our example of Ballinskelligs Abbey, adaptation options were explored during the 2019 summer workshop, in discussions with various local, regional and national stakeholders. These included the care-taking organisations of the building and the graveyard, Ireland's Office of Public Works and Kerry County Council, as well as structural engineers of the Irish section of the non-government advocacy organisation Society for the Protection of Ancient Buildings and local representatives of the Ballinskelligs Environmental Group.

In a systematic discussion moderated by Historic Environment Scotland as the lead partner of the project Adapt Northern Heritage, potential adaptation measures were explored, using brainstorming, feedback on colour-coded sticky notes, group discussions and result recording on whiteboards (Figure 14). After the workshop, the key stakeholders liaised to developed advance the identified options of adaptation measures into an *Adaptation Measures Register*.

In the following we will discuss the impacts of wave action of the place element Sea Wall and illustrate how adaptation measures were identified for this specific element and impact. More details on other impacts, risk ratings and adaptation measures or Ballinskelligs Abbey (and Ballinskelligs Castle) have been published in the *Climate Risk Management plan* series in the Adapt Northern Heritage toolkit.

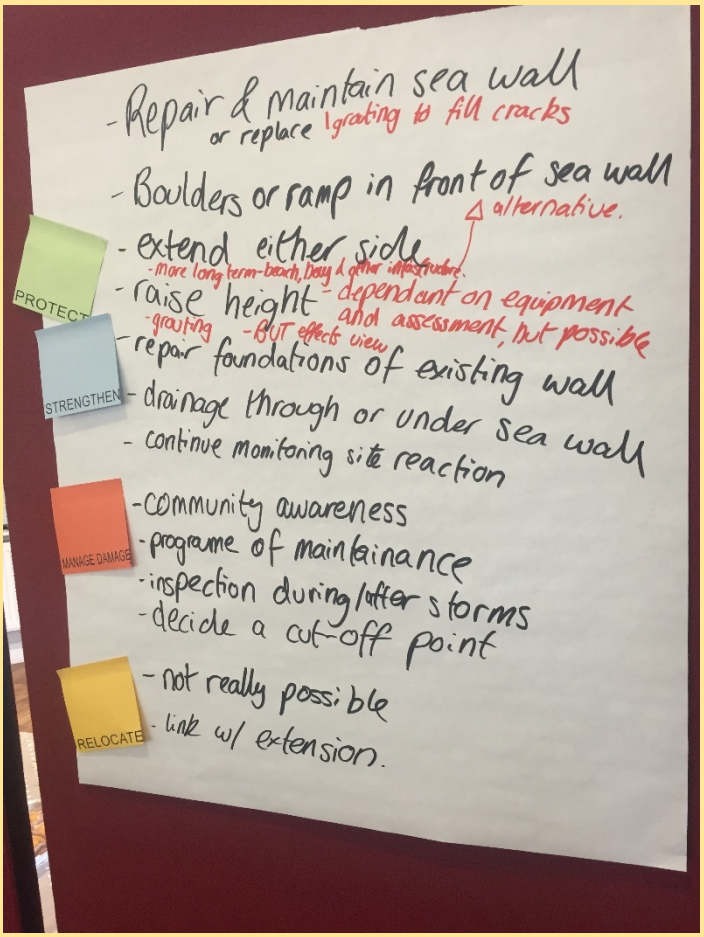


Figure 14

For the risk management assessment of Ballinskelligs Abbey in 2019, the workshop attendees used coloured sticky notes and a whiteboard to record the results of their discussion about potential adaptation measures for the place's sea wall.

Image © Historic Environment Scotland

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 reloacte sea wall
RESPOND TO DAMAGE	
D1	Inspection and responsive maintenance after storms
MANAGING LOSS	
L1	Decide cut-off point
L2	Community awareness
MANAGE UNCERTAINTY	
I1	Investiate tidal behaviour at Ballinskelligs Bay, including monitor coastline damage
I2	Appraise implications of wave breakers

Table 59 For the impact 'Impact damage to sea wall from wave action' of Ballinskelligs Abbey, eleven adaptation measures were considered for further evaluation.

Adaptation measure appraisal	
Risk / Measure ID	1/P1
Adaptation measure (short title)	Add boulders or ramp in front of 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
Adaptation type	Protect
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** using refined responses of Table 49	**Adjusting intensity / vulnerability rating** using data from Table 49	**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.*

Table 60 Assessment of adaptation measure #P1 for the sea wall of Ballinskelligs Abbey, namely "Boulders or ramp in front of sea wall": This assessment uses the Advanced Level (depicted in blue) of the risk management process to adjust the ratings and, in the continuation table on the next page (Table 61) to record the potential economic, environmental and social effects the measure would have on the affected environment and communities. (Grey table cells are data transfers; yellow cells are calculation results or instruction on how to use these two tables.)

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	
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.	not applicable
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.	

Table 61 Continuation of Table 60 on the previous page

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	Manage Uncertainty	not applicable	neutral	☒ include	neutral	beneficial (potentially also beneficial for other places, e.g. nearby harbour)	neutral
1/I2	Appraise implications of wave breakers	Manage Uncertainty	not applicable	neutral	☐ include	neutral	beneficial (potentially also beneficial for other places, e.g. marine / wildlife reserve)	neutral
Impact investigated	Storm impact 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)

Table 62 Adaptation Measures Register for Ballinskelligs Abbey, recording in a single place the options developed in the workshop in 2019 and in subsequent assessments

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 impact damage to abbey ruin due to breach in sea wall, 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

Table 63 Summary of Adaptation Measures Register for Ballinskelligs Abbey for use in the report's Executive Summary.

Advanced Plus: Appraising feasibility and viability

Feasibility and viability

In the previous sections, we have identified potential adaptation measures to reduce the climate-related risks to our historic place and have screened the measures to filter out those which we consider undesirable, because they do not achieve a suitable reduction of the risk or have too adverse effects on the cultural significance of our historic place (or too adverse effects on the environment and/or economically and socially on relevant communities). In the following, we will move the assessment from desirability to feasibility and viability. We know the measures we would like for our site. Now, we need to establish if we can attain them economically and realise them operationally. (Figure 15)

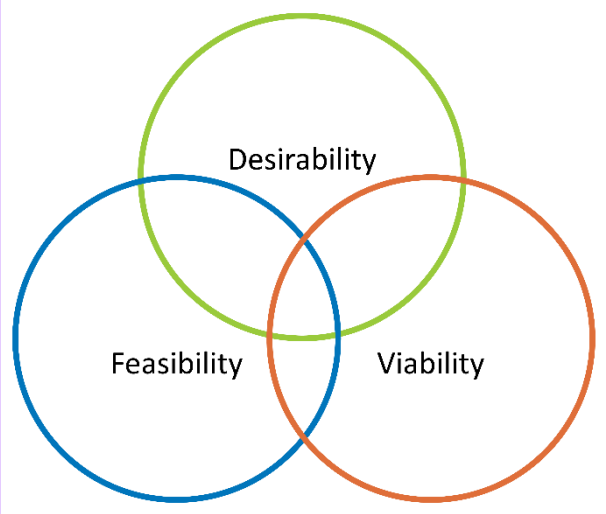


Figure 15 To be suitable, adaptation measures need to be desirable for use at a historic place, operationally feasible and economically viable.

For this, we will explore the following queries:

- Feasibility
  - Complexity: How complex is the design and implementation process?
  - Expertise / knowledge: Is the required expertise / knowledge available?
  - Responsible organisation: Who would be the person / organisation principally responsible for the implementation?
- Viability
  - Investment cost: How much would the implementation cost?
  - Operation cost: How much would operation and maintenance cost?
  - Time frame: When could or should the measure be implemented and how long would the implementation take?

As this is a first appraisal, we are interested in answers giving us rough indications. We are not seeking precise responses. For most queries, we will respond with given options of answers. We can record our appraisal in Table 64.

Feasibility and viability assessment of adaptation measure		
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*		
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*		*for example, in 30 years or in 2070 or when the first river flood reaches the building*

Table 64 This table records any anticipated impacts on the cultural significance an implementation of the adaptation measure investigated would have.

Barriers and limits

We should also identify barriers and limits. These are restrictions, which might prevent the implementation of the adaptation measure, and can relate to individuals, organisations and governments. Restrictions, which can be overcome, are barriers. A limit is something that cannot, without unreasonable action or expense, be overcome.

The restrictions can include:

- Individual
  - Lack of understanding or knowledge about climate change science
- Organisational
  - Capacity gaps
  - Uncertainty about the risks
  - Limited local information
  - Limited financial resources
  - Decision-making culture of the organisation
  - Lack of leadership
- Governmental
  - Regulatory and institutional frameworks
  - Legal uncertainty
  - Organisational buy-in and leadership
  - Community context

We can list the restrictions applicable in Table 65, which also helps us to identify mitigation activities to overcome the restriction and establish if the restriction is a *barrier* or a *limit.*

Barriers and limits		
Restrictions *Identify restrictions which might prevent the measure's design and implementation*	**Mitigation activities** *Identify activities to overcome the restriction*	**Barrier or limit?**
		☐ barrier ☐ limit
		☐ barrier ☐ limit

Table 65 This table records any restrictions to the implementation of the adaptation measure and associated activities to overcome the restrictions. If no mitigation activities can be identified to overcome a restriction, this restriction is referred to as a limit. *Otherwise a restriction is called* barrier.

If we have identified any limits, we can no longer consider the measure suitable and should strike it with a comment from the Adaptation Register.

Prerequisites, maladaptation and dependency

Finally, we should consider prerequisites for a measure, the possibility that the measure might be considered maladaptation in future, and any dependencies of multiple measures.

Prerequisites are any activities and conditions required to design or implement the measure investigated. For example, if we have previously identified the measure as costly, a funding plan might be sensible. A complex measure might require, as a precursor, a feasibility study. And, secondly, we will consider if multiple adaptation measures might depend on each other

Maladaptation is "an action that may lead to increased risk of adverse climate-related outcomes"[5] and can result in unintended negative impacts. An adaptation measure might, for example, prevent the installation of another at a later point in time.

And by dependencies, we refer to combinations of adaptation measures, which might benefit or influence each other and should therefore be considered together or at least in relation to each other.

We can record our investigation into prerequisites, maladaptation and dependencies in Table 66.

Prerequisites, maladaptation and dependencies	
Prerequisites *Identify any activities or conditions required to design and implement measure*	
Maladaptation *Identify how, in future, the measure might hinder the implementation of other measures*	
Dependencies *List any measure(s) which could be beneficially combined with the measure investigated*	

Table 66 This table records any anticipated impacts an implementation of the adaptation measure would have on the cultural significance.

[5] IPCC, 2014. Annex II: Glossary. [Agard, J., and El. L. F. Schipper (eds.)]. In: *Climate change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and sectoral aspects. Contributions of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. [Field, C. B., et al., pp 833-868. Available online: https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-AnnexII_FINAL.pdf (accessed 01 May 2020).

Example Ballinskelligs Abbey: Feasibility, viability etc.

If using the Advanced Plus level, we could now investigate the feasibility and viability of (select) measures listed in the summary of the *Adaptation Measures Register* (Table 63). We do this, for example for the adaptation measure #1/P1 (Impact & Measure ID), namely 'Boulders or ramp in front of sea wall', by responding to the queries in Table 65.

Feasibility and viability assessment of adaptation measure	
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

Table 67 Assessment of feasibility and viability of Adaptation Measure #1/P1, namely 'Boulders or ramp in front of sea wall'

Barriers and limits, prerequisites, maladaptation and dependencies

If using the Advanced Plus level, we could explore further any specific adaptation measure with regard to implementation barriers or limits, prerequisites for the measure's implementation and the measure's potential for maladaptation and dependencies (Table 68).

Barriers and limits		
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 and dependencies		
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	

Table 68 Table recording for the example of Ballinskelligs Abbey for the Adaptation Measure #1/P1, potential barriers / limits, prerequisites, maladaptation and dependencies

Advanced Plus Level: Developing Adaption Pathways

Pathways approach

'A pathways approach to adaptation planning is about keeping options open and thereby avoiding path dependency and lock-in. It provides structure and guidance to help incorporate flexibility into adaptation planning. It can reduce unnecessary expenditure, preventing organisations from being locked into actions that may not be the best solutions for what is a long-term problem. Under the approach, rather than determining a final outcome or decision at an early stage, decision makers are able to build a strategy that will follow changing circumstances over time. The approach acknowledges that while not all decisions can be made now, they can be planned, prioritised and prepared for. It is a useful approach for dealing with uncertainty, especially in cases where the uncertainty may reduce over time, for example with improvements in estimates of future local sea-level rise.'[6]

Create pathways map

Displaying pathways in diagrammatic form as a map can help visualise, for the purpose of stakeholder communication and engagement, adaptation options and their potential implementation dates. You might want to organise a stakeholder workshop to develop such a pathways map. (Figure 16)

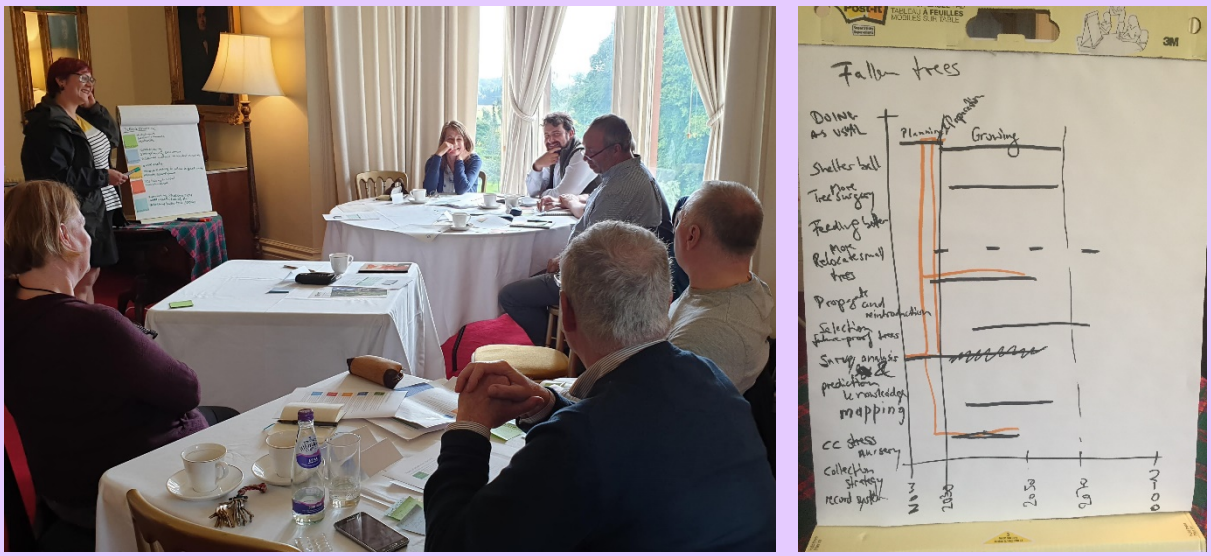


Figure 16 As part of the project Adapt Northern Heritage, a stakeholder workshop took place in 2019 at the Threave Estate, a historic place of the National Trust for Scotland (see left photo). Jointly, the stakeholders produced in discussion an adaptation pathways roadmap for the place's arboretum (see right photo).

[6] NCCARF, 2017. *CoastAdapt: A changing climate in coastal Australia: Build knowledge, take actions*. Available from: https://coastadapt.com.au/ (accessed 01 May 2020)

To create a pathways roadmap, as shown in Figure 6 as an example[7], list on the vertical axis at the top the option "No change". This option will be our starting point. Underneath this option, list, one by one, all the adaptation measures identified in the Adaptation Measure Register. Each created Adaptation Measures Card should now be listed on the vertical axis.

Next, we define the left end of our horizontal axis at the intersection with the vertical axis, as "now". Working our way through each adaptation measure listed, we will mark all implementation time points or periods. To do this, we will sort our Adaptation Measures Card by starting dates in the identified time frames. Starting with the ones in the nearest future, add the relevant year(s) to the horizontal axis and mark next to listed measure a point for a time point and a line for a time period.

Where trigger points are being used, estimate the time period when the trigger event will occur and mark this period with a line in a different colour to the points and lines indicating absolute time points or periods. (Trigger points are not illustrated in the example in Figure 17.)

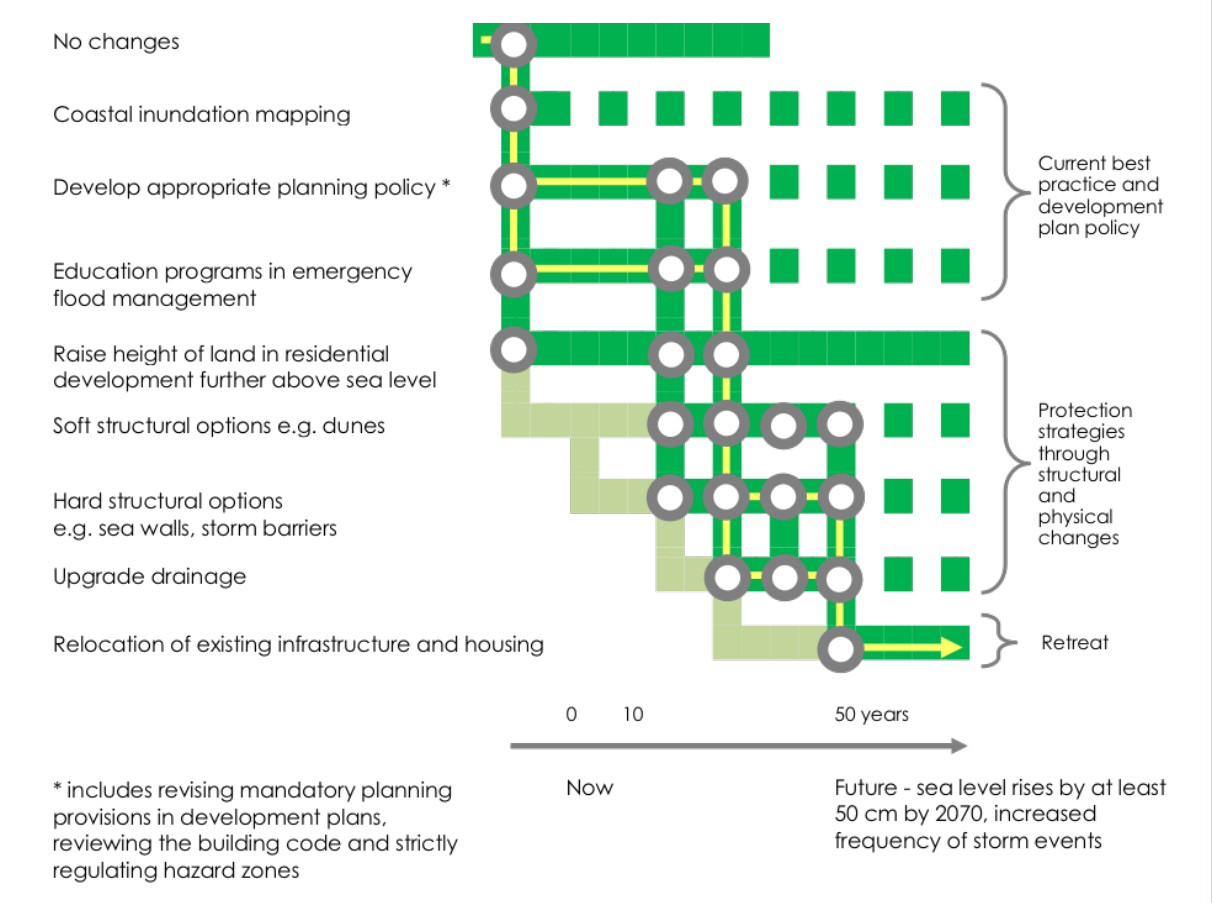


Figure 17 An example of an adaptation pathway roadmap concerned coastal adaptation to climate change. This example was taken from the Australian project CoastAdapt.

[7] Siebentritt, M., & Hall, N., 2017. *A comparative analysis of coastal adaptation decision-making approaches: The use of the pathways approach in CoastAdapt's C-CADS framework*. Available from: https://coastadapt.com.au/sites/default/files/factsheets/RR8_Pathways_analysis_0.pdf (accessed 01 May 2020)

Assessing pathways

Using expert knowledge and/or stakeholder engagement, assess the pathways now drawn on the map. Discuss the possible combination of adaptation options, creating on the map a system of horizontal and vertical roads between the different implementation dates. You can add further implementation dates for adaptation measures, as required and appropriate. The aim is not to produce an exact time plan, like a Gantt chart, but to use the evolving graphic to aid the discussion about options to arrange and prioritise the adaptation measures shortlisted – on their own, in combination or in competition. This way we can develop an understanding of our options to implement the measures over a longer period.

We will record the results of our discussion in a description narrative, using Table 69.

Assessment of pathways
Pathways roadmap
Insert here a single image / photograph of the produced pathways roadmap
Describe each of the created pathways
Name the preferred pathway, stating the reasons for this preference
State the actions, resources and responsibilities needed to commence the implementation of the preferred pathway
Define timescale for the next review of the adaptation pathways, including reason

Table 69 In this table, we can record our produced pathways roadmap, by inserting an impact / photograph and summarising the results of the assessment of the roadmap, by responding to the queries listed in the table.

Example Ballinskelligs Abbey: Adaptation pathways

Assessment of pathways

Pathways roadmap

Insert here a single image / photograph of the produced pathways roadmap

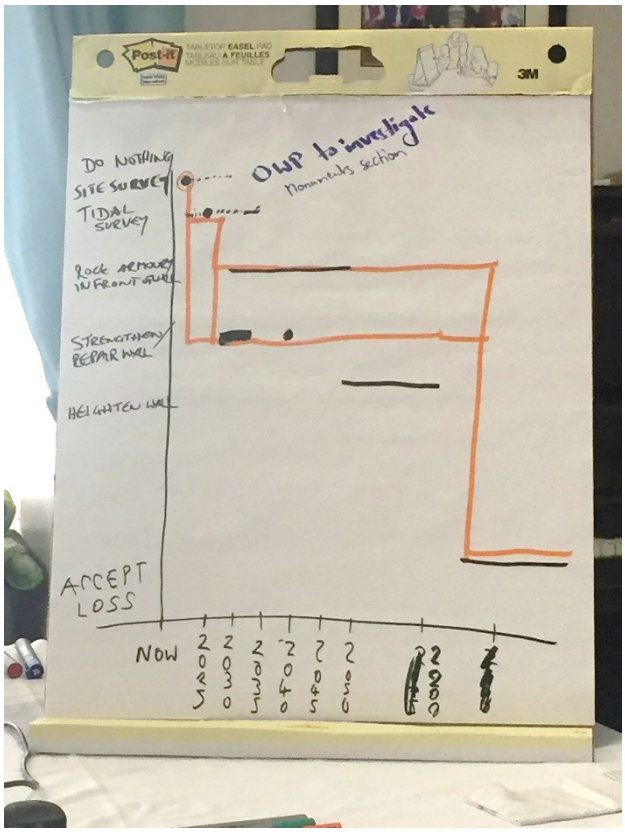


Figure 18

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.

Table 70 Assessment of Adaptation Pathway options for Ballinskelligs Abbey

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

Table 71 Continuation of Table 70, on the previous page


Define historic places
Establish hazards and impacts
Analyse and rate risks
Identify adaptation measures
Develop adaptation strategy
Risk management process

6 THE CLIMATE RISK MANAGEMENT PLAN

In this chapter, we will summarise our risk management assessment by collating the produced information into a *Climate Risk Management Plan*. We will firstly create a report cover, then collate the key tables from our assessment into an executive summary and, finally, append our *Hazard, Risk* and *Adaptation Measures Registers*. If we have been assessing groups of historic places or place categories, we will summarise the conclusions of our assessments of the various places or categories investigated.

By the end of this chapter, we will have created a *Climate Risk Management Plan*, which can be used to inform the future development of our historic place by helping to make informed decisions.

If using the Advanced Plus Level, we will also include our development of the Pathways Roadmap in our Climate Risk Management Plan.

Producing the Plan

The *Climate Risk Management Plan* is the final output of the risk management process described in this document. The plan summarises the results of the process and supports those detailing, implementing and monitoring adaptation measures for historic places. It is essentially a collection of the three registers produced in the course of the risk management process. The *Hazard, Risk and Adaptation Measures Registers* will, in the form of an appendix, be the backbone of our Plan. The plan's body will consist of summaries of these registers, fronted by a report cover and an executive summary (Table 72). All essential tables are provided in the Adapt Northern Heritage toolkit as the *Workbook for Risk Assessment and Adaptation Planning*.

Table 72 This figure illustrates the content outline of the Climate Risk Management Plan*, a report summarising the results of the risk management process described in this document.*

Report cover

As we have already produced registers and summaries for them in the previous sections, we only need to collate these and produce the report cover. This will look slightly different depending on whether we have assessed a *singular historic place*, a *group of historic places* or *categories of place elements*. The first part of the report cover will state the name of the place / group / categories, to which we can add a single photograph, representing the place / group / categories assessed in the report.

☒ Singular historic place
Name of place
Insert a single photograph here, representing the historic place assessed in this report
Figure 1 ….

Table 73 This table is the first part of our Climate Risk Management Plan*, if we have been assessing a* singular historic place*. We can add a single photograph, representing the historic place assessed in the report. (The grey table cells are a data transfer from Table 3.)*

☒ Group of historic places
Name of group
Insert a single photograph here, representing the group of historic places assessed in this report
Figure 1 ….

Table 74 This table is the first part of our Climate Risk Management Plan*, if we have been assessing a* group of historic places*. We can add a single photograph, representing the group of historic places assessed in the report. (The grey table cells are a data transfer from Table 4.)*

☒ Place categories

Name of assessment
Insert a single photograph here, representing the place categories assessed in this report *Figure 1 ….*

Table 75 This table is the first part of our Climate Risk Management Plan*, if we have been assessing* categories of historic places*. We can add a single photograph, representing the place categories assessed in the report. (The grey table cells are a data transfer from Table 5.)*

The second part of the report cover states the names and affiliations of the assessors – the people who have applied this risk management process and produced the *Climate Risk Management Plan*. We should also state the version number and date of completion of the assessment, if the assessment was made using the Standard or Advanced Level and add any comments regarding the preparation of the *Climate Risk Management Plan*, such as acknowledging the stakeholders involved in the process. We can record this information in Table 76.

Assessment details	
Names and affiliations of the assessors	
Version number of the assessment	
Date of completion of the assessment	
Assessment type	☐ Standard Level ☐ Advanced Level
Comments on assessment process	

Table 76 In this table, we can record the assessors of the Climate Risk Management Plan*, its version number, completion date and assessment type. We can also record any comments regarding the plan's preparation.*

Executive summary

The executive summary of our *Climate Risk Management Plan* consists of key tables summarising the information used in the risk management process. throughout the previous chapters, including an *Overview Historic Place*, the *Risk Register Summary* and the *Summary of Adaptation Measures Register*. These overview tables simply display already gathered information. If using G*roups of Historic Places* or P*lace Categories,* we will have several of these overviews.

If we have been using the Advanced Level, we will also add information about our strategic planning using a *Pathways Roadmap*.

Appendices

We will conclude the *Climate Risk Management Plan* by appending any of the final versions of our *Hazard, Risk and Adaptation Measures Registers*, so that, if needed, the assessment details and process are available for future reference.

To help visualise the finalised plan, the *Climate Risk Management Plan* for Ballinskelligs Abbey, used in this guide as example, is available in full on the project's website.

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