

Climate Change Adaptation Report 2024



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Executive Summary

Highlands and Islands Airports Limited (HIAL) is responsible for 11 regional airports serving some of Scotland's most remote communities.

This Climate Change Adaptation Report summarises a climate vulnerability and risk assessment (VRA) of HIAL's operations, infrastructure, and strategic functions in response to the fourth round of UK adaptation reporting administered by the Department for Environment, Food and Rural Affairs (Defra).

The aviation industry is highly sensitive to climate-related hazards and resultant climate vulnerabilities which have the potential to cause severe disruption to airport operations and delays for passengers. Safety is of paramount concern to the aviation industry and the industry has, and continues to, facilitate the development of mitigations gained from experience in extreme weather across the world to minimise impacts to safety.

The most recent Intergovernmental Panel on Climate Change (IPCC) assessment report states that countries nationally determined contributions make it likely that warming will exceed 1.5°C during the 21st century, with every additional increment of global warming increasing the severity of extreme events.¹

Previously, the latest UK climate projections suggested that, even under a stringent greenhouse gas emissions reduction scenario, a degree of physical climate risk is now scientifically inevitable. HIAL's airports support essential air connectivity for businesses and communities across its operating area. Therefore, it is essential that HIAL's operations, infrastructure, and strategic functions are resilient to climate variability and change.

The VRA systematically establishes and interacts ratings of the components of climate risks in accordance with the IPCC's definitions of terms. First, climate sensitivities and associated adaptive capacities were rated in order of climate vulnerabilities. The magnitude and frequency of exposure of climate vulnerabilities to climate-related hazards was then rated to determine the scale of potential climate impacts and in combination with their likelihood resulted in ratings of climate risks.

The VRA addresses people, assets, and services associated with each of HIAL's 11 airports. The airport runways at Barra, Benbecula, Dundee, Islay, Stornoway and Sumburgh are most at risk from climate-related hazards, especially coastal flooding and the impacts of sea-level rise. This is not surprising given the coastal

nature of these airports. Airport aprons are also at risk but have much lower risk ratings than airport runways, with the exception of Barra Airport.

Terminal buildings across the HIAL estate are generally identified as 'medium impact, medium likelihood' risk ratings, where terminal buildings are often set back from the coastline or some distance from other key water sources and the main risk is of high temperatures causing passenger discomfort. However, Barra and Islay's airport terminal buildings were identified as higher risk ratings due to the impact of sea-level rise at Barra and heavy rainfall causing additional water ingress and surface flooding at Islay Airport.

Overall, 25-30 climate risks have been identified and categorised by climate variable for each HIAL airport in the standard risk assessment template.

As part of this climate change risk assessment, existing control measures as well as bespoke adaptation actions have been identified to mitigate the potential physical risks of climate change. These adaptation actions range from the enhanced review and ongoing monitoring of airport building control requirements to recording and monitoring incidents of climate-related hazards.

However, not all impacts associated with climate change should be considered as negative; changes arising from climate change can also present positive opportunities for HIAL, such as changes to destination choices with more people choosing to travel to Scotland's Highlands and Islands, and the potential for rainwater harvesting at airport sites.

With the complete risk assessment and underlying VRA, HIAL recognises the need to address climate change risks by embedding climate change adaptation into its risk governance processes, strategic business planning, existing risk management strategies and climate mitigation strategies.

¹ IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change. Contributions of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)] IPCC, Geneva, Switzerland.

Introduction

HIAL is a private limited company wholly owned by the Scottish Ministers and is responsible for the management and operation of 11 regional airports located at Barra, Benbecula, Campbeltown, Dundee, Inverness, Islay, Kirkwall, Stornoway, Sumburgh, Tiree and Wick John O’Groats.

HIAL’s mission is to enable air connectivity and support lifeline services for the communities we serve through a network of safe and sustainable airports. This is reinforced by our ambition to become a net zero regional airport group.

HIAL’s airports are an essential element of Scotland’s transport network supporting essential air connectivity for business and communities across its operating area. Almost 1.5 million passengers travelled through HIAL’s airports in 2022/23 with just under 104,000 aircraft movements.

This Climate Change Adaptation Report summarises a climate VRA conducted for each of HIAL’s 11 airports. This report highlights the highest climate change risk ratings for each airport. The risks and opportunities identified in this report will inform HIAL’s existing risk management processes to ensure that HIAL’s climate change adaptation response remains appropriate and effective.

1.1. Climate Change Overview

The most recent assessment report from the Intergovernmental Panel on Climate Change (IPCC) states that “Global greenhouse gas emissions in 2030 implied by nationally determined contributions (NDCs) announced by October 2021 make it likely that warming will exceed 1.5°C during the 21st century and make it harder to limit warming below 2°C. With every additional increment of global warming, changes in extremes continue to become larger.”² Previously, the latest UK Climate Projections 2018 (UKCP18) suggested that even under a stringent greenhouse gas emissions reduction scenario, a degree of physical climate risk is now scientifically inevitable. It is projected that in the UK there will be an increase in warmer, wetter winters and hotter, drier summers as well as increased frequency and magnitude of extreme weather events.

In line with our two-year review cycle any future adaptation requirements will be assessed using a risk-based approach and presented to the HIAL Board for approval.

Historically, weather-related disruption is an issue that HIAL has had to manage on a regular basis, and climate-related hazards will not be a new challenge. Adverse weather plans already exist for each of the 11 airports and climate-related impacts identified through this assessment will need to be incorporated into existing policies.

Crisis and contingency planning are managed via a tactical response defined by gold, bronze, silver, and command response management teams. Control meetings at each level are determined by defined criteria with crisis management teams drawn from suitable experienced staff for each command level.

1.2. Approach to Climate Change Risk at HIAL

HIAL has a well-established risk management and assessment process that encompasses various risk categories, including weather-related disruptions. Climate risks identified in the standard risk assessment template, underpinned by the completed VRAs, will be included in the appropriate departmental risk register and managed through HIAL’s established risk management process and procedures.

² IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change. Contributions of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)] IPCC, Geneva, Switzerland.

Establishing a Climate Baseline

To understand climate risks, historical observations of climate-related hazards were reviewed to establish a baseline. This informed the assessment of HIAL’s existing vulnerability to climate-related hazards.

2.1. Climate Baseline

The climate across Scotland's Highlands and Islands is classified as temperate with rainfall throughout the year. Given that HIAL's airports are spread across a wide geographical area, regional climate variations do exist. The climate of western Scotland (where Barra, Benbecula, Campbeltown, Islay and Tiree airports are located) is much milder than that of eastern Scotland (Dundee and Inverness) due to the strong influence of the warmer Gulf Stream for example.

With winds mainly blowing from the sea, annual mean temperatures on the west coast are in the range of 9.5 to 9.9°C. Annual mean temperatures in northern Scotland (where Kirkwall, Stornoway and Wick John O’Groats regional airports are located) tend to fall due to altitude. The lowest annual mean temperatures for low lying areas in the UK is about 7°C in the Shetlands (Sumburgh Airport).

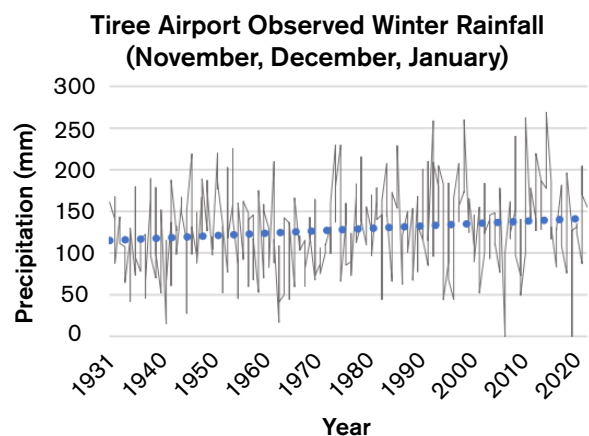
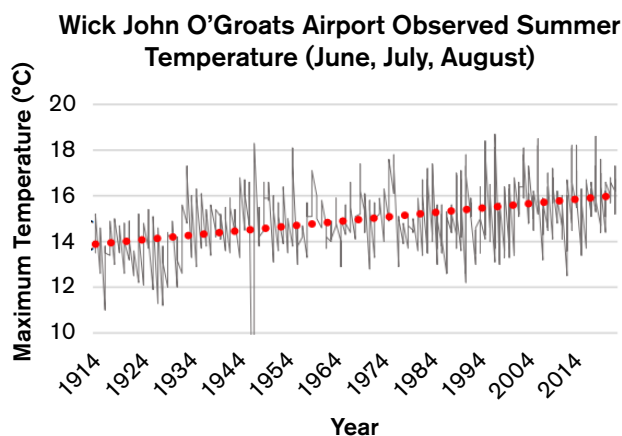
Appendix 1 details average annual maximum and minimum temperatures across HIAL and various climate baseline years.

2.2. Historical Observations of Climate Change

Over the last few decades, Scotland has experienced a warming trend, shifting rainfall patterns and rising sea levels. Scotland’s 10 warmest years on record have all occurred since 1997 and the average temperature in the last decade has been around 0.7°C higher than the 1961-1990 average.³

Evidence of warming trends can already be seen across many HIAL airports. As an example, Figure 1 shows observed summer temperatures at Wick John O’Groats Airport since 1914, utilising historic data from the airport weather station provided by the Met Office.⁴ There is also evidence of increasing rainfall across Scotland in the past decade, with an increasing proportion coming from heavy rainfall events. Over the last decade, the average year has been 9% wetter than a 1961-1990 baseline. Again, evidence of this can already be seen across many HIAL airports by assessing historic weather station data. On average, Tiree Airport has seen an increase in winter rainfall from ca.110mm in 1930 to ca. 150mm today.

Figure 1: Examples of changing climate at Wick John O’Groats and Tiree airports.



³ Adaptation Scotland, 2021. Climate Projections for Scotland Summary. ⁴ Historic station data, 2023. Available here: [Historic station data – Met Office](#).

Establishing Future Climate Projections

The UK Climate Projections 2018 (UKCP18), provided by the Met Office Hadley Centre Climate Programme, were used to assess future climate risks.

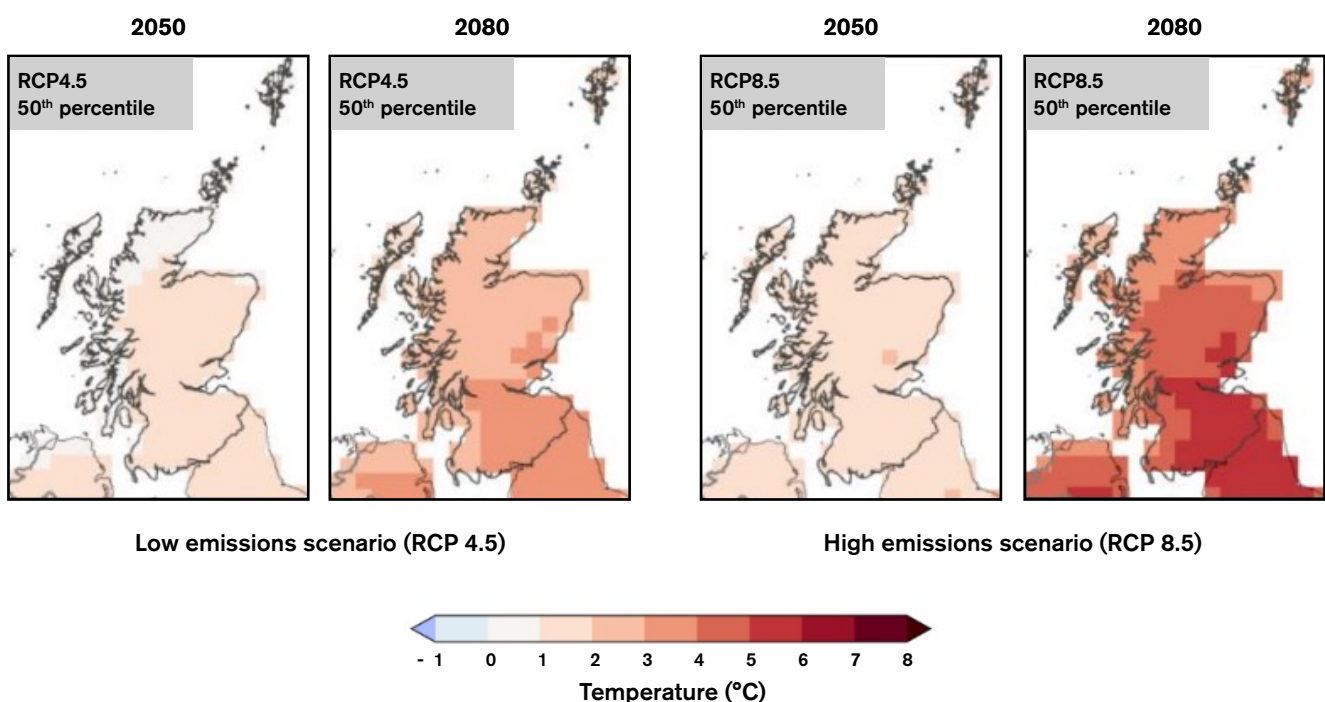
UKCP18 uses cutting-edge climate science modelling and probabilistic projections to provide the most up-to-date assessment of how the UK's climate will change up to 2100 under several emissions scenarios. Although multiple emissions scenarios are available within the UKCP18 tool, for the purpose of this analysis two emissions scenarios (identified by the IPCC as Representative Concentration Pathways) have been used: RCP 4.5, the most probable baseline emissions scenario, which represents a 2.4°C global mean surface temperature increase; and RCP 8.5, a high emissions scenario, which represents a 4.3°C global mean surface temperature increase.

3.1. Temperature

Historic observations of temperature show an annual warming across Scotland (see Appendix 1), which is projected to continue. UKCP18 climate projections indicate that there will be an increase in both summer and winter temperatures across Scotland. UKCP18 climate projections for mean summer temperature under RCP4.5 are projected to increase by 0.8°C by the 2050s and by 1.6°C by

the 2080s. Under RCP8.5, mean summer temperatures are expected to rise by 1.1°C by the 2050s and by 2.4°C by the 2080s. Variations in UKCP18's regional projections are that summer warming will be greatest on the west coast of Scotland, i.e., in the vicinity of Barra, Benbecula, Campbeltown, Islay and Tiree airports.

Figure 2: UKCP18 mean summer temperature projections in 2050 and 2080 under RCP4.5 and RCP8.5 compared to the 1981 – 2000 baseline.



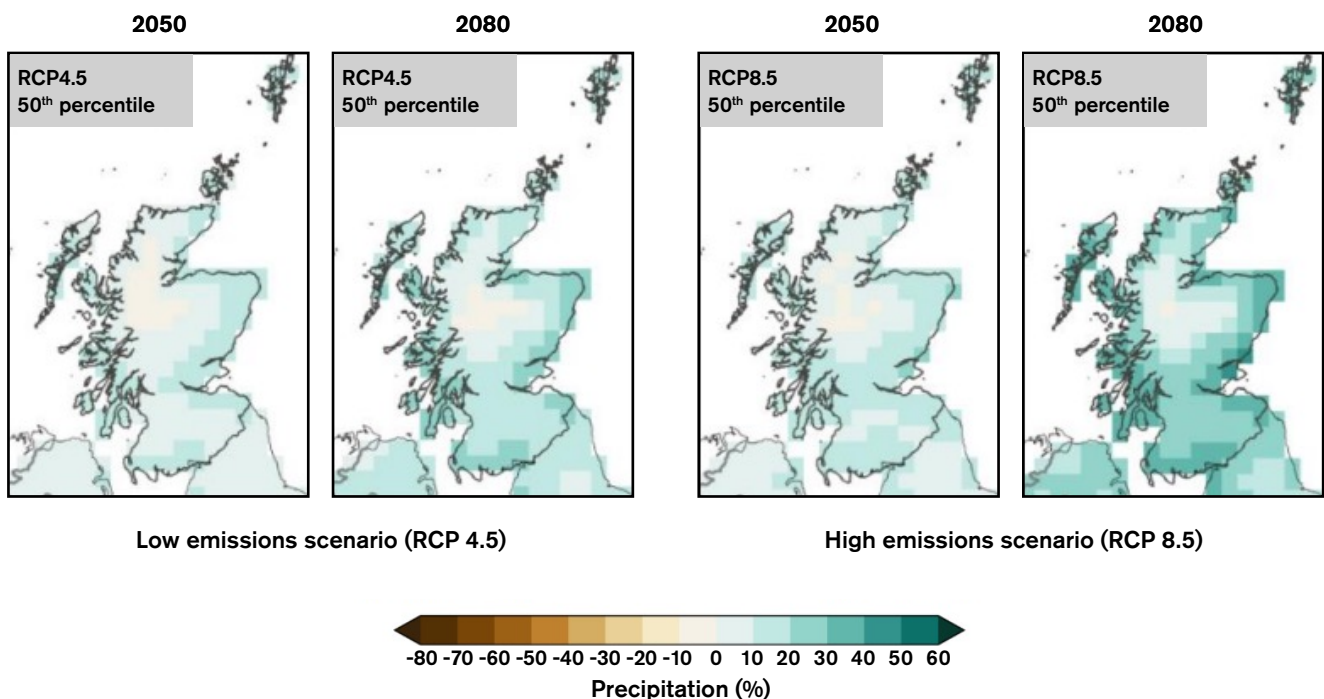
Establishing Future Climate Projections

3.2. Precipitation

Historic observations of precipitation show high levels of variability trending towards warmer, wetter winters. Under UKCP18 projections, both summer and winter rainfall are expected to increase across Scotland. UKCP18 projections for mean winter precipitation across Scotland under RCP4.5 are projected to increase by 8% by the 2050s and 11% by the 2080s. Under RCP8.5, winter

precipitation is expected to increase by 10% by the 2050s and 18% by the 2080s. Regional variations project that increases in winter precipitation will be greatest on the Orkney and Shetland islands where HIAL's Kirkwall and Sumburgh airports are located. Although Scotland's winter temperatures are projected to increase, cold and snow events remain a possibility.

Figure 3: UKCP18 mean winter precipitation projections in 2050 and 2080 under RCP4.5 and RCP8.5 compared to the 1981 – 2000 baseline.



Establishing Future Climate Projections

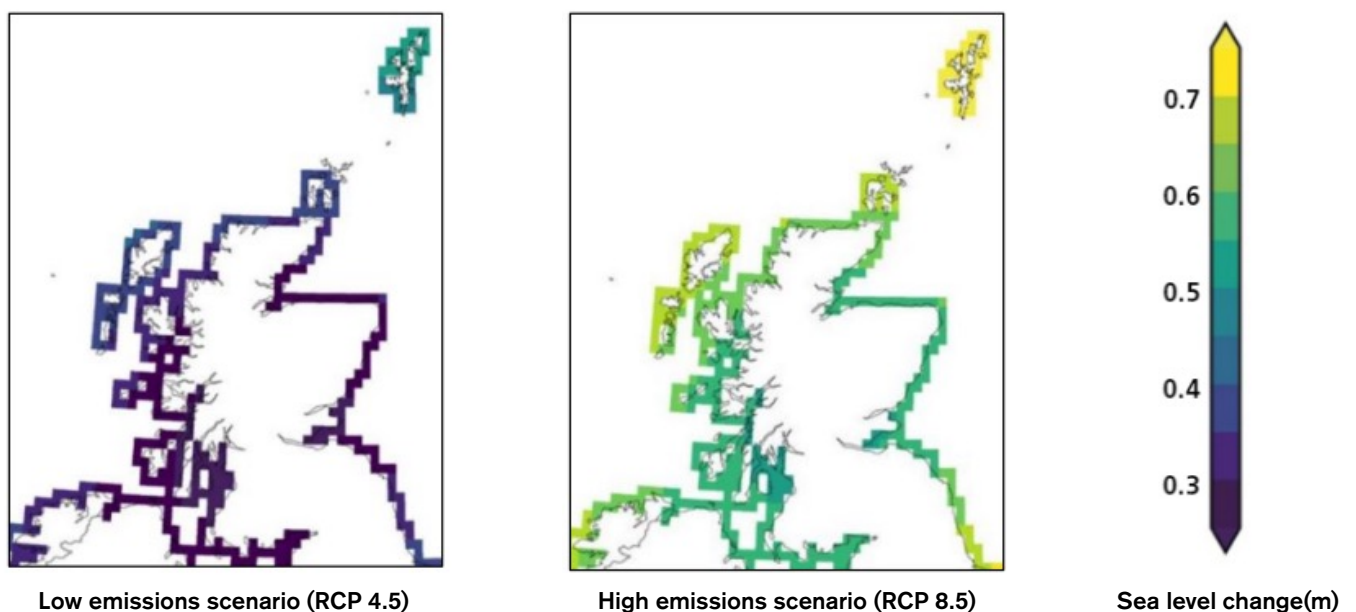
3.3. Storms, lightning and wind

UKCP18 projections indicate an increase in near-surface wind speeds across Scotland for the second half of the 21st century in winter. However, the projected increase in wind speed is modest compared to natural variability, so confidence is low. Warming water in the North Atlantic could potentially increase the likelihood of ex-tropical storms being directed across the UK during autumn but other factors also influence the frequency and magnitude of storms across the UK, which vary significantly each year. Scotland's weather is likely to remain variable with more extreme weather events likely to occur with climate change.

3.4. Sea-level rise

Sea levels around Scotland's coastline are projected to rise in the decades ahead, increasing flooding and coastal erosion. There are regional variations in projected sea-level rise, primarily due to vertical land movement caused by glacial rebound from the last ice age. Under RCP4.5, sea level is projected to rise by 0.3-0.4m by 2100 and 0.5-0.6m surrounding the Shetland Islands. Under RCP8.5, sea level is projected to rise by 0.5 to 0.6m, and by more than 0.7m surrounding the Shetland Islands compared to a 1981-2000 baseline. Sea level rise projections provided under UKCP18 are considered the most likely range of change, however the possibility of sea level rise outside of this range cannot be ruled out.

Figure 4: UKCP18 median projected sea level rise around Scotland's coast by 2100 under RCP4.5 and RCP8.5 emissions scenarios compared to the 1981 – 2000 baseline.



Airport Vulnerability and Risk Assessment

The VRA addressed people, assets, and services associated with each of HIAL's 11 airports.

A desk-based review of the best available evidence was conducted by environmental consultancy Ricardo Energy and Environment, which was validated and supplemented by two workshops held with airport managers from each of HIAL's airports to identify and rate climate vulnerabilities, risks and adaptation options.

The VRA systematically established and interacted ratings of the components of climate risks in accordance with the IPCC's definitions of terms (see below).

First, climate sensitivities and associated adaptive capacities were rated in order to rate climate vulnerabilities. The magnitude and frequency of exposure of climate vulnerabilities to climate-related hazards was then rated to determine the scale of potential climate impacts and in combination with their likelihood resulted in the overall ratings of climate risks reported in the airport risk assessment templates.

IPCC definition of key terms

Sensitivity

Degree to which a system or species is affected, adversely or beneficially, directly or indirectly, by climate variability or change.

Adaptive capacity

Ability of systems, institutions, humans, and other organisms to adjust to potential damage, take advantage of opportunities, or respond to consequences.

Vulnerability

Propensity or predisposition to be adversely affected. Vulnerability encompasses sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Hazard

Potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.

Exposure

The presence of people, livelihoods, species or ecosystems, environmental functions, services and resources; infrastructure or economic, social or cultural assets in places and settings that could be adversely affected.

Impact

The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather and climate events), exposure, and vulnerability.

Risk

Results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence.

Airport Vulnerability and Risk Assessment

4.1. Terminal Buildings

HIAL's terminal buildings are sensitive to climate-related hazards. The majority of HIAL's terminal buildings (Benbecula, Campbeltown, Dundee, Inverness, Kirkwall, Stornoway, Sumburgh, Tiree and Wick John O'Groats) were given a risk rating of 3 - medium impact, medium likelihood. Terminal buildings are sensitive to high temperatures where no air conditioning is present in the terminal building, which is the case for all airports except Dundee and Inverness.

Heavy rainfall is another key climate sensitivity and may cause surface flooding and water ingress. HIAL's terminal buildings are well designed, comply to strong building regulations and are subject to frequent risk assessments. This suggests that HIAL's terminal buildings are generally able to adjust or respond within existing climate limits, but major challenges may be presented beyond them.

Impacts of increasing exposure to climate-related hazards include passenger discomfort due to high temperatures, an increasing number of health and safety incidents and greater energy demand for cooling systems with increasing financial costs and GHG emissions.

Table 1: VRA risk ratings for terminal buildings across HIAL regional airports

| Airport | Impact Rating | Probability of Impact | Risk Rating |
|----------------------------|---------------|-----------------------|-------------------------------------|
| Barra Airport | High | Medium | 4. High impact, medium likelihood |
| Benbecula Airport | Medium | Medium | 3. Medium impact, medium likelihood |
| Campbeltown Airport | Medium | Medium | 3. Medium impact, medium likelihood |
| Dundee Airport | Medium | Medium | 3. Medium impact, medium likelihood |
| Inverness Airport | Medium | Medium | 3. Medium impact, medium likelihood |
| Islay Airport | High | High | 4. High impact, high likelihood |
| Kirkwall Airport | Medium | Medium | 3. Medium impact, medium likelihood |
| Stornoway Airport | Medium | Medium | 3. Medium impact, medium likelihood |
| Sumburgh Airport | Medium | Medium | 3. Medium impact, medium likelihood |
| Tiree Airport | Medium | Medium | 3. Medium impact, medium likelihood |
| Wick John O'Groats Airport | Medium | Low | 3. Medium impact, low likelihood |

Airport Vulnerability and Risk Assessment

4.2. General Office Buildings and Air Traffic Control (ATC)

General office buildings and ATC towers across the HIAL estate may be sensitive to climate-related hazards. High temperatures may cause increasing staff discomfort and difficult working conditions, which may lead to increasing health and safety incidents and staff absence.

Office buildings and ATC towers at Barra, Dundee, Islay, Stornoway and Sumburgh are particularly at risk due to a lack of air conditioning units. HIAL staff can adjust or respond within existing climate limits, but minor challenges are presented beyond given UKCP18 projections indicating increasing exposure to high temperatures. Campbeltown, Kirkwall, Tiree and Wick John O'Groats have air conditioning units installed so will be less exposed to high temperatures and therefore have a low-risk rating.

4.3. Other Airport Buildings, Appliance Bays and Vehicle Storage

Several other secondary buildings are situated across each HIAL airport estate, and these provide critical operational airport functions including warehouse storage, generator cabins, appliance bays, vehicle storage, workshops, pumphouses etc. Most additional airport buildings are very sensitive to climate-related hazards, especially where high temperatures reduce the performance or result in failure of critical airport appliances (e.g. generators) or where heavy rainfall causes water ingress to key airport facilities.

Across HIAL's smaller and more remote island airports (Barra, Benbecula, Islay, Tiree), airport appliance and storage facilities are predominantly isolated single structures made of tin or metal and these buildings may be less resilient to severe or extreme weather events.



Airport Vulnerability and Risk Assessment

4.4. Airport Apron and Airport Runways

Given the coastal nature of the majority of HIAL's airports, airport aprons and runways may be highly sensitive to climate-related hazards. The VRA concluded that airport runways at Barra, Benbecula, Dundee, Islay, Stornoway and Sumburgh are at a high rating and Barra Airport is the only airport apron at very high risk due to its proximity to the shoreline.

Barra's beach runways are defined as extremely climate sensitive to sea level rise and coastal flooding. High temperatures also harden the natural beach runway surface and reduce natural drainage functionality, resulting in excess surface water and increasing algae. Flight times are varied with high tide and major challenges to adjust or respond within existing climate limits makes Barra's runways highly vulnerable. With UKCP18 climate projections indicating sea level rise of up to 0.6m by 2100 on the west coast of Scotland, there is potential for complete loss of Barra's runway with aircraft unable to land.

Dundee Airport has one runway of 1,400m in length adjacent to the shoreline. The runway is very sensitive to climate-related hazards despite a small coastal zone and airport road which provides a barrier to the shoreline. Dundee's runway is able to adjust within climate limits but major challenges are presented beyond these limits. Similarly, Benbecula, Islay, Stornoway and Sumburgh's runways are equally vulnerable to coastal flooding.

HIAL's airport runways are not just sensitive to sea level and coastal flooding; all airport runways are sensitive to surface damage caused by temperatures exceeding design standards resulting in melting and cracking of the runway surface. Higher temperatures can also cause land to dry out and become less permeable. Airport runways are designed to withstand temperature extremes and most of HIAL's runway operations can adjust or respond within existing climate limits with minor challenges beyond these limits.

Table 2: VRA risk ratings for airport runways across HIAL

| Airport | Apron Risk Rating | Runway Risk Rating |
|----------------------------|--------------------------------------|--------------------------------------|
| Barra Airport | 5. Very high impact, high likelihood | 5. Very high impact, high likelihood |
| Benbecula Airport | 3. Medium impact, medium likelihood | 5. Very high impact, high likelihood |
| Campbeltown Airport | 3. Low impact, medium likelihood | 3. Medium impact, medium likelihood |
| Dundee Airport | 3. Low impact, medium likelihood | 5. Very high impact, high likelihood |
| Inverness Airport | 3. Medium impact, medium likelihood | 3. Medium impact, medium likelihood |
| Islay Airport | 3. Low impact, medium likelihood | 4. High impact, medium likelihood |
| Kirkwall Airport | 3. Low impact, medium likelihood | 3. Medium impact, medium likelihood |
| Stornoway Airport | 3. Low impact, medium likelihood | 4. High impact, medium likelihood |
| Sumburgh Airport | 3. Low impact, medium likelihood | 4. High impact, medium likelihood |
| Tiree Airport | 3. Low impact, medium likelihood | 3. Medium impact, medium likelihood |
| Wick John O'Groats Airport | 3. Low impact, medium likelihood | 3. Medium impact, medium likelihood |

Airport Vulnerability and Risk Assessment

4.5. Fire Station and Emergency Services

HIAL's Airport Fire Service (AFS) carries out a variety of duties over and above firefighting. These include daily inspections of the runway, maintenance of the airfield, de-icing, snow clearance, parking of aircraft and delivery of first aid. The service provided by airport fire colleagues across HIAL may be sensitive to climate-related hazards, especially where fire risk is likely to increase due to extreme temperatures, frequent periods of drought and increasing lightning following extreme weather events. Extreme temperatures may also increase emergency service utilisation due to increasing incidence of heat-related illnesses. By its nature, the AFS has strong capabilities to deal with increased fire risk and the AFS is most likely able to adjust or respond regardless of climate, making it somewhat resilient to future climate hazards.

Some locations, such as Barra and Islay, are more exposed to extreme heat and increased fire risk as the airport site is remote and often surrounded by vegetation and grassland which can be extremely problematic in drought conditions. Severe impacts include the service's inability to cope with an increasing demand for services as fire risk increases. Fire Training Grounds (FTG) across HIAL airport sites may be sensitive to climate impacts, reducing the AFS's ability to respond and disrupting training sessions. For example, at Dundee Airport, FTG facilities are located close to the shoreline and are vulnerable to sea level rise and coastal flooding.



Climate Change Risk Assessment and Adaptation Actions

As part of the risk assessment, existing control measures or strategies and additional actions required to adapt to the potential physical risks of climate change have been identified.

5.1 Adaption Actions

At the second workshop, stakeholders were advised that adaptation actions should seek to reduce vulnerabilities by reducing climate sensitivity or increasing adaptive capacity. They were advised that options might include the development and management of operational strategies, infrastructural changes, or capacity-building. They were also guided that some options might involve adjusting (climate-proofing) current activities, whilst other options might be new, or require major transformations in, airport operations.

The key adaptation actions can be themed as:

- Review conditions regularly and ensure optimal conditions are maintained.
- Record and monitor incidents of climate-related hazards through a central log.
- Enhance review and monitoring of building control requirements e.g. heating, ventilation and air conditioning.
- Ensure future building and infrastructure design considers and manages risks from climate change.
- Ongoing engagement with interdependent stakeholders.
- Continuous review and update of adverse weather and contingency plans.
- Improve programme and build evidence for monitoring tidal variation and coastal erosion.

5.2. Climate Change Opportunities

Not all impacts associated with climate change should be considered as negative; changes arising from climate change can also present positive opportunities for HIAL. The opportunities discussed and identified through the adaptation workshops were:

- Changes to destination choices: with warmer weather projected across Scotland's Highlands and Islands, and increasing heat stress impacting overseas travel, more tourists may visit Scotland.
- Reduced requirement to heat airport buildings: warmer winter temperatures predicted under the UKCP18 are likely to shorten the time when heating is required in airport buildings. This will reduce energy costs as well as greenhouse gas emissions.
- Potential for rainwater harvesting at airport sites: with precipitation set to increase under UKCP18 projections across the Highlands and Islands, rainwater harvesting could act as a potential opportunity, especially for remote islands such as Barra or Benbecula where freshwater may become scarce.

Climate Change Risk Assessment and Adaptation Actions

5.3. Interdependencies

Through completion of the VRA and airport standard risk assessment template, several interdependencies and stakeholders were identified.

- **Island residents and businesses:** HIAL supports essential air connectivity for residents and businesses across Scotland's Highlands and Islands.
- **Local authorities:** Local authorities have a crucial role to play in the climate change agenda in both delivering adaptation strategies devised from national agendas (Adaptation Scotland) as well as co-ordinating bottom-up action in their role as community leaders.
- **Road networks:** As well as passengers and HIAL colleagues travelling to the airports, supplies such as fuel, de-icer are dependent on road networks to and from the airport.
- **Energy and water suppliers:** HIAL airports require a stable supply of energy and water to operate and are dependent on suppliers to ensure that their infrastructure is adequate to meet future climate changes.
- **Scottish Environmental Protection Agency (SEPA):** SEPA plays a key role in managing and mitigating Scotland's flood risk at the local and national level. SEPA also plays a key role in managing and mitigating water quality and pollution risk, such as de-icer pollution from airport run off.
- **Scottish and UK Government:** HIAL policies must align and support national climate objectives, especially given that HIAL operates under the Public Service Obligation.

5.4. Uncertainties

The risk assessment and underlying VRA has been completed using UKCP18, the most up to date climate model available provided by the UK Met Office. As our understanding and ability to simulate climatic changes is advancing, it is important to recognise that climate models cannot fully represent all of the features in the present-day climate. There are still several limitations and uncertainties associated with our ability to project 21st century weather and climate; and it is important to remember that climate projections should not be misinterpreted as climate predictions.

The scientific community adopts the term projections rather than predictions, when describing future changes in climate, as projections involve assumptions in parameters, e.g. future socio-economic and technological developments, and are therefore subject to substantial uncertainty.

All future modelling simulations are conditioned on a limited number of representative concentration pathways (RCPs) and projections are strongly dependent on future global greenhouse gas emissions.

While global projections provide a range of climate futures, they cannot cover all potential future climate outcomes. For this reason, UKCP18 uses probabilistic projections where probabilities represent an indication of how much the evidence from models and observations taken together support a particular future climate outcome.

Appendix 1: Average Annual Maximum and Minimum Temperatures Across HIAL Airports

Table 3: VRA risk ratings for airport runways across HIAL

| Airport | Closest Weather Station | 1961-1990 | | 1971-2000 | | 1981-2010 | | 1991-2020 | |
|--------------------|----------------------------|-----------|-----|-----------|-----|-----------|-----|-----------|-----|
| | | Max | Min | Max | Min | Max | Min | Max | Min |
| Barra | Barra Airport | 11.3 | 7.1 | 11.6 | 7.3 | 11.9 | 7.5 | 12.1 | 7.7 |
| Benbecula | South Uist Range | 10.9 | 6.3 | 11.1 | 6.5 | 11.5 | 6.9 | 11.7 | 7.0 |
| Campbeltown | Machrihanish | 11.9 | 6.2 | 12.1 | 6.3 | 12.4 | 6.4 | 12.6 | 6.6 |
| Dundee | Myinefield | 11.8 | 5.0 | 12.1 | 5.2 | 12.4 | 5.3 | 12.8 | 5.4 |
| Inverness | Inverness | 11.9 | 5.4 | 12.2 | 5.6 | 12.5 | 5.6 | 12.7 | 5.7 |
| Islay | Port Ellen | 11.8 | 5.8 | 12.0 | 6.0 | 12.2 | 6.2 | 12.4 | 6.4 |
| Kirkwall | Kirkwall Airport | 10.2 | 5.1 | 10.5 | 5.3 | 10.7 | 5.5 | 11.0 | 5.8 |
| Stornoway | Stornoway Airport | 10.9 | 5.2 | 11.0 | 5.6 | 11.2 | 5.9 | 11.5 | 6.2 |
| Sumburgh | Lerwick | 9.2 | 4.8 | 9.3 | 5.0 | 9.6 | 5.3 | 9.8 | 5.6 |
| Tiree | Tiree Airport | 11.4 | 6.5 | 11.6 | 6.6 | 11.8 | 6.9 | 11.9 | 7.1 |
| Wick John O'Groats | Wick John O'Groats Airport | 10.4 | 4.8 | 10.6 | 4.9 | 10.8 | 5.1 | 11.0 | 5.4 |
| HIAL | Average | 11.1 | 5.7 | 11.3 | 5.8 | 11.5 | 6.1 | 11.8 | 6.3 |
| Scotland | Average | 10.3 | 3.8 | 10.5 | 4.0 | 10.8 | 4.2 | 11.1 | 4.4 |

Appendix 2: Vulnerability and Risk Assessment

The following table is a summary of the Vulnerability and Risk Assessment. To view the full report [click here](#).

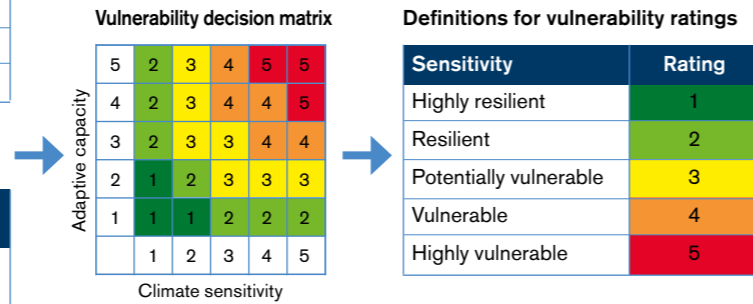
Vulnerability Rating:

Definitions for rating climate sensitivities

| Sensitivity (S) rating | Definition of ratings |
|------------------------|--|
| 1 | Insensitive to climate-related hazards |
| 2 | May be sensitive to climate-related hazards |
| 3 | Sensitive to climate-related hazards |
| 4 | Very sensitive to climate-related hazards |
| 5 | Extremely sensitive to climate-related hazards |

Definitions for rating adaptive capacities

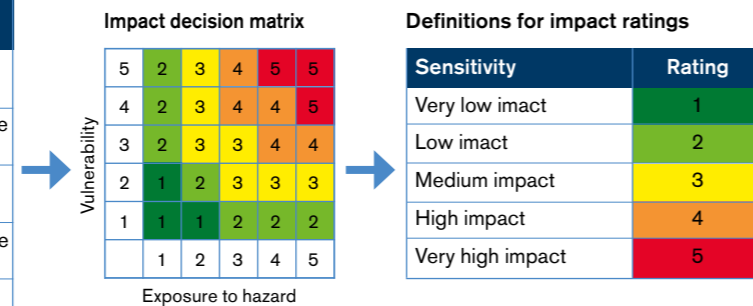
| Adaptive capacity (A.C) rating | Definition of ratings |
|--------------------------------|---|
| 1 | Major challenges to adjust or respond within existing climate limits |
| 2 | Minor challenges to adjust or respond within existing climate limits |
| 3 | Able to adjust or respond within existing climate limits but major challenges beyond them |
| 4 | Able to adjust or respond within existing climate limits but minor challenges beyond them |
| 5 | Able to adjust or respond regardless of climate |



Impact Rating:

Definitions for rating exposure

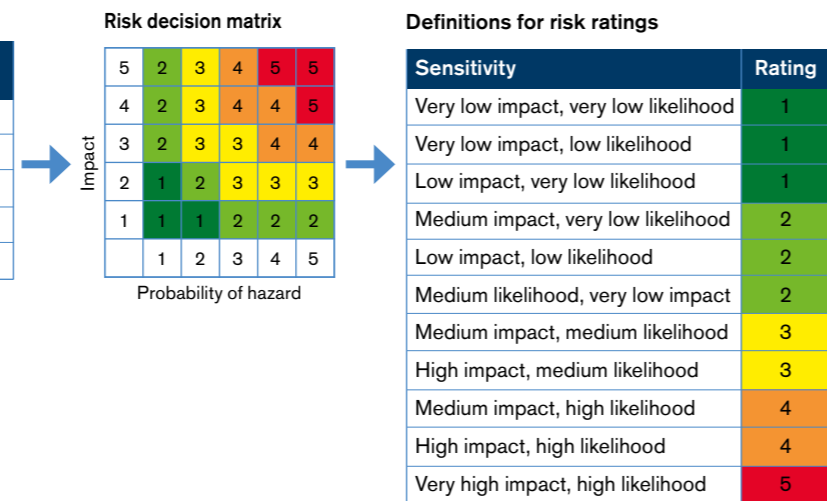
| Exposure (E) rating | Definition of ratings |
|---------------------|--|
| 1 | Asset with few or no units with little to no value is not exposed to the hazards |
| 2 | Asset with some or few units of moderate value has some exposure to the hazards |
| 3 | Asset with many units of moderate value has some exposure to the hazards |
| 4 | Asset with some or few units of important value is highly exposed to the hazards |
| 5 | Asset with many units of important value is highly exposed to the hazards |



Risk Rating:

Definitions for rating probability of impacts

| Probability of impacts (P.I.) rating | Definition of ratings |
|--------------------------------------|-----------------------|
| 1 | Very low likelihood |
| 2 | Low likelihood |
| 3 | Medium likelihood |
| 4 | High likelihood |
| 5 | Very high likelihood |



| Potentially vulnerable sub-sectors | Asset or airport function | Barra Airport | Benbecula Airport | Campbeltown Airport | Dundee Airport | Inverness Airport | Islay Airport | Kirkwall Airport | Stornoway Airport | Sumburgh Airport | Tiree Airport | Wick John O'Groats Airport | |
|--|--|----------------------|-------------------|---------------------|----------------|-------------------|---------------|------------------|-------------------|------------------|---------------|----------------------------|--|
| Airport Building | Terminal Building | Vulnerability Rating | | | | | | | | | | | |
| | | Risk Rating | | | | | | | | | | | |
| | General Office Building | Vulnerability Rating | | | | | | | | | | | |
| | | Risk Rating | | | | | | | | | | | |
| | Airport facilities, appliance bays and vehicle storage | Vulnerability Rating | | | | | | | | | | | |
| | | Risk Rating | | | | | | | | | | | |
| Airfield Operations | Airport Apron | Vulnerability Rating | | | | | | | | | | | |
| | | Risk Rating | | | | | | | | | | | |
| | Runways | Vulnerability Rating | | | | | | | | | | | |
| | | Risk Rating | | | | | | | | | | | |
| | Fire Station and Emergency services | Vulnerability Rating | | | | | | | | | | | |
| | | Risk Rating | | | | | | | | | | | |
| Airport Interdependencies – Cargo and Access | Air Freight Storage and Postal Deliveries: | | | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| | | | | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| | Roads | Vulnerability Rating | | | | | | | | | | | |
| | | Risk Rating | | | | | | | | | | | |
| | Car Park | Vulnerability Rating | | | | | | | | | | | |
| | | Risk Rating | | | | | | | | | | | |

Appendix 3: Climate Change Risk Assessment

The following table is a summary of the Vulnerability and Risk Assessment. To view the full report [click here](#).

Impact Rating:

Definitions for rating exposure

| Exposure (E) rating | Definition of ratings |
|---------------------|--|
| 1 | Asset with few or no unit with little to no value is not exposed to the hazards |
| 2 | Asset with some or few units of moderate value has some exposure to the hazards |
| 3 | Asset with many units of moderate value has some exposure to the hazards |
| 4 | Asset with some or few units of important value is highly exposed to the hazards |
| 5 | Asset with many units of important value is highly exposed to the hazards |



Impact decision matrix

| | | | | | | |
|---------------|---|---|---|---|---|---|
| Vulnerability | 5 | 2 | 3 | 4 | 5 | 5 |
| | 4 | 2 | 3 | 4 | 4 | 5 |
| | 3 | 2 | 3 | 3 | 4 | 4 |
| | 2 | 1 | 2 | 3 | 3 | 3 |
| | 1 | 1 | 1 | 2 | 2 | 2 |
| | 1 | 2 | 3 | 4 | 5 | |

Exposure to hazard

Definitions for impact ratings

| Sensitivity | Rating |
|------------------|--------|
| Very low impact | 1 |
| Low impact | 2 |
| Medium impact | 3 |
| High impact | 4 |
| Very high impact | 5 |

Risk Rating:

Definitions for rating probability of impacts

| Probability of impacts (P.I.) rating | Definition of ratings |
|--------------------------------------|-----------------------|
| 1 | Very low likelihood |
| 2 | Low likelihood |
| 3 | Medium likelihood |
| 4 | High likelihood |
| 5 | Very high likelihood |



Risk decision matrix

| | | | | | | |
|--------|---|---|---|---|---|---|
| Impact | 5 | 2 | 3 | 4 | 5 | 5 |
| | 4 | 2 | 3 | 4 | 4 | 5 |
| | 3 | 2 | 3 | 3 | 4 | 4 |
| | 2 | 1 | 2 | 3 | 3 | 3 |
| | 1 | 1 | 1 | 2 | 2 | 2 |
| | 1 | 2 | 3 | 4 | 5 | |

Probability of hazard

Definitions for risk ratings

| Sensitivity | Rating |
|--------------------------------------|--------|
| Very low impact, very low likelihood | 1 |
| Very low impact, low likelihood | 1 |
| Low impact, very low likelihood | 1 |
| Medium impact, very low likelihood | 2 |
| Low impact, low likelihood | 2 |
| Medium likelihood, very low impact | 2 |
| Medium impact, high likelihood | 3 |
| High impact, medium likelihood | 3 |
| Medium impact, high likelihood | 4 |
| High impact, medium likelihood | 4 |
| Very high impact, high likelihood | 5 |

| Climate Variable | Risk | Potential Consequence | Barra Airport | Benbecula Airport | Campbeltown Airport | Dundee Airport | Inverness Airport | Islay Airport | Kirkwall Airport | Stornoway Airport | Sumburgh Airport | Tiree Airport | Wick John O'Groats Airport |
|------------------|---|---|---|-------------------|---------------------|----------------|-------------------|---------------|------------------|-------------------|------------------|---------------|----------------------------|
| Temperature | Decrease in passenger and staff comfort within airport buildings | Negative impact on passenger and staff wellbeing with an increase in health & safety incidents and accidents. Increased energy demand for cooling systems with increasing financial costs and carbon emissions. Reduced staff productivity and possible increase in staff absence. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Temperature | Health and wellbeing of outside workers | Failure to exercise appropriate duty of care for outside workers will result in increased health and safety incidents and accidents to staff, increased staff absence and negative impacts on staff wellbeing. There may also be increased financial costs and delay to projects due to staff absence. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Temperature | Overheating of airport buildings | Increased energy demand for cooling systems increasing financial costs. Temperature sensitive infrastructure may experience failure, damage or inefficiency leading to operational disruption. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Temperature | Structural damage to runway and aprons | Increased operational disruption and flight disruption which could lead to airport closure. Increased erosion may mobilise pollutants and increase sediment loads or turbidity in run off. Damage to water infrastructure (including drainage and utility pipes). Upper strata dry out may cause surface water seepage into groundwater. Financial costs to repair surface damage. Reputational damage. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Temperature | Airfield surface and sub-surface structural damage to runway and aprons as a result of freeze-thaw and frost weathering | Financial costs to repair associated damage. Operational disruption and possible airport closure. Reputational damage. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Temperature | Changes to take off procedures | Potential for increasing backlog, delays and cancellation. Reduced range of aircraft operating out of airport. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Temperature | Landslide surface and sub-surface structural damage to bituminous surfaces | Loss of access to and from the airport due to road closures and damage. Need for increased maintenance with temporary closures of affected areas for repair. Risk of maintenance vehicles contributing to congestion. Financial costs to repair damage and reputational damage. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |

Appendix 3: Climate Change Risk Assessment

Impact Rating:

Definitions for rating exposure

| Exposure (E) rating | Definition of ratings |
|---------------------|--|
| 1 | Asset with few or no unit with little to no value is not exposed to the hazards |
| 2 | Asset with some or few units of moderate value has some exposure to the hazards |
| 3 | Asset with many units of moderate value has some exposure to the hazards |
| 4 | Asset with some or few units of important value is highly exposed to the hazards |
| 5 | Asset with many units of important value is highly exposed to the hazards |

Impact decision matrix

| | | | | | |
|---|---|---|---|---|---|
| 5 | 2 | 3 | 4 | 5 | 5 |
| 4 | 2 | 3 | 4 | 4 | 5 |
| 3 | 2 | 3 | 3 | 4 | 4 |
| 2 | 1 | 2 | 3 | 3 | 3 |
| 1 | 1 | 1 | 2 | 2 | 2 |
| | 1 | 2 | 3 | 4 | 5 |

Definitions for impact ratings

| Sensitivity | Rating |
|------------------|--------|
| Very low impact | 1 |
| Low impact | 2 |
| Medium impact | 3 |
| High impact | 4 |
| Very high impact | 5 |

Risk Rating:

Definitions for rating probability of impacts

| Probability of impacts (P.I.) rating | Definition of ratings |
|--------------------------------------|-----------------------|
| 1 | Very low likelihood |
| 2 | Low likelihood |
| 3 | Medium likelihood |
| 4 | High likelihood |
| 5 | Very high likelihood |

Risk decision matrix

| | | | | | |
|---|---|---|---|---|---|
| 5 | 2 | 3 | 4 | 5 | 5 |
| 4 | 2 | 3 | 4 | 4 | 5 |
| 3 | 2 | 3 | 3 | 4 | 4 |
| 2 | 1 | 2 | 3 | 3 | 3 |
| 1 | 1 | 1 | 2 | 2 | 2 |
| | 1 | 2 | 3 | 4 | 5 |

Definitions for risk ratings

| Sensitivity | Rating |
|--------------------------------------|--------|
| Very low impact, very low likelihood | 1 |
| Very low impact, low likelihood | 1 |
| Low impact, very low likelihood | 1 |
| Medium impact, very low likelihood | 2 |
| Low impact, low likelihood | 2 |
| Medium likelihood, very low impact | 2 |
| Medium impact, high likelihood | 3 |
| High impact, medium likelihood | 3 |
| Medium impact, high likelihood | 4 |
| High impact, medium likelihood | 4 |
| Very high impact, high likelihood | 5 |

| Climate Variable | Risk | Potential Consequence | Barra Airport | Benbecula Airport | Campbeltown Airport | Dundee Airport | Inverness Airport | Islay Airport | Kirkwall Airport | Stornoway Airport | Sumburgh Airport | Tiree Airport | Wick John O'Groats Airport |
|------------------|--|---|---|-------------------|---------------------|----------------|-------------------|---------------|------------------|-------------------|------------------|---------------|----------------------------|
| Temperature | Increased fire risk due to hotter temperatures combined with increased lightning and drought potential | Visibility hazard posed to aircraft resulting in health and safety implications. Asset damage and possible evacuation or disruption of services. Firewater supply limited by droughts. Diversions and cancellations would result in lost landing fees. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Temperature | Flashpoint of fuels exceeded on hot days leading to delays in re-fuelling procedures and causing potential fire hazard | Potential fire hazard and subsequent operational disruption. Increased financial costs for damage caused. Health and safety incidents. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Temperature | Changes to bird migration patterns resulting in increase in bird strike risk | Increases in aircraft bird strike risk resulting in accidents or diversions. Reputational damage, frequent delays and flight cancellation. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Temperature | Overheating of aircraft on apron | Increased use of fixed ground power for A/C on-board aircraft results in increased financial costs of increased energy demand. Negative impact on air quality/noise/health due to increased noise and emissions from running engines for cooling. Increase in health and safety incidents/accident and increased fire risk. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Temperature | Increased ground movements due to drought conditions | Financial costs to repair damage and replace affected assets. Operational disruption and airport closure. Reputational damage and need for increased maintenance. Increase in the number of health and safety incidents. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Temperature | Increased incidence of fuel venting from aircraft in warmer weather | Potential fire hazard and subsequent operational disruption. Increased financial costs for damage caused. Health and safety incidents. Pollution incidents. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Rainfall | Localised onsite surface flooding | Potential for flooding and damage to critical assets and infrastructure. Possible backlogs, delays, diversions and cancellations to flights which would result in increased disruption. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |

Appendix 3: Climate Change Risk Assessment

Impact Rating:

Definitions for rating exposure

| Exposure (E) rating | Definition of ratings |
|---------------------|--|
| 1 | Asset with few or no unit with little to no value is not exposed to the hazards |
| 2 | Asset with some or few units of moderate value has some exposure to the hazards |
| 3 | Asset with many units of moderate value has some exposure to the hazards |
| 4 | Asset with some or few units of important value is highly exposed to the hazards |
| 5 | Asset with many units of important value is highly exposed to the hazards |

Impact decision matrix

| | | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 5 | 2 | 3 | 4 | 5 | 5 |
| 4 | 2 | 3 | 4 | 4 | 5 |
| 3 | 2 | 3 | 3 | 4 | 4 |
| 2 | 1 | 2 | 3 | 3 | 3 |
| 1 | 1 | 1 | 2 | 2 | 2 |
| | 1 | 2 | 3 | 4 | 5 |

Exposure to hazard

Definitions for impact ratings

| Sensitivity | Rating |
|------------------|--------|
| Very low impact | 1 |
| Low impact | 2 |
| Medium impact | 3 |
| High impact | 4 |
| Very high impact | 5 |

Risk Rating:

Definitions for rating probability of impacts

| Probability of impacts (P.I.) rating | Definition of ratings |
|--------------------------------------|-----------------------|
| 1 | Very low likelihood |
| 2 | Low likelihood |
| 3 | Medium likelihood |
| 4 | High likelihood |
| 5 | Very high likelihood |

Risk decision matrix

| | | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 5 | 2 | 3 | 4 | 5 | 5 |
| 4 | 2 | 3 | 4 | 4 | 5 |
| 3 | 2 | 3 | 3 | 4 | 4 |
| 2 | 1 | 2 | 3 | 3 | 3 |
| 1 | 1 | 1 | 2 | 2 | 2 |
| | 1 | 2 | 3 | 4 | 5 |

Probability of hazard

Definitions for risk ratings

| Sensitivity | Rating |
|--------------------------------------|--------|
| Very low impact, very low likelihood | 1 |
| Very low impact, low likelihood | 1 |
| Low impact, very low likelihood | 1 |
| Medium impact, very low likelihood | 2 |
| Low impact, low likelihood | 2 |
| Medium likelihood, very low impact | 2 |
| Medium impact, high likelihood | 3 |
| High impact, medium likelihood | 3 |
| Medium impact, high likelihood | 4 |
| High impact, medium likelihood | 4 |
| Very high impact, high likelihood | 5 |

| Climate Variable | Risk | Potential Consequence | Barra Airport | Benbecula Airport | Campbeltown Airport | Dundee Airport | Inverness Airport | Islay Airport | Kirkwall Airport | Stornoway Airport | Sumburgh Airport | Tiree Airport | Wick John O'Groats Airport |
|------------------|---|--|---|-------------------|---------------------|----------------|-------------------|---------------|------------------|-------------------|------------------|---------------|----------------------------|
| Rainfall | Hardening of natural airport surfaces with reduced natural drainage function resulting in increased run-off and risk of flooding: | Operational disruption due to excess surface water on aprons, runways and other airport surface. Airport closure. Financial costs to repair/replace affected infrastructure. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Rainfall | Changes to groundwater levels could cause building subsidence and water ingress damage | Potential for damage to subsurface utilities and water ingress to low lying assets i.e. basements or ground floor electrical equipment. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Rainfall | Torrential rain creates hazardous conditions for vehicles and aircraft | Increased risk of road traffic accidents, congestion and health & safety impacts. Reduced visibility and braking, increased risk of hydro-planning for aircraft. Potential increase in diversions and cancellations causing disruption. Loss in customer confidence if routes are increasingly impacted by extreme weather events. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Rainfall | Release of contaminated surface water into surrounding water bodies | Regulatory notifications or fines, breach of Controlled Activities Regulation (CAR) resulting in Enforcement Action from SEPA. Reputational damage of environmental pollution. Restrictions for future development. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Rainfall | Extreme rainfall events could restrict the flow of essential supplies to and from the airport | Increased disruption and cancellation of flights due to extreme weather may cause reputational damage. Increased disruption to local community livelihood and local businesses on the island airports. Disruption to airport operations where supply of items such as de-icer are low. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Fog | Seasonal changes to fog frequency results in changes to fog related disruption | Fog causes increased potential for delays, diversions and flight cancellations. Restrictions on maintenance team activities air side (free ranging curtailed and lookouts required). | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |
| Snow | Increased energy demand for heating stretches supply | Increased greenhouse gas emissions to heat buildings and increased energy costs. Varying temperatures also have adverse effects on de-icer storage at airports. Specialist mechanical equipment may fail to operate under sustained low temperatures. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2080+ Post-Control | | | | | | | | | | |

Appendix 3: Climate Change Risk Assessment

Impact Rating:

Definitions for rating exposure

| Exposure (E) rating | Definition of ratings |
|---------------------|--|
| 1 | Asset with few or no unit with little to no value is not exposed to the hazards |
| 2 | Asset with some or few units of moderate value has some exposure to the hazards |
| 3 | Asset with many units of moderate value has some exposure to the hazards |
| 4 | Asset with some or few units of important value is highly exposed to the hazards |
| 5 | Asset with many units of important value is highly exposed to the hazards |

Impact decision matrix

| | | | | | |
|---|---|---|---|---|---|
| 5 | 2 | 3 | 4 | 5 | 5 |
| 4 | 2 | 3 | 4 | 4 | 5 |
| 3 | 2 | 3 | 3 | 4 | 4 |
| 2 | 1 | 2 | 3 | 3 | 3 |
| 1 | 1 | 1 | 2 | 2 | 2 |
| | 1 | 2 | 3 | 4 | 5 |

Definitions for impact ratings

| Sensitivity | Rating |
|------------------|--------|
| Very low impact | 1 |
| Low impact | 2 |
| Medium impact | 3 |
| High impact | 4 |
| Very high impact | 5 |

Risk Rating:

Definitions for rating probability of impacts

| Probability of impacts (P.I.) rating | Definition of ratings |
|--------------------------------------|-----------------------|
| 1 | Very low likelihood |
| 2 | Low likelihood |
| 3 | Medium likelihood |
| 4 | High likelihood |
| 5 | Very high likelihood |

Risk decision matrix

| | | | | | |
|---|---|---|---|---|---|
| 5 | 2 | 3 | 4 | 5 | 5 |
| 4 | 2 | 3 | 4 | 4 | 5 |
| 3 | 2 | 3 | 3 | 4 | 4 |
| 2 | 1 | 2 | 3 | 3 | 3 |
| 1 | 1 | 1 | 2 | 2 | 2 |
| | 1 | 2 | 3 | 4 | 5 |

Definitions for risk ratings

| Sensitivity | Rating |
|--------------------------------------|--------|
| Very low impact, very low likelihood | 1 |
| Very low impact, low likelihood | 1 |
| Low impact, very low likelihood | 1 |
| Medium impact, very low likelihood | 2 |
| Low impact, low likelihood | 2 |
| Medium likelihood, very low impact | 2 |
| Medium impact, high likelihood | 3 |
| High impact, medium likelihood | 3 |
| Medium impact, high likelihood | 4 |
| High impact, medium likelihood | 4 |
| Very high impact, high likelihood | 5 |

| Climate Variable | Risk | Potential Consequence | Barra Airport | Benbecula Airport | Campbeltown Airport | Dundee Airport | Inverness Airport | Islay Airport | Kirkwall Airport | Stornoway Airport | Sumburgh Airport | Tiree Airport | Wick John O'Groats Airport |
|------------------|--|--|---|-------------------|---------------------|----------------|-------------------|---------------|------------------|-------------------|------------------|---------------|----------------------------|
| Snow | Increasing variability of snowfall challenges winter contingency plans and de-icing supplies | Years of limited snowfall followed by heavy snowfall combined with staff turnover could lead to negative impacts on corporate knowledge and systems being out of practice. Supplies of de-icer could be inadequate if based on recent past rather than potential extremes. Airport closure, flight cancellation and delays are possible. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Snow | Wintry conditions pose health and safety risks for passenger and staff | Reduced thermal comfort for outdoor staff and staff working in unheated areas. Risk of trips and falls. Hazardous driving conditions landslide and air side. Staff shortages where snow disrupts access to the airport. Financial costs from cancelled flights and passenger compensation. Some HIAL routes may become unviable over winter months. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Wind | Wind damage to assets | Staff vulnerable to injury. Building damage and increased cost. Unable to serve aircraft due to high winds and small aircraft may be unable to fly. Increased staff absence if aircraft can't land. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Storms | Increased risk of schedule interruption from stormy conditions | Increased backlog, delay and cancellation of flights. Impacts on distribution of freight, postal services and other lifeline services to residents and businesses in some airports. HIAL staff need to be especially aware of frail passengers during high winds. Stranded passengers present huge complications as terminal building is not suitable for passengers to stay overnight, staff shortages and access to/from the airport can be limited. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Lightning | Power cuts and voltage spikes to parts of the airport during electrical storms | Risk of disruption and equipment failure or damage resulting in additional costs, reputational damage. Disruption to control systems i.e. security scanners, baggage handling kit. Impacts such as misconnected bags, delays at security. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Lightning | Increased lightning strikes | Operational disruption caused by decrease in aircraft movements. A lightning strike on the ground would result in delays to operations as the aircraft would spend longer on stand restarting and checking equipment, this may impact on the flight schedule, increased insurance claims, reputational damage as well as increased health and safety incidents. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |
| Sea-level rise | Disruption to airfield and airport services from sea level rise | Inability to receive aircraft with essential services to the island disrupted. | Current overall risk rating | | | | | | | | | | |
| | | | Potential Future Climate Impacts Post-Control | | | | | | | | | | |
| | | | Potential Future Climate Impacts 2050+ Post-Control | | | | | | | | | | |

