

Climate change adaptation at Brisbane Airport

Case Study: New Parallel Runway project

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- Brisbane Airport's New Parallel Runway (NPR) is an interesting case study from a climate change adaptation perspective.
- The NPR is an infrastructure project of national significance, requiring support from diverse stakeholders with varying objectives.
- Balancing these stakeholder interests has been a feature of the project, providing important lessons for future adaptation projects/measures.
- In addition, the importance of having accurate and relevant information on climate change has been reinforced.

Introduction

This report provides some insight into the challenges posed by incorporating climate change considerations into the design, planning, construction and operation of infrastructure assets, using Brisbane Airport's New Parallel Runway (NPR) as a case study.

When considering the impact of climate change on their portfolios, investors often find the first question the hardest: exactly what is the link between climate change and the value of my investment? Rarely is the answer as obvious as it is in the case of Brisbane Airport, which is building a new runway on a low-lying coastal site exposed to rising sea levels.

However, the challenge doesn't end there. For the long-term owners of Brisbane Airport, the real difficulty has been the task of building a climate change-resilient piece of infrastructure while meeting a plethora of regulatory hurdles and balancing the objectives of a wide range of stakeholders.

The report is divided into four main sections. We begin by providing some context around Brisbane Airport and the NPR project. We then highlight the diverse stakeholder landscape of Brisbane Airport, including some of its regulatory obligations. We then examine some of the key decisions made at the board-level as they pertain to the runway project. Finally, we make some summary observations.

Context and Background

Brisbane Airport is the principal international and domestic gateway to Queensland. It is Australia’s third-largest airport by passenger volume, handling more than 21 million passengers annually.

Since its privatisation in 1997, passenger growth at Brisbane Airport has more than doubled. In the absence of additional runway capacity, Brisbane Airport is forecast to experience major capacity constraints over the next decade – indeed, there is some evidence that peak period congestion is already emerging.

To meet this growing demand, over \$2.5 billion worth of infrastructure is being developed over the next decade. Foremost of these is the 3300m NPR. The NPR has been included in planning documents as far back as the 1970s, but only received full Federal Government approval in 2007, with work beginning in August 2012. The NPR is scheduled for completion in 2020, highlighting the long lead-times for large-scale infrastructure assets.

Figure 1: Project timeline



The project faces unique environmental challenges. At 2,700 hectares, Brisbane is one of Australia’s largest airports in terms of land area and is based on a low-lying coastal site susceptible to flooding events. The airport is adjacent to a number of sites including Nudgee Beach, Moreton Bay Marine Park, the Boondall Wetlands and the Kedron Brook Floodway. In addition, more than 10 per cent of the on-site area is a designated Biodiversity Zone, the conservation and maintenance of which is Brisbane Airport’s responsibility.

Figure 2: Artist’s impression of Brisbane Airport’s New Parallel Runway



Reflecting the importance of environmental factors, Figure 1 reveals that the majority of the construction period is devoted to environmentally delicate site preparation (largely due to an approved but substantial dredging program in Moreton Bay). This, in turn, is necessary to create infrastructure that is resilient to the impacts of climate change. Indeed, the project was identified in a recent Productivity Commission report as an example of climate change risks being considered in a project.¹

Beyond the environmental dimension, however, the project is of national significance. From an economic perspective the NPR will play an essential role in facilitating economic growth and development in the state, particularly in South-East Queensland. By 2035, these benefits are expected to accrue to around \$5 billion per year (inflation adjusted). Modelling done at the time of the Environmental Impact Statement estimated the net present value of economic benefits to the Brisbane-Moreton region at \$8.2 billion, the rest of Queensland at \$1.1 billion, and the rest of Australia at \$0.6 billion.²

As a project with significant environmental, economic and other dimensions, the NPR is an interesting case study for institutional investors charged with the stewardship of assets in the responsible investment (RI) era. From an RI perspective, there has been no template for the project as such.

Balancing stakeholder interests

One of the distinguishing characteristics of infrastructure assets is the complexity in balancing stakeholder expectations, including maintaining a social license to operate. The large scale and strategic importance of infrastructure assets such as airports, toll roads, railways, water utilities and energy utilities draw a high level of public scrutiny, while the monopolistic nature of many infrastructure assets attracts a higher degree of regulatory attention than for assets facing competitive market forces.

In the case of Brisbane Airport, there exist numerous stakeholders ranging from Federal, State and local government agencies, regulators including the Australian Competition and Consumer Commission (ACCC), airlines, nearby residents and passengers from the broader catchment area (see Figure 3). The airport is majority-owned (81% as at June 2012) by superannuation funds, either directly or through fund managers, adding a further dimension to the stakeholder landscape.

Figure 3: Major stakeholders for Brisbane Airport



Source: CFSGAM Research

Brisbane Airport – legislative context

As a major Federally-leased capital city airport, Brisbane is subject to wide-ranging regulations. Below is a selection of key legislation relevant to planning, operations and ownership at Brisbane Airport:

- **Airports Act 1996:** the main act setting out the system of regulation for airports. Among other things, it mandates the production of an airport master plan and environmental strategy for each airport. Projects such as the NPR are relevant to

¹ Productivity Commission Draft Report: *Barriers to Effective Climate Change Adaptation* (April 2012)

² Note: these figures are inflation-adjusted, based on the period 2006 to 2035. At the time of the draft EIS, project completion was expected in 2015.

Brisbane Airport's lease obligation to 'provide for the continued development of the airport site. It includes the following associated pieces of legislation.

- **Airports Regulations 1997**
- Airports (**Building Control**) Regulations 1996
- Airports (**Control of On-Airport Activities**) Regulations 1997
- Airports (**Environment Protection**) Regulations 1997
- Airports (**Protection of Airspace**) Regulations 1996

- Airports (**Ownership Interests in Shares**) Regulations 1996: places a 49% limit on foreign ownership, a 5% limit on airline ownership, and a 15% limit on cross-ownership in Brisbane and Sydney airports (there are similar provisions for Sydney/Melbourne and Sydney/Perth).

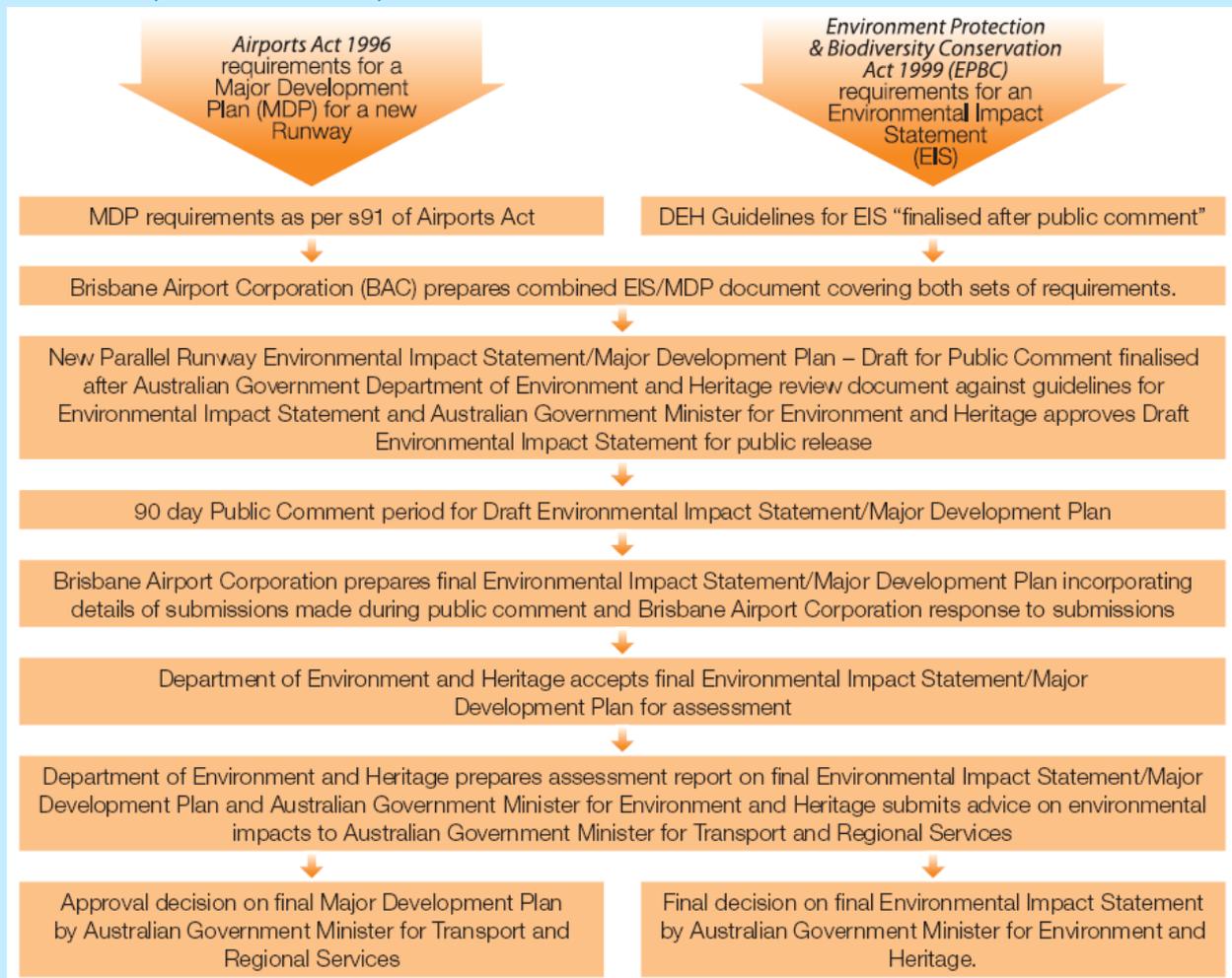
- **Environment Protection and Biodiversity Conservation (EPBC) Act 1999**: administered by the Department of Sustainability, Environment, Water, Population and Communities, the act requires environmental assessment and approval for all major projects. Over 300 individual environmental conditions were required to be met for the approval of the NPR.

- **Economic regulation**: as a major capital city airport, Brisbane is now subject to price monitoring (having previously been regulated under a price cap system). The price monitoring regime, which is a more light-handed form of regulation, was introduced in 2002. It includes reporting on the prices charged for 'aeronautical services and facilities, financial statements and quality of service information.' At a high level, a degree of pricing certainty is required for large-scale projects such as the NPR to proceed.

Box 1: How does climate change fit in?

Every five years, Brisbane Airport is required to submit, in conjunction with its Master Plan, and Airport Environment Strategy (AES), a statement to government, industry and the public of how the Airport community plans to manage the environment at Brisbane Airport.

Figure 4: Brisbane Airport NPR - MDP/EIS process



While Australian airport regulation mandates a high-level environmental focus, it tends to be less explicitly focused on incentives for climate change adaptation and mitigation than regulation for other infrastructure sectors (e.g. water and energy).

In addition, regulation is typically concerned with minimising the impact of infrastructure on the environment, rather than the impact that environment has on infrastructure (for example, requiring assets to be resilient to the potential impacts of climate change). Part of the issue here is obviously a lack of available data, as well as ambiguity over what would constitute an acceptable level of ‘future-proofing.’ For example, should assets be built to withstand 1-in-50 year events, 1-in-100 year events?

These factors place a greater onus on infrastructure owners to drive specific adaption measures at the board-level.

Adaptation Measures

We now focus on several key decisions pertaining to the NPR, outlining some the key climate change considerations, as well as some of the other relevant stakeholder considerations. These are:

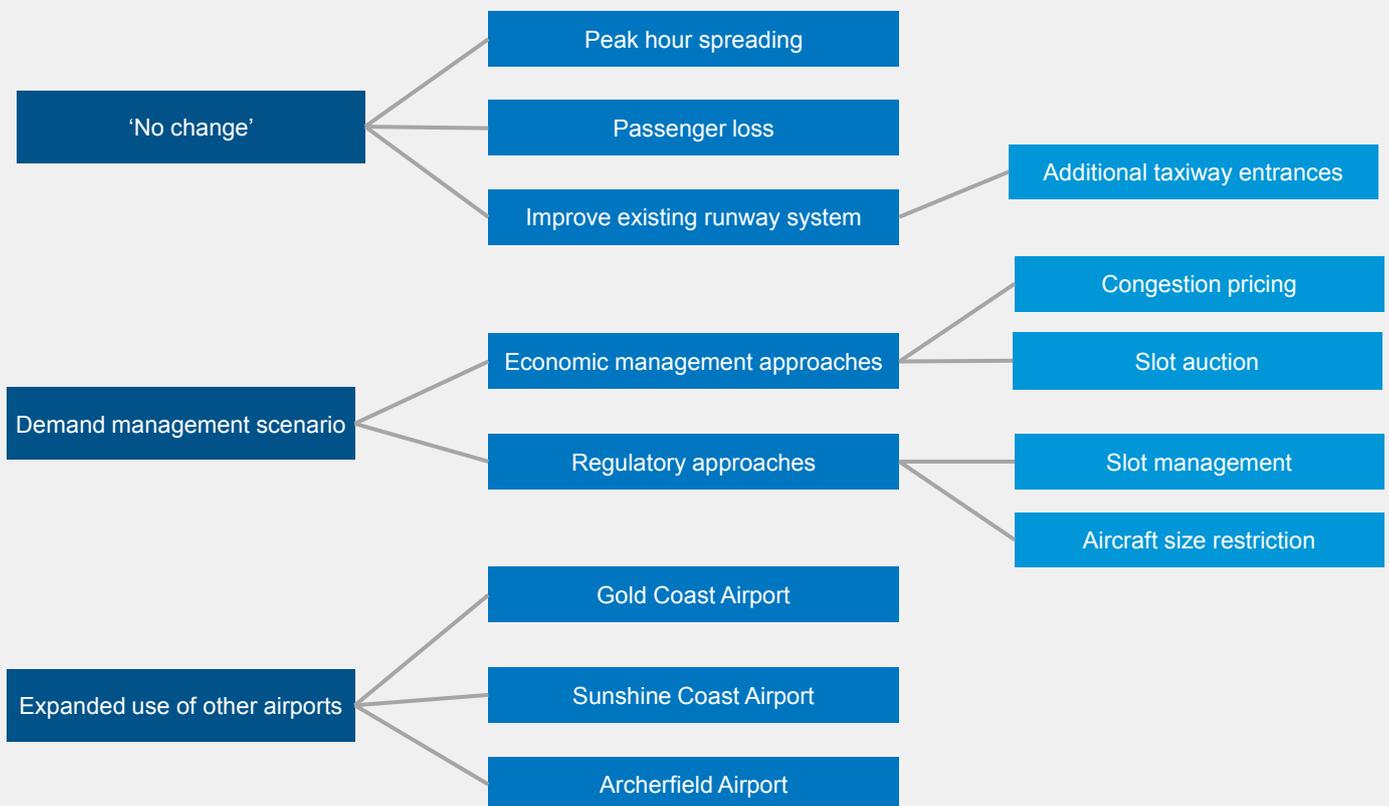
- The build / no-build decision
- The placement and layout of the runway
- The runway height
- The runway length

Build / no-build decision

The most fundamental decision pertaining to the runway project from a climate change perspective is assessing the need for the project itself. While the case at Brisbane Airport is compelling, in light of continued strong aviation growth, this is a non-trivial decision – indeed, a report by Deloitte Access Economics noted that ‘airport infrastructure, whether terminal facilities or runway works, are among the most expensive forms of commercial and civil construction.’³

In the early-stage assessment of the NPR, Brisbane Airport considered a multitude of options for accommodating passenger traffic growth which did not include the construction of a new runway. These are summarised in Figure 5.

Figure 5: Alternatives to building the New Parallel Runway at Brisbane Airport



Source: BAC New Parallel Runway Draft EIS/MDP (Volume A3) and CFSGAM Research

³ Deloitte Access Economics. *Connecting Australia: The Economic and Social Contribution of Australia’s Airports*. (May 2012).

Under the 'no change' scenario, options such as peak hour spreading are considered. This would involve spreading demand from morning and evening peaks to other hours of the day. However, the scope for this is limited.

For example Brisbane's domestic business travellers typically have particular windows during which they must travel. Likewise, international arrivals and departures at Brisbane are influenced by time zones, curfews and slot constraints at major Asian and European airports.

Overall, without the new runway, it is estimated that approximately 12 million international and domestic passengers would be lost by 2034/35. This equates to just under \$5 billion per annum spent by passengers, with associated economic multiplier effects.

The 'demand management' scenario considers both economic and regulatory approaches, including congestion pricing during peak periods (albeit typically a weak price signal), allocating slots on the basis of price or airline activity, or introducing a minimum aircraft size to encourage smaller aircraft to fly to other airports near Brisbane.

Indeed, the final scenario investigates the capacity of other airports to meet some of the increased in demand for air travel in South East Queensland. The Gold Coast, Sunshine Coast and Archerfield airports have all been considered – however, the prevailing view is that these airports are complementary rather than legitimate alternatives to Brisbane Airport given their greater distance from Brisbane as the centre of primary demand.

Placement and layout of runway

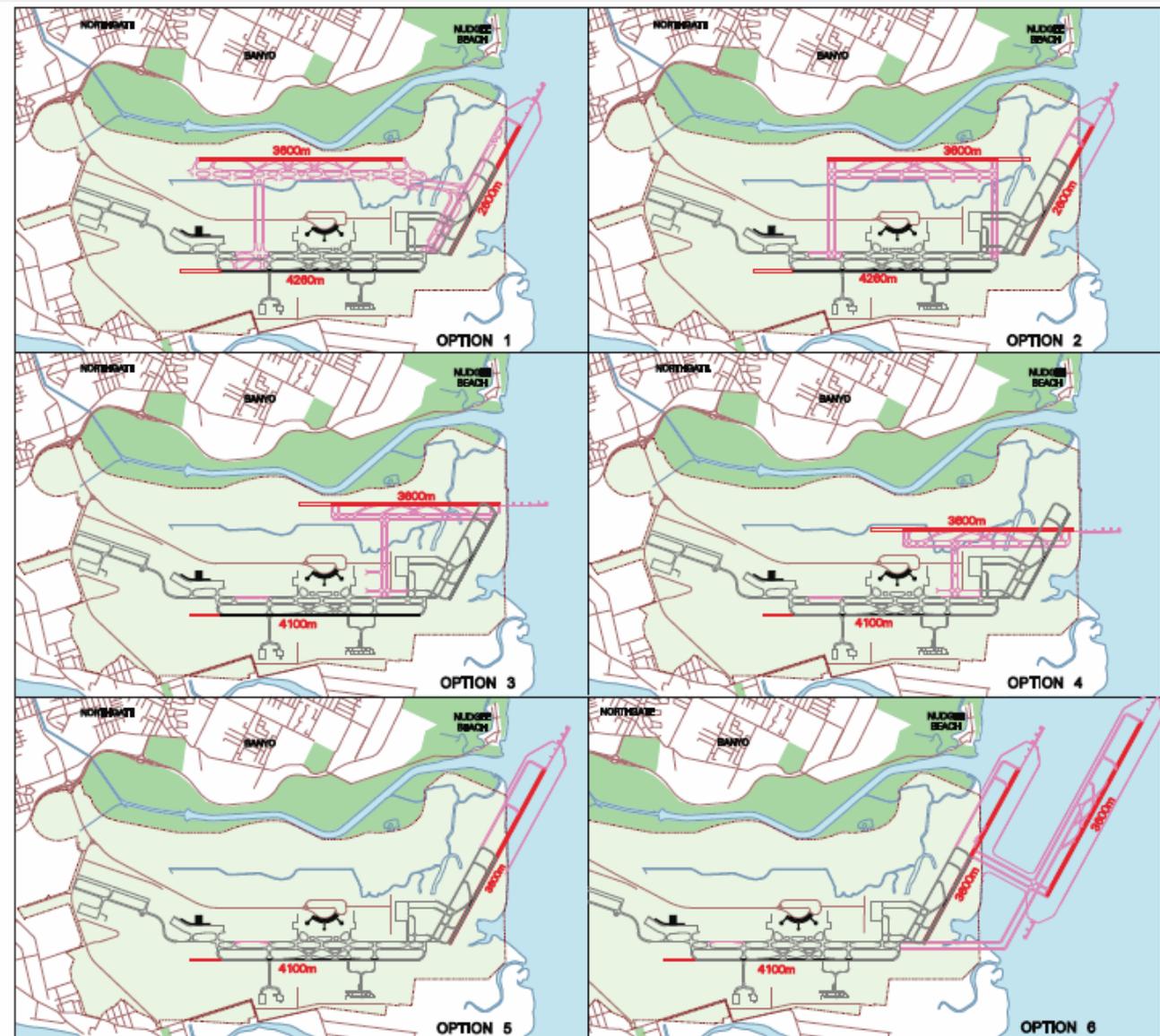
The selection of the new runway position and layout has been based on a multitude of factors. Climate change resilience is being balanced against cost, operational and safety standards, noise restrictions as well as other environmental considerations, such as ecological impacts. Prioritisation of safety (as outlined in the Federal Government's Aviation White Paper) is as expected a key consideration in runway system design along with the effective additional capacity delivered, against which Brisbane Airport has sought to optimise these objectives with other factors.

The selection of the new runway position and layout has been based on a multitude of factors. Climate change resilience is being balanced against cost, operational and safety standards, noise restrictions as well as other environmental considerations, such as ecological impacts. Beyond the prioritisation of safety (as outlined in the Federal Government's Aviation White Paper), the responsibility of dealing with various trade-offs at the project level has been effectively managed by Brisbane Airport.

Figure 6 shows a number of alternative runway configurations that were considered. Option 3 – the preferred option – was chosen as it offered the best set of outcomes against the various criteria/considerations. Specifically, it:

- Avoids any land reclamation into Moreton Bay, unlike Options 1, 2, 5 and 6.
- Has minimal impact on the Moreton Bay foreshore habitats for marine life and wader birds.
- Has a lower cost than other configurations. Option 6, in particular, has a capital cost approximately six times larger.
- Maximises the number of planes that can arrive and depart Brisbane Airport over Moreton Bay rather than over surrounding suburbs. This means Option 3 has the lowest impact on ground-based noise.
- Option 3 also rates well on safety by allowing by vertical separation for arriving and departing aircraft on each runway
- Allows for maximum flexibility with regard to the design and construction of future airport infrastructure (e.g. terminals) between the runways.

Figure 6: Alternative runway configuration options



Source: BAC. New Parallel Runway Draft EIS/MDP. Vol A: Background and Need (Options and Alternatives)

Height of runway

The key climate change impacts modelled with regard to the NPR are sea level rises, storm surge and local/regional flood events. For the height of the runway, Brisbane Airport faces a trade-off between the cost of the runway and the resilience of the infrastructure to sea level rises, storm and flood events.

Furthermore, the runway requires sand to be transported from Middle Banks in Moreton Bay to elevate the site. Choosing the optimal runway height, therefore, implies a trade-off between (i) maximising protection of the infrastructure from climate change impacts and (ii) minimising the fill materials used (and associated environmental impact of transporting these to the runway site).

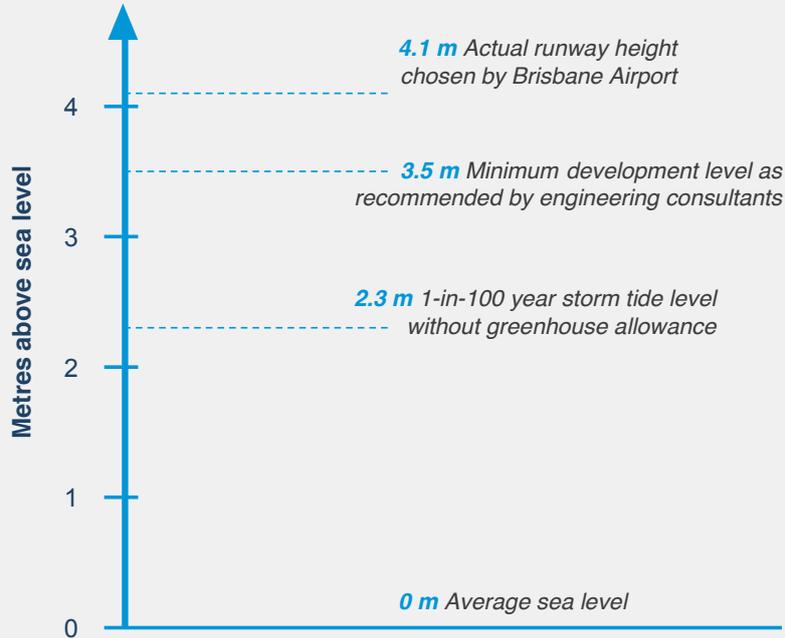
How did Brisbane Airport approach this?

In 2008, Brisbane Airport commissioned the Antarctic Climate & Ecosystems Collaborative Research Centre (ACE CRC) to evaluate the various runway height options in light of the most recent climate and sea level data available. The ACE CRC works with governments, the community and commercial organisations to model the impacts of climate of change, and has developed tools such as [CANUTE](#) (a sea-level calculator) to assist these groups in this regard.

In 2009, the ACE CRC released its report titled 'The vulnerability of Brisbane Airport to sea level rise.' In it, the ACE CRC described the runway's design level of 4.1 metres above mean sea level as 'strongly precautionary'.

Figure 7 demonstrates that the runway has been designed in excess of minimum standards such as historical data points and conservative engineering recommendations.

Figure 7: New Parallel Runway design level versus selected thresholds



Source: BAC and CFSGAM Research

Brisbane Airport has also conducted a 'fill minimisation study' to investigate ways in which the amount of fill for the NPR could be reduced. The study considered substituting lower-quality fill in some areas; however this solution did not preserve the required pavement strength and would have implied a lower level of climate change resilience for the runway.

Other complementary measures that were undertaken included the construction of tidal channels as well as the installation of a new sea-wall along the northern boundary of the airport. Both measures aim to hold floodwater out of the site, thereby reducing the quantity of sand needed as runway site fill.

Length of runway

As part of the aviation industry's efforts to minimise carbon emissions, airports play an important role in supporting airlines' emission minimisation efforts.

As an example, the latest generation of aircraft – such as Airbus's A380 and Boeing's B787 – have 20 to 30 per cent less emissions than older aircraft types due to significant improvements in fuel efficiency technology.

Brisbane Airport's NPR, along with other infrastructure at the airport, has been designed to accommodate these latest generation aircraft, thus complementing the airline industry's efforts to reduce emissions, thereby seeking to mitigate the impacts of climate change.

Minimising total aircraft fuel usage (and therefore emissions) was also considered by Brisbane Airport in designing new flight paths for the NPR.

Conclusions

The experience of Brisbane Airport and the NPR project provide some insight into not only the challenges posed by incorporating climate change adaptation into infrastructure, but highlight some of the rigour that has gone into decision-making surrounding the project.

1. Regulation of these projects is well-intentioned, with environmental criteria and considerations embedded in the framework for major project approvals (e.g. Environmental Impact Statements). However, regulation is still largely focused on the impact of assets on the environment rather than vice versa.
2. Beyond the prioritisation of safety, regulation does not provide explicit guidance regarding trade-offs between various objectives (for example the prioritisation of economic versus environmental mandates in the Federal Government's Aviation White Paper). However, this has not prevented Brisbane Airport from effectively managing these trade-offs at a project and business level.
3. Where available, Brisbane Airport has sought to utilise climate change research or tools. This augurs well for the development of further tools and data surrounding climate change, particularly at a localised level. These may be private sector or government-driven.
4. Adopting a balanced approach to stakeholder needs does not necessarily mean compromising environmental standards. Indeed, this could result in more resilient infrastructure from a climate-change perspective than would otherwise be the case.

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