RESILIENCE VALUATION INITIATIVE

Australian Institute for Disaster Resilience

Queensland Government
Queensland Reconstruction Authority

RESILIENCE VALUATION INITIATIVE CASE STUDY

Queensland Reconstruction Authority Cost-Benefit Analysis

Queensland Reconstruction Authority (QRA) Cost-Benefit Analysis of Betterment investments: the 2013 upgrade to the Gayndah Water Intake - North Burnett Regional Council

Summary	· After infrastructure has been damaged in a disaster, QRA's betterment program builds them back to be more resilient to future disasters. · To estimate the benefits of the betterment program, QRA undertakes retrospective cost-benefit analysis on infrastructure projects comparing rebuilding costs with avoided losses from extreme events that have impacted the infrastructure since the rebuild. · The analysis showed that avoided costs exceeded reconstruction and restoration much faster than expected.
Decision Type	· Financial
Level of analysis	· Top-down approach collating data from each betterment project
Outputs generated	· Cost-benefit analysis taking into consideration avoided future losses and the costs of betterment projects.
Outcomes	· Demonstrate avoided loss (cost saving) from resilience-building measures to support a business case for further investment in betterment projects
Next steps	· To expand analysis to include the social, economic and environmental benefits associated with having more resilient infrastructure

About the Betterment Fund

Queensland betterment programs are jointly funded (50:50) by the Australian and Queensland Governments and enables the reconstruction of public assets to a more disaster resilient standard. Improvements are made to vital infrastructure such as roads, bridges and floodways. Projects can vary from stabilisation of low-lying roads to reduce erosion and scouring, upgrading drainage structures, or replacing gravel with reinforced concrete.

Betterment increases the resilience of communities to disasters, while at the same time reducing future expenditure on asset restoration. Betterment can also reduce incidents, injuries and fatalities during and after disasters, and improves asset utility during and after disasters.

Since the first betterment fund was established in 2013, more than 520 projects across 70 local government areas in Queensland – with a betterment value of more than $263 million – have been approved, helping to create stronger, more resilient Queensland communities.

Exposure to hazards in Gayndah

In 2011, the Gayndah Water Supply Intake Station on the Burnett River was severely damaged. The Gayndah Water Supply Intake Station provides the town's only water supply and supports a population of approximately 2000, as well as local primary industries. It had been previously rebuilt at a cost of $1.2 million, before being re-damaged in 2013

In 2013, the Gayndah Water Supply Intake Station was repaired as a betterment project. This involved relocating the water intake above the Claude Wharton Weir, building a new submersible-style pumping station and new raw water rising main to the water treatment plant. This betterment restoration was estimated to cost $3.8 million.

Following betterment restoration, Gayndah has been impacted by four natural disaster events, one in 2015 and 2016 and two in 2017. Throughout these events it has remained functional.

For example, the Gayndah Water Supply Intake Station was undamaged by severe Tropical Cyclone Marcia in 2015.

Applying a retrospective cost-benefit analysis to Gayndah

In 2019, QRA undertook a cost-benefit analysis of the betterment project at Gayndah. This involved assessing the cost of a standard build back, plus the additional cost for betterment. This was compared to the avoided losses from extreme weather events that had occurred between 2013 and 2019, which would have been of sufficient intensity to damage the original water supply intake station.

QRA uses a binary equation when assessing whether an asset has been impacted by an extreme event, with an assessment of either 'yes' or 'no'. If yes, QRA looks at whether it was impacted more, the same or less than a benchmark level (the level of impact before the upgrade through the betterment program).

QRA then used standardised rebuild costs to estimate the avoided loss from each of the extreme events between 2013 and 2019 that impacted that asset.

The calculation of the benefits achieved at Gayndah were part of a broader program to estimate the benefits of the betterment program overall. It is estimated that the betterment of the Gayndah Water Supply Intake Station has avoided losses of over $10 million.

Investing in a state-wide analysis

To estimate the costs and benefits for each of the betterment interventions that have been made under the program, QRA needed to collate and collect data from across the state.

The impacts of disasters are felt differently throughout Queensland, and the costs of infrastructure vary across the state. To estimate the avoided losses for each betterment project, an understanding of the cost to rebuild in each specific locality is needed. To address this, QRA created benchmark rates and common treatments to restore services, each with associated costs. There were 51 restoration options, such as bitumen, guardrail repair, which QRA used to determine restoration costs. QRA now has a database with estimates of restorations cost across all 77 Queensland local councils.

The geographic location and description of betterment works for each asset is maintained in a database. This allows for tracking to identify when a betterment project asset may have been impacted by an extreme event. QRA staff are then sent on-site to assess any impacts on the asset.

Demonstrating a return on investment

As at July 2022, 375 projects have been subsequently impacted by disasters. In total, there have been 1016 impacts to betterment sites from 40 events, with 81 per cent suffering no damage or only minor or superficial damage.

Of the projects that have been re-impacted, an investment of $137 million has generated more than $391 million in savings or avoided costs, which is a great outcome for all levels of government, as well as Australian taxpayers.

The key audience for the analysis was initially the state and federal treasuries due to an interest in pay-off periods of the betterment investments. **The expectation from QRA was that the pay-back period would be around 20 years, however it was found that the cost savings are appearing in less than 10 years. Therefore, avoided costs exceeded reconstruction and restoration costs much faster than expected.**

Even though the estimates from this analysis are likely an underrepresentation of benefit (as they don't consider broader benefit beyond infrastructure costs) this didn't create limitations. The QRA analysis has helped to advocate for additional funding as it makes a compelling case of the value of betterment.

The success of the program and demonstrated value generated has meant there have been several rounds of betterment investment over the years.

Lesson learnt

It was QRA's first time using this approach, which involved a lot of internal learning.

Data collection and management was a significant effort. QRA created an internal benchmarking team which worked to understand restoration costs across the state. QRA now has a high level of benchmarking granularity compared to other organisations.

Keeping track of the spatial data associated with each betterment project was also critical as it allows QRA to assess when the assets are subsequently impacted by future disaster events. Information on the severity and footprint of natural hazard events was also important to understand when and where assets may have been impacted. These data collection and management processes are now established meaning that future effort to estimate costs and benefits will be easier to undertake.

Future opportunities

The current calculation of the benefits of betterment projects focuses primarily on avoided reconstruction costs. QRA's methodology for assessing the benefits of betterment projects does not currently consider the intangible benefits associated with having more resilient infrastructure. This can include social, economic, and environmental benefits such as more connected communities, continuity of telecommunications, road networks and other essential services, increased consumer confidence and business activity, and reduced impacts on the environment (for example, erosion and run off into creek beds and other waterways). If these intangible benefits were included, the total avoided cost figure would be much higher. This is an area of future work that QRA is exploring.

Betterment funding has been announced in response to specific disaster events, such as severe tropical cyclones in 2013, 2015 and 2017, as well as the North and Far North Queensland Monsoon Trough in 2019 and, and the severe flooding events that have occurred throughout 2022. QRA are trialling a betterment program that applies to all councils impacted by any event in a financial year, and they are looking for betterment to become available to all public reconstruction programs.

QRA are also looking at creating a guideline and resilience standard associated with the betterment of public infrastructure to further support the expansion of betterment programs.

More information

You can read more about the QRA betterment program **here**,and the Gayndah Water Supply Intake Station upgrade **here**.

For more information about the Resilience Valuation Initiative: **www.resiliencevaluation.com.au**
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