Economic Assessment of Southern Seawall Renewal

Wellington International Airport Limited

August 2025

Executive summary

Scope

Wellington International Airport Limited (WIAL) intends to seek resource consents, Reserves Act approvals, wildlife approvals, and archaeological authorities, under the Fast-track Approvals Act 2024, for the Southern Seawall Renewal Project (the Project).

The Southern Seawall at WIAL ("the Airport") has reached the end of its functional life. The proposed Project will help safeguard the long-term operation of the Airport against natural hazards, increase the Airport's resilience to climate change, and reduce the (otherwise increasing) maintenance demands of the existing seawall.

The Project includes the following key elements:

- Establishing two new construction yards (Miramar Golf Course Construction Yard ("MGC Yard") and Moa Point Construction Yard ("Moa Point Yard")), and using them, along with the existing George Bolt Street Construction Yard ("George Bolt Yard") for storage and construction activities

- Reconstructing the Southern Seawall with rock and Cubipods

- Remediating the eroding Eastern Bank with rock protection

- Establishing two new kororā colonies to support habitation and breeding.

Overall, the Project is expected to take six to eight years, with the seawall construction itself taking 24 to 30 months. Construction will be managed to maintain airport operations, minimise nighttime noise, and work around adverse weather and sea conditions. The Project must also appropriately manage constraints arising from sourcing, transporting, and stockpiling the significant volumes of rock and Cubipods required to complete the seawall works.

The Project was selected as one of 149 projects in Schedule 2 of the Fast-track Approvals Act. The purpose of this Act is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits. The Southern Seawall at Wellington International Airport protects airport operations by shielding the airfield from wave-induced storm damage, while also protecting Moa Point Road, an underpass, and surrounding infrastructure. The existing seawall has reached the end of its functional life and will require extensive and ongoing maintenance to uphold its depleted quality against expected increasingly intense storm damage.

Cost-benefit analysis

WIAL has commissioned this economic assessment to evaluate the costs and benefits of the Project, compared to maintaining the existing seawall, through a cost-benefit analysis (CBA) that covers a 50-year timeframe.

Benefits

The primary benefit from the Project is the prevention of expected repair costs, arising from different storm damage events that the existing seawall will require. Further benefits include prevention of disruption costs of Airport closure in extreme storm event scenario, cheaper and less regular maintenance, less frequent surveys of the seawall for damage after storms, and the prevented repair costs of council land and infrastructure. The incremental benefits associated with the Project, relative to maintaining the existing seawall, are estimated at $553.6 million (net present value (NPV)).[1]

Costs

The incremental costs for the Project, relative to maintaining the existing seawall, are estimated at $216.7 million (NPV). This includes the capital costs required for the construction of the renewed seawall as well as the estimated cost of a new crest wall in 2049.

Benefit-cost ratio

The estimated benefit-cost ratio (BCR) for the Project is 2.6 with a net benefit of $336.9 million (NPV). In other words, for every $1 spent on the Project $2.60 worth of benefits are achieved. A BCR greater than "1" indicates the benefits of a project (in this case, the seawall renewal) outweigh the associated costs.

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[1] Net Present Value (NPV) represents the sums of future money discounted back to reflect its value today.

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1 Introduction

Wellington International Airport Limited (WIAL) intends to seek resource consents, Reserves Act approvals, wildlife approvals, and archaeological authorities, under the Fast-track Approvals Act 2024 (Beehive, 2024), for the Southern Seawall Renewal Project (Project).

WIAL commissioned Business and Economic Research Limited (BERL) to undertake a cost-benefit analysis (CBA) of the Project, compared to retaining the current seawall, over a 50-year timeframe.

The authors of this report are Hugh Dixon and Connor McIndoe, and it was peer-reviewed by Killian Destremau. Our qualifications and expertise are set out in Appendix C and confirm that we have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023. This report has been prepared in compliance with that code, as if it was expert evidence presented in proceedings before the Environment Court. Unless we state otherwise, this report is within our area of expertise, and we have not omitted material facts known to us that might alter or detract from the opinions expressed in this report.

The Southern Seawall protects the airport's runway, flight operations, and surrounding infrastructure. The existing seawall has reached the end of its functional life and WIAL is considering renewal of the seawall. Given the regional and national significance of WIAL, and the importance of the Southern Seawall to WIAL's operations, renewing the seawall was selected as one of 149 projects in Schedule 2 of the Fast-track Approvals Act.

1.1 CBA assessment

The economic assessment of the Southern Seawall at Wellington International Airport is a CBA. The purpose of a CBA is to calculate and weigh the costs alongside the benefits to society of an intervention or activity. It is a systematic process to analyse decisions by summing up the potential benefits expected from a situation or action, and subtracting the total costs associated with taking that action. When the benefits exceed the costs, the project is considered an efficient use of resources (Ernst & Young, 2017).

A CBA compares the costs and benefits of a project or policy against a counterfactual over a specified timeframe. For this CBA, renewing the existing seawall (the scenario) is compared to retaining and maintaining the existing seawall (the counterfactual), over a 50-year timeframe.

Our CBA approach follows Treasury's Guide to Social Cost Benefit Analysis, which sets out best practice and a step-by-step guide to cost-benefit analysis for projects or policies requiring a decision (The Treasury, 2015).

1.2 Background

The Southern Seawall at Wellington International Airport (Figure 1) protects airport operations by shielding the airfield from wave-induced storm damage, while also protecting Moa Point Road, the underpass, and surrounding infrastructure (including council infrastructure). The existing seawall has reached the end of its functional life and will require extensive and ongoing maintenance to uphold its depleted quality against increasingly intense storm damage. A review of Asset Inspection and Maintenance Reports from 1994 to 2016 revealed that 92 percent of the concrete block (Akmon) units in the seawall have been replaced since its construction, indicating that it was originally under designed. This feature will further compound with expected future sea state conditions. On this basis, WIAL determined that the Southern Seawall renewal requires consideration.

Figure 1 Existing Wellington International Airport Southern Seawall

Source: Beca (2025)

As an input into the application under the Fast-track Approvals Act for the Project, this economic assessment has been prepared to consider the costs and benefits associated with renewing the

Southern Seawall. Our modelling is informed by research prepared by Beca Ltd on behalf of WIAL - *WIAL Sea Defence Structures Renewal* (Beca, 2025). Beca (2025) provides a high-level summary of estimated future Southern Seawall storm damage and repair and disruption costs to inform the economic analysis completed by BERL. Our CBA assumptions and results should be read in conjunction with Beca's report.

2 Cost-benefit analysis

The CBA methodology adopted in this report follows the Treasury's recommended five step process (The Treasury, 2015):

1. Define the counterfactual that the current proposal(s) will be assessed against

2. Identify the affected parties' gains and losses

3. Identify the costs and benefits

4. Value the costs and benefits

5. Discount to present value and then compare costs and benefits.

We explicitly structure this report in line with these steps, detailing how we have completed them, explaining any assumptions we have made, and the reasoning behind our analysis. Our modelling and assumptions are derived from the Beca (2025) summary of the estimated storm damage and repair costs for the existing seawall and the proposed seawall renewal at Wellington International Airport.

We assess the benefits and costs over a 50-year time horizon, using a discount rate of five percent to discount future costs and benefits to the current year. This discount rate is recommended by the Treasury. We also assume a two percent annual increase in monetised costs and benefits, based on the assumed long-run average cost inflation for New Zealand.

2.1 Step one - Define the scenario and the counterfactual

In the first instance, it is necessary to define the counterfactual (as the next best alternative) against which to assess the benefits and costs of the scenario (i.e., renewal of the Southern Seawall).

Counterfactual – Existing Southern Seawall

The counterfactual for this CBA is to retain the existing Southern Seawall (the counterfactual). As the existing Southern Seawall has reached the end of its functional life, extensive maintenance of the seawall would be required to uphold its defences against increasing storm damage. At the same time, even with continued maintenance, lower protection would be provided to the airport, its operations, and the surrounding infrastructure.

Scenario – Seawall renewal

The scenario (or proposed project) is the renewal of Wellington International Airport's Southern Seawall. The renewal will involve a substantial construction project expected to be completed by 2032. It is designed to provide significantly greater protection for both airport operations and surrounding infrastructure from a range of possible storm damage scenarios.

2.2 Step two – Identify affected parties

There are several affected parties involved in the Southern Seawall renewal scenario and the maintenance of the existing seawall. These include Wellington International Airport, the construction sector, and Wellington City Council (and ratepayers). For details on further identified parties, and the costs and benefits to them, please refer to Appendix A. Other parties impacted include wildlife and nearby residents to the Airport. The costs and benefits to these additional parties under the seawall renewal scenario (some of which are also likely to arise under the maintenance counterfactual) are not captured as part of this economic assessment (CBA).

2.3 Step three – Identify direct benefits and costs

The costs and benefits associated with our two scenarios – maintaining the existing seawall (counterfactual) and the seawall renewal – consist largely of construction, repair, disruption, and baseline maintenance costs under a range of storm damage scenarios.

2.3.1 Benefit variables

Prevented storm damage and seawall repair costs

The primary benefit of the Project is the prevented repair costs from a range of storm damage scenarios.

The proposed Project will be built to withstand multiple different storm damage scenarios incorporating modern technologies and materials not available at the time of the completion of the existing seawall. The renewed seawall will mitigate, and is expected to withstand, routine, moderate, major, and failure storm damage scenarios that would currently result in damage to the existing seawall – this is the prevented cost (a benefit). In addition, the Project includes a reduction in the risk and, therefore, the repair cost to council infrastructure located behind the seawall, as well as council land located to the east of the seawall.

Prevented costs from Airport closure in extreme storm event

The Project prevents disruption costs from Airport closure in the event of an extreme storm event.

The potential disruption scenario is an extreme storm event that causes widespread Akmon armour failure, including exposure of the underlying rock (i.e., failure), followed by a sustained sea state that breaches the seawall bund and crest. Such an event would prevent an immediate response to the storm damage and would require closure of the runway for between ten to 15 days (so that critical emergency works can temporarily stabilise the breaches, followed by a seawall rebuild to permanently address the widespread armour failure and breaches) (Beca, 2025).

The Project would prevent the risk of Airport closure entirely as there is no risk of seawall failure in the first instance.

Reduction in required ongoing maintenance and survey costs

Both the scenario (Project) and the counterfactual (existing seawall) require ongoing maintenance and survey costs. However, with expected increases in the intensity of storm damage, the under design of the existing seawall means it will require more regular and costly maintenance and surveying.

2.3.2 Cost variables

Construction costs (seawall renewal)

The Project (our scenario) involves a large construction project, costing approximately $289.7 million, expected to be completed in 2032.

Under the counterfactual scenario, that is maintaining the existing seawall, a $5 million upgrade in 2030 would be required for crest gabion baskets and a reno mattress, along with a $1 million upgrade of the rear slope protection (over and above maintenance and survey costs).

Both the scenario and the counterfactual require the construction of an additional crest wall in 2049, at an expected cost of $10 million. This is an identified cost for the CBA as the Project scenario costs are much higher in comparison to the counterfactual.

Additional identified costs that were determined to be out of scope due to their insignificance are outlined in Appendix A.

2.4 Step four – Value benefits and costs

The following section presents the valuation of benefits and costs used in our analysis and describes the impact that specific inputs have on the modelling.

2.4.1 Benefits

The main benefits accrued by the Project are the prevented repair costs from seawall damage in different storm damage scenarios, as well as the lower and less regular maintenance and survey costs. These benefits are better understood as cost-savings.

Beca (2025) suggested different ranges to be assessed for the associated repair costs of the storm damage events.[2] The suggested sensitivities are presented in Section 3. On this basis, we have structured the valuation of benefits into three ranges of repair costs:

- Low – representing the lower bound

- Median – representing the midpoint

- High - representing the upper bound.

The range of repair costs are assessed in the final benefit-cost ratio (BCR) in Section 2.5. For presentation purposes, however, we primarily only describe the median level – the midpoint – unless explicitly stated otherwise.

Prevented storm damage and seawall repair costs

The primary benefit of renewing the Southern Seawall is the prevented damage and repair costs from routine, moderate, or major storm damage events. Table 1 and Table 2 present the estimated costs (at the median) for both the existing seawall (counterfactual) and the Project across different storm damage events.[3]

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[2] We have also assumed that the probabilities provided for different storm damage scenarios were not mutually exclusive.

[3] Both these tables are replicated from Beca (2025) where further information about the probabilities and costs are provided.

Existing seawall (counterfactual)

Table 1 Existing seawall - Probabilities for storm damage scenarios and repair costs

Seawall damage and repair events	Annual probability (%)			Existing seawall repair cost (NZD, Mar 2025)
	Present day	2060	2080	
"Routine" damage	57	59	61	800,000
Moderate damage	35	38	40	1,900,000
Moderate – increasing damage	28	31	33	3,700,000
Moderate – increasing damage	24	27	30	4,200,000
Major damage – localised armour failure area	9	10	11	14,400,000
Failure – multiple armour failure areas	2	4	5	340,000,000
Failure – multiple armour failure areas[4]	1	4	5	340,000,000

Source: Beca (2025)

Seawall renewal (scenario)

The Southern Seawall Renewal (Project) is designed to withstand routine, moderate, major, and failure damage storm scenarios. The design features eliminate a range of expected repair costs that the existing seawall would otherwise face under the same storm damage scenarios.

Table 2 Seawall renewal - Probabilities for storm damage scenarios and repair costs

Seawall damage and repair events	Annual probability (%)			Seawall renewal costs (NZD, Mar 2025)
	Present day	2060	2080	
"Routine" damage				
Moderate damage				
Moderate – increasing damage				
Moderate – increasing damage	*Assumed not to be at risk for repair under routine, moderate, and major damage and failure events.*			
Major damage – localised armour failure area				
Failure – multiple armour failure areas				
Failure – multiple armour failure areas				
5 percent damage to crest rock and Eastern Bank Remediation rock. Two Cubipods replaced.	0.1	0.1	1.0	2,200,000
6 percent damage to crest rock and Eastern Bank Remediation rock. Four Cubipods replaced.	0.01	0.01	0.1	6,800,000

Source: Beca (2025)

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[4] "Future AEP, damage and costs for the two larger storm events (rows 6 and 7 of the table) round to the same values because waves at the seawall are limited by water depth, hence the wave heights for the 1% and 2% events are very similar (calculated as within 0.1m)." (Beca, 2025).

Prevented damage to council land and infrastructure

Similarly, the Project is expected to prevent repair costs from damage to council land and infrastructure because of the greater protection from storm damage.

In the event of major damage, or a failure of the existing seawall (counterfactual), estimated repair costs for the Eastern beach area would be between $3-$4 million and replacing the Moa Point Road pipe would be between $1-$2 million.[5] Conversely, for the Project, the Eastern beach area and the Moa Point Road pipe would see their risk of suffering damage from a storm reduced to zero (and hence their total repair costs are assumed to be zero).

Prevented costs from Airport closure in extreme storm event

The Project is also expected to prevent disruption costs from potential Airport closure because of an extreme storm event that inhibits immediate repair work. We assess the economic cost of this disruption scenario by estimating the daily economic value of activity associated with WIAL each year over a 50-year timeframe, and analysing the annual probabilities of such an event happening and the expected duration of closure.

Using BERL (2024), which estimated that WIAL contributed a total of $3.9 billion in expenditure to the Wellington regional economy in 2024 (Table 3), we estimate the total expenditure of WIAL associated activities over a 50-year timeframe at $99.8 billion (NPV). Each year over this timeframe, the daily expenditure is also estimated.

Table 3 Expenditure from WIAL activities, 2024

	2024
Expenditure from Airport activities ($m)	3,900
Occurrence	Annual

Source: BERL analysis

We estimate the daily expenditure from WIAL activities so that we can determine the economic impact of Airport closure for an assumed duration. We have assumed the midpoint between ten to 15 days of the disruption duration provided by Beca (2025) - i.e., Airport operations would be closed for 12.5 days to allow for critical emergency repair works.

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[5] In the median scenario, we take the midpoint of these ranges.

Beca (2025) assessed the probabilities of a closure scenario with the annual probabilities presented in Table 4.[6]

Table 4 Existing seawall - Probabilities for storm disruption and airport closure duration

Disruption scenario	Annual probability (%)			Disruption duration
	Present day	2060	2080	
Runway closure (exposure to wave attack due to seawall breaches, critical emergency repair works)	0.2	0.4	0.5	Potentially 10 to 15 days[7]
	0.1	0.4	0.5	

Source: Beca (2025)

The assessed disruption scenario is only expected to be possible with the existing seawall as it requires failure of the seawall. The proposed Project is designed to withstand failure storm damage scenarios (see Table 2). On this basis, despite being a monetary cost, the prevented cost of Airport disruption is considered a benefit. The total value of Airport closure over a 50-year timeframe is estimated at $16.4 million.

Lower baseline maintenance and survey costs

The difference in baseline maintenance and survey costs (to determine storm damage and repairs required), and their required occurrence, between our counterfactual and the scenario are presented in Table 5. The seawall renewal (scenario), once completed in 2032, requires less costly and less regular maintenance costs in comparison to the existing seawall (counterfactual) over the 50-year timeframe. While baseline survey costs are consistent between both the existing seawall and the proposed renewal, the existing seawall requires a survey annually rather than on a ten yearly basis.

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[6] Beca (2025) also assessed the probabilities of a potential temporary disruption scenario (two to 12 hours) as a result of storm debris deposited on the Runway End Safety Area (RESA). The economic cost of this scenario was not assessed and is detailed in Appendix A.

[7] Estimated period of critical emergency works, including mobilisation, to temporarily stabilise one to two breaches.

Table 5 Baseline maintenance and survey costs

	Counterfactual (existing seawall)	Scenario (seawall renewal)
	Present day	*From 2032*
Maintenance		
Cost ($m)	1	2
Occurrence	Annual	Every five years
Survey		
Cost ($)	20,000	20,000
Occurrence	Annual	Every ten years

Source: BERL analysis

Despite being a monetary cost, maintenance costs are presented as a benefit given that there is a significant reduction in such costs between the two scenarios. As shown in Table 7, the net present value (NPV) of the reduced maintenance costs is $12.7 million, over the 50-year timeframe, as a cost-saving benefit due to the proposed seawall requiring less maintenance than the counterfactual.

2.4.2 Costs

Construction costs

Both the counterfactual (existing seawall) and the scenario (seawall renewal) are expected to face construction costs over our analysis period.[8] However, the construction costs are expected to be significantly higher for the seawall renewal project due to the rebuild of the seawall (Table 6).

Table 6 Construction costs - Existing seawall and seawall renewal

Construction projects	Cost ($m)	Completed
Existing seawall		
Crest gabion baskets and reno mattress	5.0	2030
Rear slope protection	1.0	2030
Crest wall	10.0	2049
Sub-total	**16.0**	
Seawall renewal		
Initial seawall construction	289.7	2032
Crest wall	10.0	2049
Sub-total	**299.7**	

Source: BERL analysis

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[8] Construction costs are not subject to sensitivity testing.

The initial construction cost for the seawall renewal project is expected to be approximately $289.7 million and it is expected to take an estimated seven years to complete, assuming a start in 2025 and completion in 2032. Meanwhile, the existing seawall (counterfactual) requires two construction projects in 2030 totaling $6 million, and a further $10 million in 2049 for the construction of a new crest wall (also required by the seawall renewal project).

2.5 Step five – Calculate benefit-cost ratio (BCR)

In this subsection, we present the total benefits and costs, and the resulting BCR across three repair cost ranges – low, median, and high.[9] All benefits and costs presented are in terms of NPV using the five percent discount rate as recommended by the Treasury.

2.5.1 Total benefits

The total benefits associated with the Project (scenario) relative to the existing seawall (counterfactual) are estimated at $553.6 million in our median scenario (Table 7). There is, however, variation in the total benefits across the scenarios, from $305.9 million for lower repair costs to $691.4 million assuming higher repair costs.

Table 7 Total benefits of seawall renewal

NPV ($m)	Seawall renewal - Low	Seawall renewal - Median	Seawall renewal - High
Prevented repair costs	267.5	509.0	639.0
Lower maintenance costs	12.7	12.7	12.7
Prevented costs from Airport closure	16.4	16.4	16.4
Prevented repair costs for Eastern area	6.5	10.9	16.3
Prevented repair of council infrastructure	2.8	4.7	7.0
Total benefits	**305.9**	**553.6**	**691.4**

Source: BERL analysis

2.5.2 Total costs

The total costs for the Project (scenario) relative to the existing seawall (counterfactual) are estimated at $216.7 million. This includes the NPV of the capital costs required for the initial construction cost as well as the estimated cost of a new crest wall. These costs are assumed to be unaffected by the estimate ranges for the benefits (i.e., low, median, and high).

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[9] Ranges are required to be presented as a result of the suggested sensitivity analysis detailed further in Section 3.

2.5.3 Benefit-cost ratio (BCR)

A benefit-cost ratio (BCR) indicates whether the benefits of a project (in this case, the seawall renewal) outweigh the associated costs. At the midpoint (i.e., median repair costs), the BCR for the Project is 2.6 (Table 8). In other words, for every $1 spent on the Project, $2.60 worth of benefits are achieved over the 50-year timeframe.

Table 8 Benefit-cost ratio (BCR)

CBA (NPV)	Seawall renewal - Low	Seawall renewal - Median	Seawall renewal - High
Benefits ($m)	305.9	553.6	691.4
Costs ($m)	216.7	216.7	216.7
Net ($m)	89.3	336.9	474.7
BCR	**1.4**	**2.6**	**3.2**

Source: BERL analysis

The BCR of the Project remains positive (1.4 to 3.2) at each of the three ranges assessed for sensitivity testing, even when the cost estimates are held at their lowest point.

There are two main drivers for the results of our CBA: the initial construction cost for the Project, and the substantial prevention of repair costs as a result of the renewed seawall.

3 Sensitivity analysis – repair cost ranges

Beca (2025) recommended that our CBA includes sensitivity analysis of the repair costs associated with different storm damage events. In our CBA, these repair "costs" are identified as benefits (as they are prevented costs) and are outlined in Section 2.4.1. The sensitivity testing applied resulted in three ranges (low, median, and high) and these are applied to the benefits of our CBA.

Existing seawall (Counterfactual)

The existing seawall is subject to more substantial expected repair costs as a result of it nearing the end of its design life and general under design. These repair costs are presented in Table 9 with the suggested sensitivity testing also provided.

Table 9 Sensitivity testing applied for the counterfactual

Seawall damage and repair events	Repair cost (NZD, Mar 2025)	Sensitivity
"Routine" damage	800,000	±30%
Moderate damage	1,900,000	±30%
Moderate – increasing damage	3,700,000	±30%
Moderate – increasing damage	4,200,000	±30%
Major damage – localised armour failure area	14,400,000	100% -50%
Failure – multiple armour failure areas	340,000,000	20% - 50%

Source: Beca (2025)

Seawall renewal (scenario)

The seawall renewal project is specifically designed to withstand "routine", moderate, and major damage scenarios, as well as seawall failure. There are only two seawall damage scenarios assumed for the seawall renewal project. They, and their suggested sensitivity ranges, are presented in Table 10.

Table 10 Sensitivity testing applied for the scenario

Seawall damage and repair scenario	Repair cost (NZD, Mar 2025)	Sensitivity
5 percent damage to crest rock and Eastern Bank Remediation rock. Two Cubipods replaced.	2,200,000	+100%-50%
6 percent damage to crest rock and Eastern Bank Remediation rock. Four Cubipods replaced.	6,800,000	+100%-50%

Source: Beca (2025)

4 Economic cost of disruption to aircraft and airport operations

This section provides background and detail on the economic cost of disruption to aircraft and airport operations from potential Airport closure – a benefit in the CBA – in the context of WIAL's significant role in the Wellington regional economy.

Wellington International Airport is a vital economic connection point

As a vital economic hub that connects local, regional, national, and international communities, the Airport makes a significant economic contribution to the Wellington regional economy.

> In 2024, it was estimated that WIAL was responsible for a total of $3.9 billion in expenditure and $2 billion in gross domestic product (GDP) while supporting approximately 14,500 jobs (FTEs) in the Wellington region (BERL, 2024).

In an extreme storm event that results in failure of the existing seawall, followed by a sustained sea state that prevents immediate response to the storm damage, there is a risk that the Airport would need to close for between ten to 15 days (Beca, 2025). This closure would be necessary to allow for critical emergency works to temporarily stabilise the breaches, followed by a rebuild of the seawall to permanently address the failure.

Each day that the Airport is closed would impact the economic activity in the Wellington regional economy that WIAL facilitates and contributes to. The Project prevents this risk.

Airport closure would be a significant economic cost to the Wellington region

Given the Airport's notable estimated daily value, despite potential closure of the Airport only occurring under a low probability scenario (see Table 4), the economic cost of such an event remains significant to the Wellington regional economy.

The estimated potential economic cost of Airport closure over the 50-year timeframe is $16.4 million (NPV). That is, in present day dollars, the average annualised risk of closure is $16.4 million (NPV).[10] This is a risk only associated with the existing seawall and would be prevented by the Project.

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[10] This assumes a 12.5-day duration of closure – the midpoint of ten to 15 days assessed in Beca (2025).

5 Additional regional benefits of the Project

Although not quantified as part of our CBA, there are wider regional economic benefits that can be attributed to the Project, which we describe in this section.[11]

We note that the construction associated with the Project will contribute to employment within industries involved. This is a wider regional impact of the Project from the construction activity associated with it. However, the wider regional impacts to the construction industry are not included in the CBA as the construction of the seawall is a cost in our CBA framework. In this section, we have provided a short discussion of the potential impact to the regional Wellington heavy and civil engineering construction industry as context.

Estimated direct employment created from seawall construction

We estimate (at a high level) that the construction of the new seawall could see direct employment of up to 800 FTEs over the seven years of construction, or 114 FTEs per year. The bulk of the employment impact, around 700 FTEs, would be in the 24 to 30 months of construction. This is equivalent to around 230 FTEs per year across the period, with only a few likely to be employed in the initial phases. These are direct FTEs represented across the Project, from those specifically involved with the seawall (e.g., laborers) on site to civil engineers and consultants.

For context, in 2024 there were 4,330 FTEs employed by the heavy and civil engineering construction industry in the Wellington region. This means that across the 24-to-30-month construction phase, we estimate the 230 FTEs employed per year would represent about five percent of the regional workforce.

Furthermore, with the main construction phase running from 2030 to 2032, it would avoid competing with other large projects such as the RiverLink project in Lower Hutt and the Ōtaki – Levin highway extension. As such it could potentially make a net contribution to the regional Wellington construction industry (as opposed to being a full transfer of resources across concurrent projects).

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[11] Further benefits and costs also not quantified in the CBA are detailed in Appendix A.

Appendix A   Other benefits and costs, not in the CBA

The following appendix briefly describes identified benefits (i.e., prevented costs) and costs of the Project that were agreed to be out of scope and therefore not accounted for in the cost-benefit analysis.

Storm debris on Runway End Safety Area (RESA)

There is potential for temporary disruption (2 to 12 hours) to Airport operations from storm debris deposited on the RESA that would be accentuated by gale force southerly winds. This scenario was assessed in Beca (2025). The closure duration under this scenario depends on the timing of the storm event, whether it occurs during daylight or night hours. It is likely that closure to airport operations to solve the issue would occur outside operating hours.

On this basis, and given the relatively short disruption, we have not estimated the economic cost of the potential 2-to-12-hour closure.

Furthermore, wave overtopping could potentially cause damage to the ground-based Instrument Landing System (ILS), preventing aircraft landing from the north in low cloud conditions. Beca (2025) relays the complexity in modelling such a unique circumstance along with the relatively modest disruption costs associated with its impact. Again, on this basis, we have agreed to not model the implications of such an event.

In either case, the Project will raise and strengthen the southern seawall and make it more resilient to these events, thus reducing their likelihood.

Benefits and costs on wildlife

As part of the construction project there is an expected impact on local kororā which nest within the construction footprint. Work will be undertaken to minimise any negative impact and potentially enable some ecological benefit, by improving nesting sites, access, and shelter for the kororā.

The Stage 1 Kororā Colony – located on the landward side of Moa Point Road, south of the Airport – will be constructed in advance of the main seawall construction, allowing for the relocation of kororā before habitat within the construction footprint is lost. The Stage 2 Kororā Colony will be constructed on the south-eastern part of the Moa Point Yard (following site demobilisation) on completion of the Southern Seawall.

The overall impact on kororā and other local wildlife has not been included in the scope of the CBA (noting that the counterfactual of maintaining the seawall could equally have costs and benefits in this regard).

Disruption costs to residents

Construction is expected to take 24 to 30 months, with substantial work taking place at night, which has the potential for adverse effects on local residents in the area. There are a limited number of residential buildings near the Southern seawall site, with around 15 residential buildings located within 100 to 300 metres to the east of the site on Moa Point Road. The next closest residential area is about 500 metres away on Kekerenga Street located at the top of a nearby hill overlooking Moa Point Road. With the limited number of nearby residents, the potential negative disruption impacts of construction are not included and are out of scope for the cost-benefit analysis.

We also note that more regular maintenance of the counterfactual could similarly have some of these effects.

Appendix B   References

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Appendix C   Qualifications and experience

Hugh Dixon (Data Manager)

Qualifications:

- Diploma in Business Studies (Finance); Massey University, New Zealand

- Post-graduate Diploma in Business Administration (Economics); Massey University, New Zealand

- Bachelor of Business Studies (Economics); Massey University, New Zealand.

Experience:

- Cost benefit analysis of Blue Bluff Slips for the Kapiti District Council

- Investigation of the cost benefit analysis of Speed Management for Auckland Transport

- Cost benefit analysis of runway safety for Wellington International Airport.

Connor McIndoe (Senior Consultant)

Qualifications:

- Bachelor of Commerce (Economics and Commercial Law); Victoria University of Wellington, New Zealand.

Experience:

- Investigation of the cost benefit analysis of Speed Management for Auckland Transport

- Cost benefit analysis of runway safety for Wellington International Airport.

Killian Destremau (Deputy Chief Economist)

Qualifications:

- Master in Public Administration, National University of Singapore, 2022

- Bachelor of Commerce and Administration (Honours), Victoria University of Wellington, 2012

- Bachelor of Commerce, University of Auckland, 2011.

Beca

WIAL Southern Seawall Renewal
Estimated Future Damage

29 August 2025

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Contents

Appendices

Appendix A – Historical seawall repairs

Revision History

Revision Nº	Prepared By	Description	Date
A	Jennifer Hart	Issue for consent application	29/08/2025

Document Acceptance

Action	Name	Signed	Date
Prepared by	Jennifer Hart		29/08/2025
Reviewed by	Amy Sheppard		29/08/2025
Approved by	Jennifer Hart		29/08/2025
on behalf of	Beca Limited		

1   Introduction

This report has been prepared by Beca Ltd on behalf of Wellington international Airport Ltd ("**WIAL**") for the Southern Seawall in Lyall Bay. It provides a summary of estimated future Southern Seawall storm damage and repair and associated disruption to airport operations for a nominal 50 year period (2030 to 2080). It is a high level assessment using existing available information. The information will help to inform an economic analysis by Business and Economic Research Ltd ("**BERL**") for a resource consent application for renewal of the Southern Seawall.

2   Existing Site Background

Wellington International Airport is located in Lyall Bay at the south end of the North Island. The site is situated on the open coast and directly exposed to southerly swells propagating from the Southern Ocean. The southern end of the runway is reclaimed land with sea defences constructed in the 1950s and 1970s to provide shoreline protection against erosion and coastal flooding.

The existing Southern Seawall is shown in Figure 1. It was constructed in 1971-1972 and comprises:

- Seaward slope protection: 12 tonne Akmon concrete armour units, supplementing original 10 tonne Akmons. 1-2 tonne underlayer rock, and 5-10 tonne toe rock were reportedly also used. Breakage and abrasion of the 10 and 12 tonne Akmon units has been noted and monitored since the mid-1990s.
- Crest and wave trap protection: gabion baskets and reno mattresses over an engineered fill crest, together approximately 2.5m in height by 200m long by 10m wide, with small rock riprap on the base of the wave trap. An existing vertical wall forms the landward side of the wave trap, protecting the Instrument Landing System ("**ILS**") and underground control room. The vertical wall is shallow-founded and relies on protection of the seawall crest against direct wave attack and scour of the wall foundation.
- Rear slope protection: approx. 60m of the slope is protected by 1.4-3.5 tonne rock armour and 120-500 kilogram underlayer rock, reno mattress and gabion basket. The remaining approx. 40m is unprotected reclaimed fill.
- Eastern Area (eastern end of the seawall): informal rubble protection only.
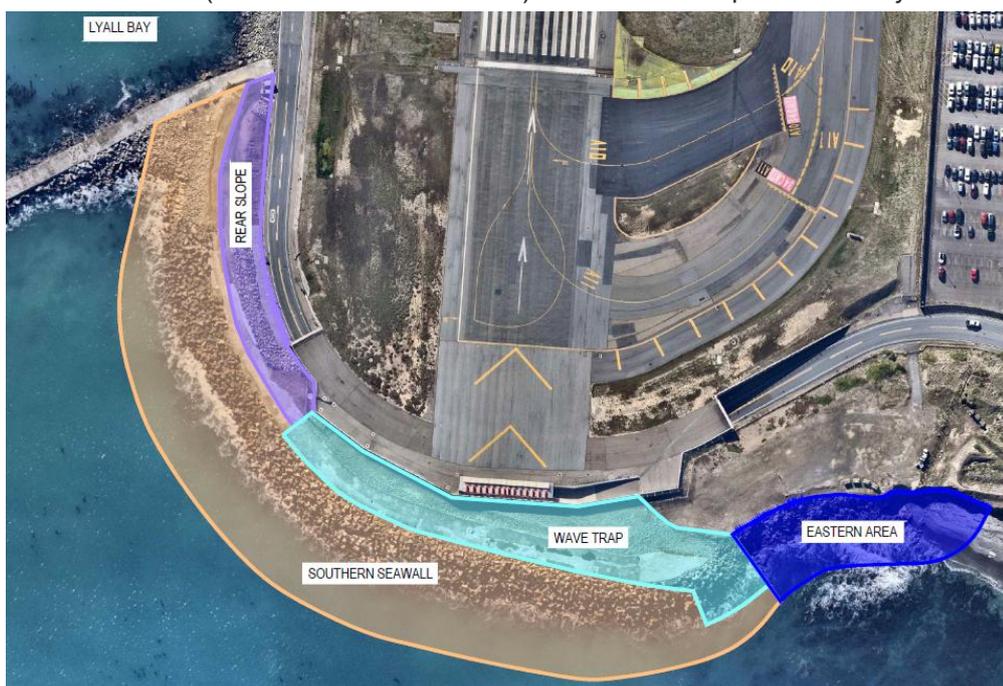

Figure 1: Southern Seawall

3 Source Information

Annual exceedance probabilities for storms, and associated repair costs have been estimated based on:

- Historical storm repair records for the Southern Seawall from 1973 to 2025, including armour failure and breach of the Southern Seawall bund in 1984, resulting in substantial loss of protective armour units, underlayer rock and fill (refer to Appendix A).
- Historical armour abrasion and breakage rates based on engineering assessments (Beca, 1994; Beca, 2016; Beca, in prep).
- Technical literature on concrete armour units (Paape and Walther, 1962; CIRIA 2007).
- Major repair costs, indexed to March 2025 using information from seawall repair contracts in 2020/21.
- "Major seawall repair" costs and programme estimated in February 2025 by an experienced marine contractor, based on the 1984 armour failure and breach repairs.
- Seawall rebuild costs associated with seawall failure, estimated in June 2022 and indexed to March 2025 based on rebuilding the seawall using a Cubipod overlay. These costs have been confirmed by a preliminary estimate prepared by an experienced marine contractor in October 2024.
- Wave conditions (represented by the nearshore significant wave height) corresponding to Annual Exceedance Probabilities (AEP) of storm events. This considered climate change effects such as projected Relative Sea Level Rise of up to 0.9m by 2080 (fossil-fuel rich development scenario SSSP8.5-83rd percentile and Vertical Land Movement, NZ SeaRise, 2024) and 2.5% increase in wave height by 2080 (Albuquerque et al, 2022). The wave conditions for 0.1% to 63% AEP were derived from numerical wave modelling for the present day, 2060 and 2080 (MetOcean Solutions, 2025a). The wave conditions were transformed to nearshore wave heights approximately 300m south of the Southern Seawall, following an approach set out in international maritime engineering guidance (CIRIA, 2007; Goda, 2000).
- A 43-year data series of wave and wind conditions at the entrance to Lyall Bay, generated by MetOcean Solutions' numerical modelling.
- Annual exceedance probabilities for wind conditions from a further wind and wave statistics study by MetOcean Solutions (MetOcean Solutions, 2025b).
- Airport operations experience of a runway closure event caused by sea storm debris (WIAL, pers. comm.).
- A study period from the present day to 2080, corresponding to a nominal 50 year period.

4 Assessment of Storm Damage and Repair Costs

The Annual Exceedance Probabilities ("**AEP**")[1] for storm damage and associated repair costs, and storm disruption have been estimated. This section summarises the high level assessment approach and the results.

Storm events were identified using the historical storm damage and repair records, together with the 43-year data series of wave and wind conditions at the entrance to Lyall Bay. Nearshore wave heights and corresponding AEP for present day, 2060 and 2080 were estimated for historical storm events, using the results of the numerical modelling and wave transformation. Repair costs for the storm events were estimated using historical repair costs (for the routine to moderate damage scenarios) and recent cost estimates (for the major damage and failure scenarios). The costs allow for physical works, professional services and WIAL internal costs. The failure scenarios include a 20% uplift for procuring materials and plant under urgency.

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[1] Annual exceedance probability (AEP) is the probability of an event occurring in any given year.

The estimated level of damage and repair for larger storm events (present day 1% and 2% AEP) was evaluated considering, the present seawall geometry, breakage and abrasion of Akmon units based on seawall inspections over the past 30 years, and an assessment of approximate damage levels using technical guidance (Paape and Walther, 1962; CIRIA, 2007).

Table 1 sets out the present day to 2080 AEPs and rough order of seawall repair costs.

Table 1: Estimated annual exceedance probabilities for storm damage and rough order repair costs

Estimated Annual Exceedance Probability			Rough order repair cost (NZD, Mar 2025)	Seawall damage & repair scenario
Present day	2060	2080		
57%	59%	61%	800,000	"Routine" damage
35%	38%	40%	1,900,000	Moderate damage
28%	31%	33%	3,700,000	Moderate - increasing damage
24%	27%	30%	4,200,000	Moderate - increasing damage
9%	10%	11%	14,400,000	Major damage – localised armour failure area
2%	4%	5%	340,000,000	Failure – multiple armour failure areas
1%	4%[1]	5%[1]	340,000,000[1]	Failure – multiple armour failure areas

[1] Future AEP, damage and costs for the two larger storm events (rows 6 and 7 of the table) round to the same values because waves at the seawall are limited by water depth, hence the wave heights for the 1% and 2% events are very similar (calculated as within 0.1m).

Any analysis using the above information should include sensitivity testing of the damage costs. Suggested sensitivities are indicated in Table 2.

Table 2: Sensitivity testing for rough order repair costs

Rough order cost (NZD, Mar 2025)	Sensitivity
800,000	±30%
1,900,000	±30%
3,700,000	±30%
4,200,000	±30%
14,400,000	+100% -50%
340,000,000	+20% - 50%

In addition to the above, the crest gabion and rear slope protection are approaching end of life and expected to fail due to deterioration within certain timeframes. Table 3 sets out the associated timeframes and estimated costs.

Table 3: Estimated timeframes and rough order replacement costs for specific seawall elements

Seawall element	Timeframe	Rough order replacement costs (NZD, Mar 2025)
Crest gabion baskets and reno mattresses	by 2030	5,000,000
Rear slope protection	by 2030	1,000,000

5 Assessment of Storm & Repair Disruption Probabilities

Storm debris and damage, and critical emergency works to address such damage, also have the potential to disrupt aircraft and airport operations. Key infrastructure for airport operations such as the above- and below-ground ILS components, ILS protection wall, and Engineered Material Arresting System ("**EMAS**") installed on the Runway End Safety Area ("**RESA**") are the first airport assets impacted by marine storm events. Two closure scenarios have been assessed, both based on actual events.

In June 2012 the airport runway was closed due to debris deposited on the RESA by storm waves, accentuated by gale force southerly winds. The wave and wind conditions have been identified from historical records and the 43-year data series. The present day, 2060 and 2080 AEP for the wave conditions were estimated using the results of the numerical modelling and wave transformation. Data is not available for the future windspeeds and AEP with climate change. It is suggested therefore that the present day AEP for the wind conditions is applied for future years. This is a conservative approach that will give a slightly lower probability of occurrence, as extreme windspeeds for Wellington are projected to increase with climate change (Ministry for the Environment, 2020). Table 4 gives the present day to 2080 AEP for the wave and wind conditions.

The second closure scenario is an extreme storm event causing widespread Akmon armour failure including exposure of the underlying rock (1% or 2% AEP storm, refer to Section 4) followed by a sustained sea state that breaches the seawall bund and crest, as well as preventing an immediate response to the storm damage. The breach or breaches would expose the existing ILS protection wall and the ILS to wave attack. It is anticipated that this would result in closure of the runway for safety reasons, and for 24 hour, 7 day critical emergency works to temporarily stabilise the breaches followed by seawall rebuild to permanently address the widespread armour failure and breaches. The scenario draws on a 1984 armour failure and bund/crest breach, which took three months to repair under daytime working, using a large crane that lowered its mast for take-offs and landing (impracticable with present day air traffic and Civil Aviation rules). The assessed scenario also considers the armour damage caused by more recent major storms, empirical rock stability calculations to identify the sustained sea state that could cause a bund/crest breach (CIRIA, 2007), a statistical analysis of numerical wave modelling to identify the annual probability of that sustained sea state (MetOcean Solutions 2025b), and a contractor's mobilisation, programme and productivity information. Repair costs for 1% and 2% AEP events (refer Table 1) would be incurred in addition to the runway closures.

Table 4: Estimated annual exceedance probabilities for storm disruption

Estimated AEP - Waves			Estimated AEP – Wind	Disruption scenario	Disruption duration
Present	2060	2080	Present		
28%	31%	33%	5%	Runway closure (storm debris on RESA)	2 to 12 hours[1]
0.2%	0.4%	0.5%	N/A	Runway closure (exposure to wave attack due to seawall breaches, critical emergency repair works)	Potentially 10 to 15 days[2]
0.1%	0.4%	0.5%	N/A		

[1] Based on historical information, closure duration varies depending on whether the storm occurs during daylight or night hours.
[2] Estimated period of critical emergency works, including mobilisation, to temporarily stabilise 1-2 breaches.

There is also potential for wave overtopping due to storms to cause damage to the ground-based ILS, which would prevent aircraft landing from the north (i.e. in southerly wind conditions), in low cloud conditions, if the aircraft did not have onboard instrument systems. Recent examples include a storm in early May 2025. Airlines were not able to operate due to high winds, and this was compounded by wave overtopping that flooded the ILS control room and disabled the localiser. The low cloud base precluded visual flight rules at the time. Wave overtopping disruption has not been explored due to the complexity of estimating the multiple marine, meteorological and aircraft factors involved, and the anticipated relatively modest disruption costs that would ultimately result (order of hours of disruption), however it remains an additional risk.

6 Assessment of Storm Damage & Repair Costs for Seawall Renewal

The AEPs for storm damage and associated repair costs have also been estimated for the seawall renewal. The seawall renewal includes:

- Overlay of the existing seawall with a rock underlayer to correct the slope and a double layer of Cubipod concrete armour units.

- A new reinforced concrete crest wall and crest armour rock.

- New rear slope protection.

- Rock protection of a length of presently unprotected bank east of the seawall (Eastern Bank Remediation).

Table 5 sets out the present day to 2080 AEP and rough order of repair costs for the seawall renewal.

Table 5: Seawall renewal - estimated annual exceedance probabilities for storm damage and rough order repair costs

Estimated Annual Exceedance Probability			Rough order cost	Seawall damage & repair scenario
Present day	2060	2080	(NZD, Mar 2025)	
57%	59%	61%	0	-
35%	38%	40%	0	-
28%	31%	33%	0	-
24%	27%	30%	0	-
9%	10%	11%	0	-
2%	4%	5%	0	-
1%	4%	5%	0	-
0.1%	*0.1%*	1%	2,200,000	5% damage to crest rock and Eastern Bank Remediation rock. 2 Cubipods replaced based on average physical modelling damage for 1% AEP event
0.01%	*0.01%*	0.1%	6,800,000	6% damage to crest rock and Eastern Bank Remediation rock. 4 Cubipods replaced based on average physical modelling damage for 0.1% AEP event

The seawall renewal is designed for the 1% AEP 2080 event and also considers an "overload" event (0.1% AEP 2080). The present day and 2060 AEPs corresponding to the 2080 design and overdesign events have been investigated, using the results of the numerical modelling and wave transformation. The corresponding AEPs are below (i.e. smaller than) the values considered in the numerical modelling. Proxy values of 0.1% and 0.01% have therefore been adopted for the present day and 2060 AEP. Any analysis using these values should include sensitivity testing. Suggested sensitivities are +100% -50%.

No repairs are expected for events smaller than the design event. A physical model of the concrete armour unit seawall has been tested for the design and over design events. Repair costs for the concrete armour units have been estimated based on the test results (due to the curved geometry of the seawall) and recent cost estimates for armour unit construction and repairs. Repair costs for the rock protection on the seawall crest and Eastern Bank Remediation have been estimated from design damage levels and recent cost estimates for rock construction and repairs. All cost estimates allow for physical works, professional services and WIAL internal costs. as these are not failure scenarios no "urgency" uplift is applied.

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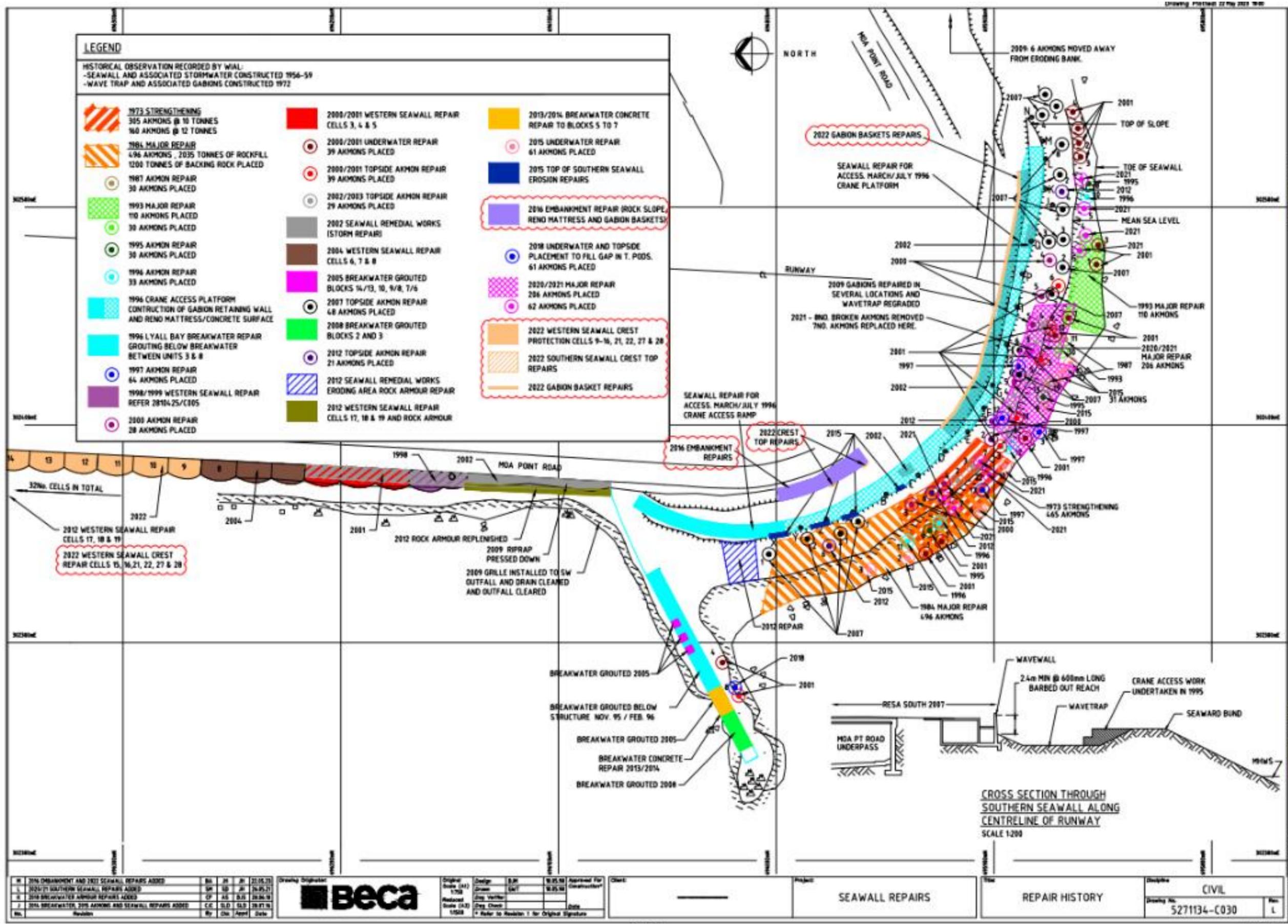
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A

Appendix A – Historical seawall repairs

Drawing Plotted 22 May 2023 10:40

LEGEND

HISTORICAL OBSERVATION RECORDED BY WIAL:
- SEAWALL AND ASSOCIATED STORMWATER CONSTRUCTED 1956–59
- WAVE TRAP AND ASSOCIATED GABIONS CONSTRUCTED 1972

1973 STRENGTHENING
305 AKMONS @ 10 TONNES
160 AKMONS @ 12 TONNES

1984 MAJOR REPAIR
496 AKMONS, 2035 TONNES OF ROCKFILL
1200 TONNES OF BACKING ROCK PLACED

1987 AKMON REPAIR
30 AKMONS PLACED

1993 MAJOR REPAIR
110 AKMONS PLACED
30 AKMONS PLACED

1995 AKMON REPAIR
30 AKMONS PLACED

1996 AKMON REPAIR
33 AKMONS PLACED

1996 CRANE ACCESS PLATFORM
CONTRUCTION OF GABION RETAINING WALL
AND RENO MATTRESS/CONCRETE SURFACE

1996 LYALL BAY BREAKWATER REPAIR
GROUTING BELOW BREAKWATER
BETWEEN UNITS 3 & 8

1997 AKMON REPAIR
64 AKMONS PLACED

1998/1999 WESTERN SEAWALL REPAIR
REFER 2810425/C005

2000 AKMON REPAIR
28 AKMONS PLACED

2000/2001 WESTERN SEAWALL REPAIR
CELLS 3, 4 & 5

2000/2001 UNDERWATER REPAIR
39 AKMONS PLACED

2000/2001 TOPSIDE AKMON REPAIR
39 AKMONS PLACED

2002/2003 TOPSIDE AKMON REPAIR
29 AKMONS PLACED

2002 SEAWALL REMEDIAL WORKS
(STORM REPAIR)

2004 WESTERN SEAWALL REPAIR
CELLS 6, 7 & 8

2005 BREAKWATER GROUTED
BLOCKS 14/13, 10, 9/8, 7/6

2007 TOPSIDE AKMON REPAIR
48 AKMONS PLACED

2008 BREAKWATER GROUTED
BLOCKS 2 AND 3

2012 TOPSIDE AKMON REPAIR
21 AKMONS PLACED

2012 SEAWALL REMEDIAL WORKS
ERODING AREA ROCK ARMOUR REPAIR

2012 WESTERN SEAWALL REPAIR
CELLS 17, 18 & 19 AND ROCK ARMOUR

2013/2014 BREAKWATER CONCRETE
REPAIR TO BLOCKS 5 TO 7

2015 UNDERWATER REPAIR
61 AKMONS PLACED

2015 TOP OF SOUTHERN SEAWALL
EROSION REPAIRS

2016 EMBANKMENT REPAIR (ROCK SLOPE, RENO MATTRESS AND GABION BASKETS)

2018 UNDERWATER AND TOPSIDE
PLACEMENT TO FILL GAP IN T. PODS.
61 AKMONS PLACED

2020/2021 MAJOR REPAIR
206 AKMONS PLACED
62 AKMONS PLACED

2022 WESTERN SEAWALL CREST
PROTECTION CELLS 9–16, 21, 22, 27 & 28

2022 SOUTHERN SEAWALL CREST TOP
REPAIRS

2022 GABION BASKET REPAIRS

NORTH

MOA POINT ROAD

2009: 6 AKMONS MOVED AWAY FROM ERODING BANK.
2007
2001
2022 GABION BASKETS REPAIRS
TOP OF SLOPE
SEAWALL REPAIR FOR ACCESS. MARCH/JULY 1996 CRANE PLATFORM
TOE OF SEAWALL
2021
1995
2012
1996
2001
MEAN SEA LEVEL
2021
2002
2021
2000
2001
2009 GABIONS REPAIRED IN SEVERAL LOCATIONS AND WAVETRAP REGRADED
2007
1993 MAJOR REPAIR 110 AKMONS
2021 – 8NO. BROKEN AKMONS REMOVED 7NO. AKMONS REPLACED HERE.
2007
2001
2020/2021 MAJOR REPAIR 206 AKMONS
1987
1993
2015 31 AKMONS
2001
2007
1995
2015
2000
1997
2012
RUNWAY
SEAWALL REPAIR FOR ACCESS. MARCH/JULY 1996 CRANE ACCESS RAMP
2016 EMBANKMENT REPAIRS
2022 CREST TOP REPAIRS
2015
2002
2021
2022 CREST TOP REPAIRS
2015
1997
1997
2015
1996
2021
1973 STRENGTHENING 465 AKMONS
2015
1997
2000
2021
2007
2012
1996
1995
2001
1984 MAJOR REPAIR 696 AKMONS
2015
2005
1996
2012

1998
2002
MOA POINT ROAD
32No. CELLS IN TOTAL
2012 WESTERN SEAWALL REPAIR CELLS 17, 18 & 19
2022
2004
2001
2012 ROCK ARMOUR REPLENISHED
2009 RIPRAP PRESSED DOWN
2009 GRILLE INSTALLED TO SW OUTFALL AND DRAIN CLEANED AND OUTFALL CLEARED
2012 REPAIR
2007
2018
2001

2022 WESTERN SEAWALL CREST REPAIR CELLS 15, 16, 21, 22, 27 & 28

BREAKWATER GROUTED 2005
BREAKWATER GROUTED BELOW STRUCTURE NOV. 95 / FEB. 96
BREAKWATER GROUTED 2005
BREAKWATER CONCRETE REPAIR 2013/2014
BREAKWATER GROUTED 2008

WAVEWALL
2.4m MIN @ 600mm LONG BARBED OUT REACH
CRANE ACCESS WORK UNDERTAKEN IN 1995
RESA SOUTH 2007
WAVETRAP
SEAWARD BUND
MOA PT ROAD UNDERPASS
MHWS
MLWS

CROSS SECTION THROUGH SOUTHERN SEAWALL ALONG CENTRELINE OF RUNWAY
SCALE 1:200

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SEAWALL REPAIRS

REPAIR HISTORY

Discipline: CIVIL

Drawing No. 5271134-C030 Rev. L