

**BEFORE THE OTAGO REGIONAL COUNCIL AND DUNEDIN CITY
COUNCIL**

IN THE MATTER

of the Resource Management Act 1991 (**Act**)

AND

IN THE MATTER

Resource Consent Applications ORC RM19.441 and DCC
LUC-2019-658 – Port Otago Ltd – Te Rauone Beach Rock
Groynes and Sand Re-nourishment

STATEMENT OF EVIDENCE OF JENNIFER HART

ON BEHALF OF PORT OTAGO LIMITED

Date 30 November 2020

STATEMENT OF EVIDENCE OF JENNIFER HART FOR PORT OTAGO LIMITED

INTRODUCTION

1 My full name is Jennifer Helen Hart.

Qualifications and Experience

2 I am a Senior Principal in the Transport Infrastructure section with Beca Ltd.

3 I have a Bachelor of Civil Engineering (Honours) from the University of Canterbury, a Master of Civil Engineering, specialising in Coastal Engineering, from the University of Auckland, and a Masters of Engineering specialising in Coastal Engineering and Port Development from the IHE Delft Institute for Water Education in the Netherlands. I am a member of the New Zealand Coastal Society.

4 I have worked on major infrastructural projects for 25 years in New Zealand, the United Kingdom and the Asia-Pacific region. The focus of my project experience has been in port and coastal projects, and transport infrastructure. My relevant experience includes:

- Leading the coastal processes effects assessment for Ports of Auckland Ltd.'s resource consent application for the capital deepening and maintenance dredging of the Rangitoto Channel shipping lane.
- Leading the detailed design of a rock seawall at Hector, on the West Coast.
- On behalf of Otago Regional Council as the regulatory authority, review of the coastal processes aspects of an application to modify an existing seawall at Oamaru.
- Leading the engineering inputs, including the coastal processes effects assessment, for the initial consent application by Panuku Development Auckland for the 36th America's Cup base development on the Auckland waterfront.
- Review of the Long Mac training wall at the Otago Harbour entrance for Port Otago Ltd.
- Leading the coastal processes effects assessment for Ports of Auckland Ltd.'s consent application for maintenance dredging of the Waitemata Navigation Channel Precinct.
- Leading the coastal processes effects assessment and providing expert evidence at the unitary authority hearing for Auckland Council's Waikowhai Boardwalk across Hillsborough Bay.

- Preparation of coastal processes effects assessments and providing expert evidence for the Penlink Bridge across the Weiti River Estuary at regional council and unitary authority hearings.
- Submissions, expert conferencing and preparation of expert evidence on coastal and engineering matters for the Proposed Auckland Unitary Plan Independent Hearings Panel.
- Leading the coastal processes effects assessments for consent applications for a cruise ship berth and commercial wharf extensions in the lower Waitemata Harbour, for Panuku Development Auckland and Ports of Auckland Ltd.
- Leading the preparation of long-term coastal management strategies and the delivery of five-year schemes, including environmental approval applications, for beach renourishment projects in Lincolnshire (Mablethorpe to Skegness) and North Norfolk (Happisburgh to Winterton). The schemes involved placement of 1.3 million m³ of dredged sand on the coastline to enhance sea defences and the environment.
- Preparation of the first cycle of the Omaha Coastal Compartment Management Plan, and Omaha Beach and groyne condition inspections and maintenance recommendations, both for Rodney District Council.
- Preparation of the coastal science and engineering content in the assessment of environmental effects for Ports of Auckland Ltd.'s 2001 consent application for capital deepening and maintenance dredging of the Rangitoto Channel shipping lane.

Code of Conduct

- 5 I record that I have read and agree to abide by the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2014. This evidence is within my area of expertise, except where I state that I rely upon the evidence of other expert witness as presented to this hearing. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

- 6 My evidence will deal with the following:
- a. Background and role;
 - b. Project context and summary of methodology;
 - c. Description of relevant existing environment - coastal processes;
 - d. Description of project in relation to coastal processes;

- e. Summary of assessment of coastal processes effects;
- f. Comments on submissions;
- g. Comments on Section 42A report;
- h. Proposed conditions; and
- i. Conclusions.

BACKGROUND AND ROLE

- 7 Beca Ltd was engaged by Port Otago Ltd (“**POL**”) in June 2016 to provide coastal engineering services for the Te Rauone Beach Management Scheme.
- 8 I have managed the review of the previous groyne and renourishment scheme, development of concept and preliminary design options, detailed design and preparation of a coastal processes effects assessment.
- 9 I have led the preparation of a suite of documents including the 2016 proposed scheme review, concept option drawings, a Preliminary Design Report, a Detailed Design Report, an Assessment of Effects on Coastal Processes, and coastal processes inputs to responses to Otago Regional Council (“**ORC**”) and Dunedin City Council (“**DCC**”) Section 92 requests for further information.
- 10 I have been involved in stakeholder engagement including meetings with the Te Rauone Beach Coast Care Committee (“**TRBCCC**”), ORC and DCC, between 2016 and early 2020.
- 11 I am familiar with Te Rauone Beach, having visited the site in April 2017, March 2019 and February 2020.

SUMMARY OF EVIDENCE

- 12 I summarise below the matters covered in the Beca documents:
 - a. Te Rauone Beach Management Scheme: Detailed Design Report, dated 12 March 2020.
 - b. Te Rauone Beach Management Scheme: Assessment of Effects on Coastal Processes, dated 12 March 2020.
- 13 Those documents form part of my evidence.

Project Context and Summary of Methodology

- 14 Te Rauone Beach has had a history of sand loss and beach realignment over the past century. Approximately 20 studies relating to coastal processes in the lower Otago Harbour were undertaken by ORC, DCC, POL and their advisors over the past twenty-five years. Of those, ten were studies, reviews and mitigation options relating directly to the sand loss issue at Te Rauone.
- 15 That previous work was reviewed at the outset of the present application. It was considered to be of relevance to understanding the environment and identifying potential effects of the project, noting that the nearshore, beach and coastal land had remained at a similar level of development over the past 25 years.
- 16 The existing body of work, together with beach and bathymetric surveys, beach sediment samples, swell wave and wind wave analysis, and site visits, were drawn upon in preparing the assessment of effects on coastal processes.

Description of Relevant Existing Environment - Coastal Processes

Setting

- 17 Te Rauone Beach is located on the eastern side of the Otago Harbour entrance channel. The shoreline runs approximately northeast-southwest. The approximately 800m of sandy beach is flanked by continuous rock revetments to the north and south. The beach is divided by a 100m section of rock revetment protecting private property.
- 18 The northern section of the beach has a history of erosion and continues to retreat. This is the site of the proposed beach management scheme. The southern section has accreted significantly (48m over the past 20 years). A flat subtidal sandbank and a secondary eastern channel are located between Te Rauone Beach and the main harbour channel.
- 19 Harbour entrance and channel works undertaken between 80 and 135 years ago stabilised the harbour entrance and channel and modified the original coastal processes. The original pre-1900s dune field at Te Rauone appears to have diminished over this period and the eastern side of the harbour was progressively protected by sections of continuous rock revetment from the early 1900s onwards.

Tides and Hydrodynamics

- 20 The site experiences semi-diurnal tides with a tidal range of approximately 2m. Hydrodynamic modelling indicates that tidal current velocities in the vicinity of the proposed beach management works are low (peak velocity less than 0.1m/s).

Wind, Waves and Wake

- 21 The site is subject to prevailing south-westerly and north to north-easterly winds. The stronger winds from the south-westerly quadrant have the capacity to generate moderate waves within the harbour. Te Rauone Beach is partially protected by the subtidal sandbank and by Wellers Rock, especially for the southern end of the beach. Waves generated locally by northerly winds also reach the site but are significantly smaller. Local observations suggest that the most notable erosion events observed at the northern end of Te Rauone Beach occur under wind waves from the south-westerly quadrant.
- 22 Longer period northerly swell waves reach the site through the harbour entrance, consistent with the observation that sand lost from the northern end of Te Rauone Beach appears to be transported to and accumulating at the south end of the beach.
- 23 The site also experiences long period ship wake (which has also been referred to as surge in some studies) capable of mobilising seabed and beach sediments, although the effect was considered less than that of natural waves and currents in the Harbour by a wake study.

Sediment Transport

- 24 The general interpretation of the Te Rauone studies was that the historic changes to the harbour and channel, and to potential sediment supply, affected the equilibrium of sediment transport processes; Te Rauone Beach continues to adjust to these drivers and no longer receives any significant sediment input.

Brief Description of Project in Relation to Coastal Processes

- 25 The objective of the proposed Te Rauone Beach Management Scheme scheme is to provide a beach amenity, with a high tide beach width of at least 5m. The scheme is not to address or ameliorate erosion. A different solution would be proposed if that was the case. The objective was established with the TRBCCC at the outset of the present scheme development, in 2016.
- 26 The proposed works include the following:
- a. Construction of three rock groynes extending approximately 70-80m from the shoreline (to be determined by an updated survey). The groynes will be constructed from rock, including larger armour rock (nominal mean diameter is expected to be 0.5m) and smaller underlayer (nominal mean diameter is expected to be around 0.2m).
 - b. Following construction of the groynes, sand will be placed along the northern end of Te Rauone Beach to renourish the existing beach. The renourishment area relates to approximately 300 metres of coastline located in front of the Te Rauone Beach Reserve. The total initial deposition is expected to be approximately 26,500m³ to 34,000m³, to be determined by an updated survey.

- 27 Maintenance requirements, the extent and frequency of which will be determined by monitoring and inspections, are expected to include recycling and/or further renourishment of the beach, and rock replacement and relocation. Monitoring, inspections and maintenance will be documented in a Maintenance and Operation Plan.
- 28 A twenty year design life and 2% Annual Exceedance Probability design wave condition were adopted for the rock groynes. An allowance of 0.1m was included for sea level rise during the 20 year groyne life based on 2017 Ministry for the Environment guidance. Sea level rise guidance will need to be reviewed around 2035, with any revisions to the design incorporated in the end-of-life major maintenance. At some future point, potentially around 2050, consideration will need to be given to the long term scheme viability.

Summary of Coastal Processes Effects

Tides and Hydrodynamics

- 29 The proposed beach management scheme marginally (0.4%) reduces the total cross-sectional area of the harbour at Mean Sea Level and is located in an area of low currents, outside the main and eastern channels.
- 30 The proposed scheme will have no effect on harbour tide levels, as tide levels are driven by major global processes and the changes in cross sectional area are negligibly small. The effects on tidal currents in the main channel and eastern channel are therefore expected to be negligible.
- 31 There will be minor, localised current effects at mid-tide at the site, with the low velocity currents deflected around the groynes. Any localised increase in current velocity would be difficult to discern in practice because of the negligible reduction in cross sectional area and the low velocity of the existing currents. It is expected that effects at low and high tide, when currents are minimal, will be negligible.
- 32 Overall, the effects on tides and currents are considered to be less than minor.

Wind

- 33 The development is not expected to have any effect on the overall wind climate. There may be a minimal level of localised sheltering of nearby beach areas in the lee of the northern and southern groynes, which is considered a negligible effect.

Waves and Wake

- 34 The groynes may result in minor, localised wave and wake reflection in their immediate vicinity, under certain conditions (e.g. northerly waves approaching the northern groyne). The reflection effects are partly mitigated by the groyne design i.e. the relatively mild side slopes and voids between the rock units. Overall, any adverse effect on waves and wake is expected to be minor and limited to the site. There is not expected to be any significant effect on waves and wake in the harbour beyond the immediate vicinity of Te Rauone Beach.
- 35 The proposed groynes and renourished beach are designed to reduce wave and wake energy at the shoreline through refraction and dissipation, leading to less mobilisation and loss of beach sediment at the site. This is considered a moderate, localised, beneficial effect.

Shoreline Change and Sediment Processes

- 36 The scheme is designed to provide renourished embayments at the northern end of Te Rauone Beach while mitigating potential downcoast effects, which might potentially include erosion south of the southern groyne.
- 37 The southern groyne is detailed to allow sand to pass through it to the south to continue the existing sediment transport process. The initial and ongoing placement of sand on the south side of the southern groyne to address the potential for localised erosion downcoast of the groyne also supports continued sediment transport. As with the present situation, the southward movement of sand has the potential ultimately to cause accretion at Wellers Rock Jetty. Associated monitoring and mitigation to address this is covered in paragraphs 42 and 43.
- 38 Overall, the effect of the scheme on sediment processes and shoreline change is considered to be minor in the context of:
- a. The negligible effects on the wider harbour (refer to paragraph 39),
 - b. The beneficial effect on the northern section of the beach, and
 - c. The proposed mitigation and monitoring.

General Harbour and Surf Break

- 39 The proposed works are confined to a 300m length of Te Rauone Beach. The historic harbour entrance and channel modifications compartmentalise coastal processes at the site. Effects on the sandy foreshore at Te Rauone Beach are confined between sections of rock-protected coastline to the north and south, and the main channel / entrance channel, where strong currents and deep water provide an effective outer (western) boundary to the local coastal compartment. Accordingly, the small magnitude of the coastal change proposed is not expected to affect the general harbour processes, or the Aramoana Ecological Area and Shelly Beach which are separated from the site by the main channel.

- 40 Outside the harbour entrance, Aramoana Beach is a recognised surf break of regional and national significance and is protected under the New Zealand Coastal Policy Statement (2010). Coastal processes at Aramoana Beach are isolated from the site by the harbour entrance channel, the Long Mac and the Mole. In addition, the surf at this location is generated by open ocean swells, and is independent of any changes that could be imposed at Te Rauone. The proposed works will therefore not affect Aramoana Beach and surf break.

Coastal Effects of Construction Procedures

- 41 Construction will have temporary effects including occupation of the northern section of Te Rauone Beach and adjacent land, temporary disturbance of the beach surface, minor adjustments to existing rock protection at the northern end of the beach, and the potential for release of fine sediment to the harbour from renourishment and the establishment of construction access. Detailed mitigation has been proposed to address these effects, as set out in Section 5.7 of the Assessment of Effects on Coastal Processes. The mitigation will be implemented through the Environmental Management Plan. Taking into account that mitigation, the effects are considered to be minor.

Mitigation, monitoring and maintenance

- 42 A suite of mitigation measures covering the capital works and scheme operation and maintenance were included in the proposed scheme, as set out in Section 6 of the Assessment of Effects on Coastal Processes.
- 43 Key mitigation includes:
- a. Use of groynes, as preferred by the TRBCC for reasons including reflecting legacy harbour structures.
 - b. Use of local sand for renourishment.
 - c. Beach access provisions at the central and southern groynes.
 - d. Measures to sustain southward sediment transport at the southern end of the scheme.
 - e. Regular recycling of sand within embayments and, depending on the results of beach monitoring, from the accreting area further south from the site.
 - f. Future renourishment to replace material expected to be lost from the system over time.
 - g. Inspection and monitoring of scheme performance and maintenance, managed through a Maintenance & Operation Plan. An outline of the Plan is included in Section 5 of the Detailed Design Report.

- h. Should the monitoring identify unanticipated effects on coastal processes, pragmatic mitigation options would be assessed, and a preferred approach developed. Adaptive management mitigation options could include the placement of additional sand in conjunction with continued monitoring, or modification or ultimately removal of the groynes.

COMMENTS ON SUBMISSIONS

- 44 I understand that four submissions raise specific matters relevant to my area of expertise. I address the coastal engineering and coastal processes elements of each of these submissions below.

Submission by Department of Conservation

- 45 The submission by the Department of Conservation seeks certainty that adverse effects on hydrodynamics will be avoided given a number of ecologically and culturally significant sites nearby, including Aramoana and Wellers Rock.
- 46 The submission also notes that:
- a. Consent conditions and management plans will need to be ongoing, to cover future replenishment and maintenance.
 - b. The proposed adaptive management approach is limited by the fact that the hard structures cannot meaningfully be adapted if adverse effects are detected.
- 47 Paragraphs 29 to 32, 37 to 38, 39 to 40, and 42 to 43 address effects on hydrodynamics, Wellers Rock and Aramoana and the mitigation and monitoring proposed.
- 48 Specifically, the potential for continued accretion of sand at Wellers Rock is addressed through monitoring of the southern section of Te Rauone Beach and (subject to the monitoring results) recycling of sand from this area, which will intercept sand before it reaches Wellers Rock. An additional level of monitoring at Wellers Rock is also proposed, to confirm that the mitigation operates as expected.
- 49 The Aramoana Ecological Area, Shelly Beach, Aramoana Beach and the scheduled surf break are functionally separated from the Te Rauone coastal compartment by the main harbour channel.
- 50 The proposed conditions and Maintenance & Operation Plan are on-going and cover future replenishment and maintenance.
- 51 As indicated in paragraph 43, adaptive management options that could be considered include placement of additional sand, modification of the groynes or, in the ultimate situation, their removal, although this latter would be an unusual situation.

- 52 The Department of Conservation has subsequently written to confirm that the concerns raised in its submission have been addressed through post-notification discussions. This letter was sent to the ORC and DCC on the 24th November 2020. The Department of Conservation has confirmed that on the basis of the proposed consent conditions and the draft EMP and LMP being maintained, it does not have any outstanding concerns.

Submission by Te Rūnanga o Ōtākou

- 53 The submission in support by Te Rūnanga o Ōtākou notes that:
- a. The erosion occurring at the northern end of the Te Rauone sand dunes has been a long-standing concern, although this is not necessarily captured in the application, and a solution has long been sought.
 - b. The impact of the 'construction' phase on the intertidal area where the groynes will be located and on traffic is recognised and seen as a necessary sacrifice for a long term solution, with no apparent alternative to the period of disruption.
- 54 I concur with the Rūnanga's comment regarding the long history of the issue, as indicated previously in my evidence.
- 55 I acknowledge the Rūnanga's comment regarding temporary construction activity on the beach and the continuing presence of the proposed groynes on the beach. The effects and mitigation associated with those activities are discussed in paragraphs 29 to 41, and 42 to 43.
- 56 As explained in paragraph 28, the scheme was designed for a 20-year life. Noting that climate change science continues to evolve, this provides an opportunity for review around 2035. Depending on sea level rise and coastal response knowledge at that time, revisions to the design could potentially be incorporated in end-of-life major maintenance to extend the scheme life. Again, with reference to climate change and sea level rise, at some future point, potentially around 2050, consideration will need to be given to the long term scheme viability.

Submission by Mr S R Clearwater

- 57 The neutral submission by Mr Clearwater considers that the Beca report promotes rock from Dunedin only.
- 58 Rock from any location is able to be used for the groynes, subject to meeting technical requirements, such as rock size and grading, density, shape, resistance to abrasion, etc; however I note that Logan Point Quarry was conservatively used as the source of rock in order to inform the traffic impact assessment.

Submission by Mr S James

- 59 The submission in opposition by Mr James considers that the scheme is a reclamation by subterfuge.
- 60 The objective of the proposed scheme is to provide a beach amenity, with at least a 5m-wide berm above Mean High Water Springs level, and a sloping sandy beachface in the Coastal Marine Area extending from the berm to the subtidal seabed. The rock groynes are necessary to help to retain the sand and reduce sand losses. The beach renourishment uses locally-sourced sand.
- 61 The scheme differs from a reclamation, where fill is placed within the Coastal Marine Area to create land in place of seabed or beach. Reclamations are typically protected against wave attack by seawalls.
- 62 From a coastal processes perspective, the renourished beach helps to dissipate wave energy while also providing a “soft” coastal edge that responds to changes in wave conditions by changing shape in planform and cross section. A reclamation and seawall is a fixed barrier that typically reflects wave energy, leading to lowering of the seabed adjacent to it.

RESPONSE TO SECTION 42A REPORTS

- 63 I have read the ORC Council Officer’s’ report prepared by Ms Lennox and concur with her recommendation.
- 64 I have read the DCC Council Officer’s’ report prepared by Mr Buxton. There are only minor matters requiring clarification.
- 65 Ms Botha has asked me to clarify the objective of the scheme in regard to comments in the Council Officer’s Report. The report comments (e.g. paragraph 42) that the proposed scheme is to address erosion. As set out in paragraph 25 of my evidence and also in the Detailed Design Report and the Assessment of Effects on Coastal Processes, the objective of the scheme is to provide beach amenity and not to address erosion. That is, the scheme is not intended to protect the land behind it from wave attack.
- 66 Paragraph 45 of the report seeks clarification of access arrangements for maintenance of the scheme. While the reserve area remains in its present state, it is expected that maintenance access would be via either the existing reserve track or subject to landowner approval via private property to the northern end of the renourished beach (northern embayment). Access to the southern two groynes and embayment would be via the beach berm above Mean High Water Springs. The 5m wide access at the landward end of the central groyne provides for maintenance vehicle access from the northern embayment to the southern embayment.

- 67 DCC has developed a concept to upgrade Te Rauone Beach Reserve, landward of the proposed works. Maintenance access was discussed with DCC in 2019, prior to lodgement of the beach management scheme application. The DCC reserve upgrade concept made provision for maintenance access to the northern embayment via a carpark and authorised vehicle access track. As described above, access would then be via the beach berm above Mean High Water Springs and the 5m wide access at the central groyne.
- 68 Paragraph 49 of the report notes the potential for microplastics to be released from geotextile fabric. This matter falls outside my area of expertise as it relates to water and sediment quality and ecology. I would note that geotextile is a widely-used material that is recommended for use in coastal engineering structures in industry guidance to provide a separation and filtration function. It replaces multiple layers of progressively finer rock, allowing a rock structure to be more compact (in area extent and height) and reducing the rock quantity required for the structures.
- 69 Paragraph 57 of the report seeks clarification of any potential effect of the proposed groynes on neighbouring properties in a tsunami. Data on tsunami in Otago Harbour is limited. Power's 2013 report *Tsunami curves and deaggregation plots for 20km coastal sections derived from the 2013 National Tsunami Hazard Model* indicates a 50th percentile expected maximum tsunami amplitude of approximately 4.8m for a 0.2% Annual Exceedance Probability. Such an event might flow over and / or generate eddies around the seaward ends. The flow would be expected to generate localised scour at the groyne and possibly displacement of groyne rock units, requiring maintenance. Reflection of a tsunami from the groynes onto neighbouring properties would not be expected given the porosity of the groynes and their relatively low crest level. Power's description of "usual" tsunami damage in *Review of Tsunami Hazard in New Zealand* (2013) is consistent with the rapid flows and scour indicated above.

PROPOSED CONDITIONS

- 70 I understand that the provisions in paragraphs 42 and 43 have been included in the draft conditions of consent. I have read the conditions in the Otago Regional Council and Dunedin City Council Officers' Reports. I support the conditions as they relate to coastal processes.

CONCLUSIONS

- 71 The proposed scheme is located at the northern section of Te Rauone Beach. It comprises three groynes and sand renourishment of embayments between the groynes. The objective of the scheme is to provide a beach amenity.
- 72 Taking into consideration the proposed mitigation, monitoring and maintenance, the assessment indicates that coastal processes effects will be minor, and confined to the immediate vicinity of the works. An ongoing Maintenance and Operation Plan will be prepared to support the implementation of the inspection, monitoring and maintenance over the design life of the scheme.

73 I am happy to answer any questions that the Hearing Panel may have for me in relation to my evidence.