Te Pātaka o Rākaihautū
Banks Peninsula Community Board
AGENDA

Notice of Meeting:

An ordinary meeting of the Te Pātaka o Rākaihautū Banks Peninsula Community Board will be held on:

Date:	**Monday 4 April 2022**
Time:	**1:00pm**
Venue:	**Held by Audio / Video Link** Under the current provisions of the Covid-19 Protection Framework (the Traffic Alert system) meeting attendance is only possible via an Audio/Visual link or by viewing a live stream (https://www.youtube.com/channel/UC66K8mOIfQT3I4rOLwGbeug) of the meeting. Please request access details from linda.burkes@ccc.govt.nz for the Audio/Visual link.

Membership

Chairperson	Tori Peden
Deputy Chairperson	Tyrone Fields
Members	Reuben Davidson
	Nigel Harrison
	Howard Needham
	Jamie Stewart
	Andrew Turner
	Scott Winter

25 March 2022

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Note: The reports contained within this agenda are for consideration and should not be construed as Council policy unless and until adopted. If you require further information relating to any reports, please contact the person named on the report.

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Developing Resilience in the 21st Century

Strategic Framework

Whiria ngā whenu o ngā papa, honoa ki te maurua tāukiuki

Bind together the strands of each mat and join together with the seams of respect and reciprocity

Ōtautahi–Christchurch is a city of opportunity for all

Open to new ideas, new people and new ways of doing things – a city where anything is possible

Principles

- Being open, transparent and democratically accountable
- Promoting equity, valuing diversity and fostering inclusion
- Taking an inter-generational approach to sustainable development, prioritising the social, economic and cultural wellbeing of people and communities and the quality of the environment, now and into the future
- Building on the relationship with Te Rūnanga o Ngāi Tahu and the Te Hononga–Council Papatipu Rūnanga partnership, reflecting mutual understanding and respect
- Ensuring the diversity and interests of our communities across the city and the district are reflected in decision-making
- Actively collaborating and co-operating with other local, regional and national organisations

Community Outcomes

Resilient communities

- Strong sense of community
- Active participation in civic life
- Safe and healthy communities
- Celebration of our identity through arts, culture, heritage, sport and recreation
- Valuing the voices of all cultures and ages (including children)

Liveable city

- Vibrant and thriving city centre
- Sustainable suburban and rural centres
- A well connected and accessible city promoting active and public transport
- Sufficient supply of, and access to, a range of housing
- 21st century garden city we are proud to live in

Healthy environment

- Healthy water bodies
- High quality drinking water
- Unique landscapes and indigenous biodiversity are valued and stewardship exercised
- Sustainable use of resources and minimising waste

Prosperous economy

- Great place for people, business and investment
- An inclusive, equitable economy with broad-based prosperity for all
- A productive, adaptive and resilient economic base
- Modern and robust city infrastructure and community facilities

Strategic Priorities

- **Enabling active and connected communities to own their future**
- **Meeting the challenge of climate change through every means available**
- **Ensuring a high quality drinking water supply that is safe and sustainable**
- **Accelerating the momentum the city needs**
- **Ensuring rates are affordable and sustainable**

Ensuring we get core business done while delivering on our Strategic Priorities and achieving our Community Outcomes

- Engagement with the community and partners
- Strategies, Plans and Partnerships
- Long Term Plan and Annual Plan
- Our service delivery approach
- Monitoring and reporting on our progress

Part A **Matters Requiring a Council Decision**
Part B **Reports for Information**
Part C **Decisions Under Delegation**

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Karakia Tīmatanga

1. Apologies Ngā Whakapāha

At the close of the agenda no apologies had been received.

2. Declarations of Interest Ngā Whakapuaki Aronga

Members are reminded of the need to be vigilant and to stand aside from decision making when a conflict arises between their role as an elected representative and any private or other external interest they might have.

3. Deputations by Appointment Ngā Huinga Whakaritenga

3.1 Akaroa Wharf Renewal

People who wish to be heard in support of their submission will speak to the Board regarding the Akaroa Wharf Renewal Report.

Item 4

4. Akaroa Wharf Renewal

Reference Te Tohutoro: 22/341015

Report of Te Pou Matua: Kristine Bouw - Project Manager
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General Manager Pouwhakarae: Mary Richardson - General Manager, Citizens & Community
mary.richardson@ccc.govt.nz

1. Purpose of the Report Te Pūtake Pūrongo

1.1 The purpose of this report is to present the preferred concept option for Akaroa Wharf, which has been refined following community consultation, and for the Te Pātaka o Rākaihautū Banks Peninsula Community Board to make a recommendation to the Council for staff to proceed with the detailed design.

1.2 The decision in this report is of medium significance in relation to the Christchurch City Council's Significance and Engagement Policy. The level of significance was determined by considering the impacts of the decision on the local and wider community as well as the local Ōnuku Rūnanga.

2. Officer Recommendations Ngā Tūtohu

That the Te Pātaka o Rākaihautū Banks Peninsula Community Board recommends to Council:

1. That it receives the staff report on the design, stakeholder consultation and concept option for the Akaroa Wharf.
2. That staff proceed to detailed design of the Akaroa Wharf based on the preferred concept option, as shown in Attachment B included in the agenda for this meeting.

3. Reason for Report Recommendations Ngā Take mō te Whakatau

3.1 The 135-year old Akaroa wharf holds important cultural, historical and social values for the Akaroa community. Originally constructed in 1887 the wharf is of significant recreational, heritage and commercial importance to Akaroa and the wider region and is widely recognised as a focal point for the town. The wharf is used regularly by local residents, visitors and commercial fishing and tourism operations.

3.2 A structural condition assessment in 2015, 2018 and updated in mid-2021 identified that the wharf is reaching the end of its useful life and that the wharf is no longer economical to repair and a new wharf is required **(Attachment A)**.

3.3 The public space and structure of the wharf is owned and maintained by Christchurch City Council (Council). Two privately-owned buildings abut the wharf and connect to the Council-owned structure.

3.4 In recent years and following the 2010 / 11 Canterbury earthquakes, Akaroa became a popular cruise and regional tourism destination.

3.5 Future cruise ship numbers are uncertain at present due to Covid19 but it is anticipated that cruise ship tourism will return to Akaroa in some form once the pandemic has settled globally. The number and size of cruise ships (and passenger numbers) able to berth in the Akaroa Harbour has recently been regulated, limiting access to the Akaroa harbour to the smaller

cruise ships with revised guidance around seabed disturbance from Environment Canterbury which impacts vessel size and number of visits in the Akaroa Harbour.

3.6 Staff are working in partnership with Ōnuku Rūnanga on design of the new wharf with specific consideration of the cultural significance and opportunities of the new wharf.

3.7 The 2021 – 2031 Long Term Plan includes $19.085M for the Akaroa Wharf project moving forward.

3.8 Key stakeholder engagement on options and scenarios for the wharf has been ongoing since 2019 and most recently with a public consultation process that concluded on 31 January 2022.

3.9 A preferred concept design for the new wharf **(Attachment B)** has now been developed based on community and stakeholder inputs as well as discussions with commercial operators and takes into consideration existing user groups including commercial fishing, tourism, local and community use and cruise ship transfers.

3.10 The proposed design allows for a 155metre long by 8metre wide wharf with three pontoon structures.

3.11 The Akaroa Wharf Renewal Options report **(Attachment C)** includes a description of the existing wharf, an overview of the options developed and a description of the preferred option.

4. Alternative Options Considered Ētahi atu Kōwhiringa

4.1 A number of options were identified as a part of the public consultation in May to June 2019. A series of shortlisted options were confirmed through a workshop held with engineers, heritage advisors, planners, Environment Canterbury's Harbour Master and Council staff. The purpose of the option development was to allow for a thorough review of feedback received to be considered against expert advice.

4.2 The options were based primarily on the proposed location of the new wharf. Recognising the significance of the use of materials for both the overall look and feel and the structural integrity of the structure, several material options were explored as well.

4.3 The location options included the following **(Attachment D)**:

- Baseline Option 0: Restore the existing wharf in its current location with no change to its structural form
- Option A: Construct a new wharf in the same location as the existing wharf
- Option B: Construct a new wharf along the north side of the existing wharf
- Option C: Construct a new wharf off Church Street and on the site of the original town wharf
- Option D: Construct a new wharf from Akaroa Recreation Field / Children's Bay

Construction material options included:

- Option 1: New wharf structure with like-for-like hardwood timber
- Option 2: New wharf structure with a mixture of concrete and hardwood timber, visible members would be hardwood
- Option 3: New wharf structure made from concrete

4.4 The options were further analysed in December 2019 – January 2020 through a Multiple Criteria Analysis (MCA) process and which included input from engineers, planners, quantity

surveyors, heritage advisors, Ōnuku Rūnanga representatives, urban design, the Harbourmaster, Council staff and representatives from the Banks Peninsula Community Board **(Attachment E)**.

4.5 Based on the MCA analysis and preliminary construction methodology, **Option A**-Construct a new wharf in the same location as the existing wharf was identified as the preferred option and the use of a mixture of concrete (piles and base structure) and hardwood timber (decking) materials.

4.6 An overview of the key analysis points of the other options is outlined below:

Baseline Option 0: Restore the existing wharf in its current location with no change to its structural form or height.

- *This option is a comparison of rebuilding the wharf back at the current deck height which is already prone to storm surges and future flooding and is not considered a viable option.*

Option B: Construct a new wharf along the north side of the existing wharf

- *Option B was considered at length as desirable from the ability to retain the existing wharf during construction and to allow businesses to continue to operate off of the wharf;*
- *Due its direct proximity, Option B would result in risk to the structural capacity of the existing wharf and its operational capacity during construction due to construction methodology (pile driving);*
- *Building in parallel would include a number of safety risks that would need to be carefully managed during construction to keep the wharf open and operating and would ultimately lead to higher construction costs (staging, building secondary access routes, staggering construction work and limiting hours during busy periods for commercial operators);*
- *Retaining the existing wharf as operational would cause significant public safety risks with the marine plant directly adjacent to a working wharf;*
- *Construction would have a major impact and disruption to existing businesses from regular vibration and noise;*
- *This option will also incur increased project costs due to the need to reconstruct an abutment structure and reconnect transport access to the wharf for passengers and loading and unloading of goods;*
- *This option would require the functions on the north side of the wharf to be relocated to make room for the new wharf to the south side and to other locations in the harbour;*
- *Option B isolates the existing privately-owned buildings abutting the wharf which will lose their access and connection to Beach Road during the construction period;*
- *The overall shape and location of the wharf would be altered and result in adverse effects from a heritage landscape visual perspective; and*
- *The new location of the wharf will have a greater environmental effect than Option A and will require further development into the coastal marine environment including dredging and introducing new structures within the seabed.*

Option C: Construct a new wharf off Church Street and on the site of the original town wharf

- *Option C recognises the history of Akaroa as this is the location of the original wharf and would remove many of the construction and staging issues identified with Option B;*
- *This option will also incur increased costs for the project for the significant dredging required for construction and to reconstruct an abutment structure and reconnect transport access to the wharf for passengers and loading and unloading of goods;*
- *Additionally Option C would move the wharf to the intersection directly adjacent to Church Street and Beach Road and local transport connections;*
- *The realigned structure would impact on the heritage area of the Akaroa waterfront in its new proximity to the Wharfinger building (Akaroa Weighbridge) and would require the removal of at least 1 heritage tree;*
- *This option would also modify the visual connection to the sea and harbour for adjacent businesses including restaurants and cafes;*
- *Option C isolates the existing privately-owned buildings which abut the wharf which will lose their access and connection to Beach Road;*
- *The overall shape and location of the wharf would be altered and result in adverse effects from a landscape visual perspective; and*
- *The location of the wharf will have a greater environmental effect than Option A and B as it will require further development into the coastal marine environment, including sea bed dredging and introducing new structures within the seabed.*

Option D: Construct a new wharf from Akaroa Recreation Field / Children's Bay

- *This option was suggested during the 2019 consultation phase primarily in consideration of the pressures from cruise ships on the wharf and Akaroa and suggested the construction of an additional wharf structure with a new wharf built at Children's Bay for cruise ship tenders and the repair and rebuild of the existing heritage wharf;*
- *This option would still require upgrades to the existing wharf and would be out of the scope of work and the budget in the Long Term plan;*
- *This area is very shallow and as with Options B through C above, would require extensive dredging to construct and to maintain and would have significant environmental issues;*
- *This option would require significant development on the landward side of Children's Bay in order to provide the adequate supporting infrastructure necessary for the wharf; and*
- *This area is contained within a Wāhi Tapu/Wāhi Taonga in the Christchurch District Plan. Due to the cultural significance of this area to Ōnuku Rūnanga this is not considered a viable option.*

4.7 The benefits of Option A - Construct a new wharf in the same location as the existing wharf as the preferred option includes:

- Option A retains the high historic and social significance of the wharf and iconic location of the wharf within the visual context of the Akaroa Harbour;
- Option A further represents the least risk on the surrounding heritage items and settings, particularly those at Britomart Reserve;
- Option A is sympathetic to the surrounding environment including built form along Church Street and Beach Road, established after the wharf and established in relation to its location;

- Has the lowest impact on the environment both from a coastal (seabed disturbance) and landside perspective;
- Retains transport and access links along Beach Road which are limited in other areas along the waterfront;
- The resource consent process for Option A is the most straight forward as it includes replacing a similar structure in the coastal marine area where the existing wharf has been since 1887;
- Lower cost option based on initial cost estimates (no dredging, existing access and circulation points);
- Lower environmental impacts in relation to need for dredging and other seabed disruption; and
- Support from privately-owned building owners in consistent location and access points.

4.8 The next stage of design will further consider:

- The integration of heritage and cultural design elements, working in partnership with the local community and Ōnuku Rūnanga into the design of the new structure;
- The new abutment feature and connection between the new wharf and the land;
- Detailed design of wharf structural elements;
- Construction methodology and approach;
- Deliverability of the project within the existing budget;
- Detail around accessibility;
- Discussion with commercial operators to confirm the amenity and operational requirements;
- Existing buildings;
- Fuelling options; and
- Specific use of materials – current recommendation is to use a mix of concrete (piles and main structure) and timber (decking and pedestrian details).

4.9 The main disadvantage of Option A is the need to provide temporary access to the wharf for its existing commercial users and the risks associated with the existing buildings located on the wharf. Temporary access options are currently being explored with the project team working directly with commercial operators to explore upgrades to existing infrastructure to build additional capacity in the Akaroa Harbour.

4.10 The main risks of not moving forward with Option A include:

- Continued uncertainty for commercial operators, building owners and the public following two rounds of consultation and stakeholder engagement;
- Further delaying the rebuild of the wharf and the further deterioration of the structure;
- Additional maintenance costs associated with keeping the structure operational for commercial users who rely on it; and
- Rising concerns from stakeholders and the community who have been involved in the process over the past 3 years and are keen to proceed.

5. Detail Te Whakamahuki

5.1 Akaroa Wharf replacement was open for consultation from Wednesday 1 December 2021 to Monday 31 January 2022. We opened the consultation for two months over the summer holiday period to capture both local residents as well as people who were holidaying in Akaroa over this time.

5.2 We delivered a flyer with details for our Have Your Say page to all businesses along the main road through Akaroa and posted to all property owners, including absentee owners, in Akaroa. We had copies of the full consultation document at the Akaroa Service Centre and Library for anyone wanting a hard copy, this was also detailed in the flyer. An email was also sent to approximately 220 stakeholders.

5.3 We held two drop-in sessions, one in Akaroa for four hours and one in the Christchurch for two hours. Approximately 20 people attended over both sessions.

5.4 We asked for general feedback on the Akaroa Wharf replacement project as detailed online and in the consultation document. At the close of consultation we received 47 submissions from businesses, organisations and individuals **(Attachment F)**.

5.5 We received submissions from the following businesses and organisations:

- Akaroa Civic Trust
- Akaroa Dolphins
- Akaroa Fishermen's Association
- Akaroa Motor Garage
- Akaroa Ratepayers & Residents Association Inc
- Black Cat Cruises
- Disabled Persons Assembly
- Flow Kayaks 2017 Ltd
- GCH Aviation Limited
- Heritage New Zealand Pouhere Taonga
- New Zealand Whale and Dolphin Trust
- OCEL – Offshore & Coastal Engineering Ltd

5.6 We also received submissions from residents and property owners who have had a long association with Akaroa.

5.7 The key themes raised during consultation were:

5.7.1 **Design related**

- Wharf materials (22)
- Historical and cultural significance (20)
- Working wharf –health and safety (17)
- Concern for the proposed stairs ('knuckle) (14)
- New wharf needs to cater for larger vessels and all activities (8)
- Sea level rise – wharf height (6)
- Accessibility (5)

- Commercial buildings on the wharf (4)
- Availability of fuel on the wharf (4)
- Feedback on design features – seating, viewing platform, market, shops, lighting (3)

5.7.2 **Construction related**

- Interim facilities during construction (9)
- Impact of construction on marine life (3)

5.8 We also received some general comments from the consultation including:

- That there is no need for a replacement wharf and that it should just be repaired
- Recommending an upgrade to the Wainui Wharf instead for commercial use;
- Consideration for a floating wharf structure;
- The need for a breakwater to protect the new wharf and vessels in the harbour; and
- Consideration for alternative wharf design (floating options).

Preferred Concept Design and Responses to Feedback

5.9 As a result of the consultation process the design of the wharf has been refined. The main amendment to the wharf is the removal of the northern stairs to the water as detailed below. Other key elements of the proposed conceptual wharf design include:

- The length of the wharf is the same as present at 155m long and 8m wide (0.7m wider than the current 7.3m wide wharf);
- An additional pontoon structure (total of 3) will be added to support issues with overcrowding and provide more capacity for recreational and commercial vessels;
- The orientation of the 3 pontoons are shown perpendicular to the wharf structure, the project team will continue to work with the commercial users to refine the pontoon design to meet the specific needs of the users;
- Fuel options to include petrol and diesel as well as future provision for electrical charging to be considered;
- Deck height to be raised by 0.5 – 0.65m to allow for sea level rise;
- Construction materials to be a mix of concrete and timber;
- Structural design of the wharf and bracing to be consistent with the existing heritage wharf design;
- Further detail on the design and in consideration of the consultation feedback is included below.

Wharf materials

5.10 There were a number of submissions that recommended that timber be used as wharf decking and in consideration of the unique character of the existing wharf. The use of timber decking materials is consistent with the proposed concept design and staff are investigating locally sourced materials to support the use of marine grade timber for the decking surface. Staff are recommending that the new piles and superstructure of the wharf below the decking area are constructed using concrete and steel for the durability and longevity and based on engineering recommendations. The exact use of materials will be refined during detailed design.

Historical and cultural significance

5.11 The historical, cultural, social and contextual significance of the wharf is acknowledged by many submitters. The project team recognise that respect for contextual, historical and landmark significance, and retention of elements of heritage fabric, will need to be an important feature of the proposed wharf. Several submissions commented on the significance of the recommendations in the *Conservation Plan (DRAFT 2019, Origin Consultants),* which identified the wharf as *"one of the most significant heritage structures in the town, and the cultural heritage significance to the town and wider district is highly significant".*

5.12 An Archaeological Authority from Heritage New Zealand will be required to remove the wharf. This process will include recording and documentation of the key features of the wharf as required under the *Heritage New Zealand Pouhere Taonga Act 2014* (HNZPTA) and the *Resource Management Act 1991* (RMA). Heritage New Zealand has been engaged throughout the process and provided a submission in support of the proposed design and approach by Council. The project team will also seek opportunities for the local community to record and document the social history of the wharf.

5.13 The Draft Conservation Plan was commissioned in 2018, and was prepared at the same time as the detailed structural engineering assessment was being undertaken and which ultimately confirmed the need to replace the wharf. A conservation plan is typically prepared to discuss the significance of an item and how it could be sustained. In the case of the Akaroa Wharf, the information in the Draft Conservation Plan was overtaken by engineering advice and Council resolution to proceed with the replacement. However the Draft Conservation Plan includes some guidance around the development of design elements and materials that could be incorporated into the design of a new wharf. The project team are proposing to continue to work closely with Ōnuku Rūnanga and Heritage New Zealand in the development of detailed design concepts that protect these cultural and heritage values and to integrate the story of the wharf and its location into the expression of the new structure.

'Working wharf' –health and safety

5.14 Throughout the consultation process in 2019 and 2021/2022 there has been strong support for retaining a 'working wharf' and the commercial use of the wharf for fishing, fresh fish sales and tourism uses. The continued use of the wharf for commercial and public recreation purposes does present some risks which to date have been well-managed through good communication between users and Council.

5.15 As a part of the wharf upgrade community and stakeholder inputs have also recognised the need to support improved health and safety of the wharf and is reflected in the proposed increase in the width of the wharf and will be considered when positioning pontoons, access routes and other marine infrastructure (crane, fuel bowsers, ladder etc).

Concern for the proposed stairs ('knuckle) on the north side

5.16 The design included in the consultation package in 2021/2022 included a large set of stairs providing additional water access to the north of the new wharf abutment and a smaller set of stairs connecting to the gravelly beach to the south. Concern about safety issues related to additional use of the wharf in this area was raised during the consultation and in a number of submissions.

5.17 Maritime and land-based safety concerns associated with the proposed stairs have been reviewed initially by marine safety and transport staff and are not considered a safety issue.

5.18 However, to address budget risks in regards to rising material and construction costs, it is proposed to remove both sets of stairs in the preferred design concept. Detailed design work will be required to confirm the edge treatment and finish for this area.

New wharf needs to cater for larger vessels and all activities

5.19 A number of submissions suggested improvements for the wharf which would allow for larger vessels to use the structure (currently limited due to reduced structural capacity of the existing wharf) and to allow for additional room for more vessels to use the wharf. The proposed concept design of the wharf includes upgrading the structural capacity of the wharf for larger vessels and to allow for more berthing. Staff will continue to work with the commercial operators through the detailed design of the wharf for a good and functional outcome.

Sea level rise – wharf height

5.20 Six submitters questioned the proposed height of the deck based on the sea level rise projections. The proposed design of the wharf includes raising the height of the existing wharf between 0.5-0.65mm (the range in height is due to the varying height of the existing wharf) to allow for sea level rise projections and based on advice from a coastal hazard experts.

5.21 This advice takes into consideration the current Ministry of the Environment (2017) coastal hazard guidance for incorporating sea level rise into asset planning and is in line with the recent Tonkin and Taylor (2021) report on coastal hazards.

5.22 The proposed design height is also considered a practical level for the wharf deck, specific to the Akaroa context, where constructing to a higher elevation would:

- Be considered impractical (given alignment and integration issues with the foreshore and Beach Road);
- Poorly coordinated with local infrastructure; and
- Inefficient in terms of design life versus capital costs.

Accessibility

5.23 Ensuring that the new structure is inclusive and accessible is an important requirement for the new wharf. The current wharf presents a number of challenges for disabled users (uneven surfaces, material changes etc) and comments were made in a couple of submissions about the need to consider the proposed materials and design details to allow for universal accessibility recognising the *"growing number of disabled people who will visit this great tourist destination in the years ahead"* (submission from Disabled Persons Assembly NZ).

5.24 Council staff have met with the Council's Disability Advisory Group (DAG), facilitated by the Council's Inclusive Communities Coordinator and who have provided advice on the planning, review and implementation of Council projects and services that relate to the broad spectrum of disability issues.

5.25 The detailed design of the wharf will include working with these recommendations, reporting back for to the DAG for design review in order to promote inclusivity and accessibility in the final design as a Council and consenting requirement.

Commercial buildings on the wharf

5.26 There are two privately-owned buildings that abut the wharf and connect to the Council-owned structure. Currently these building have a license arrangement with Council for access to their buildings across the wharf.

5.27 A number of submissions mentioned the existing buildings with some submissions indicating that no new buildings should be developed and that the rebuild project should consider improvements to the current buildings. There were also submissions in support for the existing buildings and concern for the businesses operating out of them during the

construction period. The project budget does not include any budget for any building structures.

5.28 Recognising the impact on the wharf rebuild on businesses, staff have been consulting regularly with the building owners on the location and temporary access options for the proposed new wharf.

5.29 Given the reliance of the existing buildings on the current wharf structure it is recognised that further discussion will be required with building owners to confirm future arrangements. Specific detail around wharf height, building access from the wharf and any upgrades to the supporting structures for the buildings will be advanced in the next phases of work.

Availability of fuel on the wharf

5.30 A diesel bowser currently operates of the northern side of the wharf primarily for commercial operators. A desire to provide petrol from the wharf has been expressed by many commercial users and submitters as currently petrol tanks are driven on the wharf by truck for commercial vessels. It is recognised that pumping petrol from a truck on the wharf is inconvenient and includes some safety risks for wharf users.

5.31 The consultation document suggested that petrol could be made available for commercial vehicles and identified the risk with petrol being provided for recreational boaters at the wharf and the need for additional pontoon space for pumping as well as health and safety risks.

5.32 A submission was also made which did not support providing petrol on the wharf in favour of protecting the local garage where the majority of recreational users fill up their vessels and identifying the risk to the local business as well as environmental and health and safety risks.

5.33 Ultimately the provision of fuel (diesel and petrol) will be provided through a tender process and the infrastructure provided by a commercial operator. Council staff will work with the local providers on a transparent approach for fuel provision moving forward.

5.34 Consideration is also being made for future fuel sources (electrical charging, hydrogen etc) to ensure flexibility in the design for the future.

Feedback on design features – seating, viewing platform, market, shops, lighting

5.35 Submissions received including a number of suggestions around design features for commercial and recreational users. Features such as seating, lighting, water and electricity will be located as a part of the detailed design phase of works and in discussion with wharf users.

Interim facilities during construction

5.36 The rebuild of the wharf in the same location presents a challenge in the provision of temporary access for businesses that require regular daily water access and include the two existing privately-owned buildings. A number of discussions have been held with the Fishermen's Association and commercial users around the use of existing facilities in the Akaroa Harbour, upgrades to existing infrastructure and temporary access options during the construction of the new wharf.

5.37 Several submissions indicated temporary access approaches and included other factors to be considered including berthage, loading and unloading of passengers and goods, petrol and fuel provision, crane access etc. which will need to be considered in any approach.

5.38 It is anticipated that the demolition of the current and construction of the new wharf could take between 12 to 18 months, during which time a number of businesses will be impacted. The exact timeframe for construction will be refined with further design detail and contractor engagement.

5.39 To date a number of options are being considered including repairing the recently damaged Drummonds wharf, use of Wainui and Daly's wharf, a floating barge and pontoon structures and a combination of the above. Once the conceptual design of the wharf is approved staff will further explore these options, working with the Fishermen's Association to confirm a proposed approach to take forward.

Impact of construction on marine life

5.40 The construction methodology for the new wharf will need to be developed in consideration of the impact on marine life. Akaroa Harbour is well known for its marine mammals including the endangered Hector's dolphin.

5.41 Depending on the construction methodology consideration and specialist reporting on reducing and managing any risks to Hector's dolphins will need to be considered. Two submissions included advice on construction timing and techniques recommended for addressing these issues.

5.42 The need for specialist advice to support the resource consent for the wharf is acknowledged and will be confirmed moving forward.

5.43 The decision affects the following wards/Community Board areas:

5.43.1 Banks Peninsula Ward

6. Policy Framework Implications Ngā Hīraunga ā- Kaupapa here

Strategic Alignment Te Rautaki Tīaroaro

6.1 The recommendation of the report is consistent with the following Community Outcomes:

6.1.1 Resilient communities: Strong sense of community;

6.1.2 Resilient communities: Safe and healthy communities;

6.1.3 Resilient communities: Celebration of our identity through arts, culture, heritage, sport and recreation;

6.1.4 Healthy environment: Unique landscapes and indigenous biodiversity are valued and stewardship exercised

6.1.5 Prosperous economy: A productive, adaptive and resilient economic base

6.1.6 Prosperous economy: Modern and robust city infrastructure and facilities

6.2 This report supports the Council's Long Term Plan (2021 - 2031):

6.2.1 Activity: Parks and Foreshore

- Level of Service: 10.8.1.1 Availability of a network of public marine structures that facilitate recreational and commercial access to the marine environment for citizens and visitors. - Customer satisfaction with the availability of marine structure facilities: 60%

Policy Consistency Te Whai Kaupapa here

6.3 The decision to replace the Akaroa Wharf in the same location, and reinstate elements of existing heritage fabric where practicable, alongside opportunities for cultural narrative is consistent with Council's Plan and Policies. Including:

- Christchurch Visitors Strategy (2019), specifically:
  - *'Ensuring the needs of the visitor and the development of the Christchurch destination informs infrastructure development' (High Priority Activities).*

- *'Take an integrated approach to cruise ship access (with the development of Lyttelton Wharf) for both Akaroa and Lyttelton to maximise visitor spend and value added opportunities'.*

- Our Heritage, Our Taonga (2019-2029):
  - *Whāinga Goal 2: Our Heritage, Our Taonga from the Christchurch and Banks Peninsula's six papatipu rūnanga is acknowledged with respect to their mana whenua and in accordance with their values and culture.*
  - *Whāinga Goal 4: Our Heritage, Our Taonga is protected through collaboration and partnership.*
- Strengthening Communities Strategy (2007), specifically:
  - Goal 2: Promoting collaboration among key stakeholders, including Maori, Iwi and Community organisations;
  - Goal 4: Helping build and sustain a sense of local community.
- Akaroa Harbour Basin Settlements Study (2009), including:
  - *Coastal Recreational Facilities, including that "Safety of harbour users can be compromised where harbour structures are not built and maintained to excellent standards".*
  - *Natural Hazards, including protecting land, housing, roading and other coastal infrastructure (e.g. wharves).*

Impact on Mana Whenua Ngā Whai Take Mana Whenua

6.4 The decision does involve a significant decision in relation to ancestral land or a body of water or other elements of intrinsic value, therefore this decision does specifically impact Mana Whenua, their culture and traditions.

6.5 The Akaroa Main Wharf is located within a landscape of high significance to two hapū, Ngāi Tārewa and Ngāti Irakehu who are the tangata whenua of the takiwā which covers the Akaroa Harbour, surrounding coastal environment and hills as defined by the Ngāi Tahu Claims Settlement Act 1998. Ōnuku Rūnanga represents Ngāi Tārewa and Ngāti Irakehu. Ōnuku Rūnanga have the responsibility to act as kaitiaki over these lands and are active in the environmental management of their takiwā (Tribal Territory).

6.6 Akaroa Main Wharf is an isolated element, and is more closely associated with the Pākeha history of Akaroa. However, this built structure is a prominent form within a cultural landscape embedded with whakapapa. The wharf extends into the heart of Ngāi Tārewa and Ngāti Irakehu identity and way of life which was centred around mahinga kai. The abutment to Akaroa Main Wharf also interfaces with Britomart Reserve, an area which for Ngāi Tahu holds significance as the place where approximately 500 Ngāi Tahu gathered in 1848 to discuss the sale of land which would later be known as Kemps Deed.

6.7 Christchurch City Council and Ōnuku Rūnanga have been working in partnership on the concept development of the Akaroa wharf with work to date including the development of a draft cultural narrative, inputs into the Conservation Plan and ongoing design development for the future of the wharf.

6.8 Representatives from Ōnuku Rūnanga will continue to work with the project team as the project advances into detailed design and construction.

Climate Change Impact Considerations Ngā Whai Whakaaro mā te Āhuarangi

6.9 The main climate change impact of the new wharf is in relation to sea level rise. To confirm a suitable deck height advice has been provided by coastal hazard experts in regards to setting a practical level for the proposed new structure (and as detailed in section 5.0 above). Staff have utilised the current Ministry of the Environment (2017) coastal hazard guidance for incorporating sea level rise into asset planning and has engaged specialist reports to support this work.

6.10 The Council will continue to investigate the potential environmental effects of the development proposal and has been looking at options for sustainable design for the future construction of the wharf.

Accessibility Considerations Ngā Whai Whakaaro mā te Hunga Hauā

6.11 The Akaroa Wharf renewal project will consider accessibility matters as a part of future design stages. As outlined in Section 5.0 above advice has been received through the consultation process and Council staff will be working with the Disability Advisory Group on the detailed elements of the design including materials, access and width of structures and slopes of ramps and pontoons.

7. Resource Implications Ngā Hīraunga Rauemi

Capex/Opex Ngā Utu Whakahaere

7.1 Cost to Implement - $19.085M has been identified in the 2021 – 2031 Long Term Plan. Further cost information will be confirmed in subsequent stages.

7.2 Maintenance/Ongoing costs – It is recognised that there will be ongoing maintenance costs associated with a new wharf, and that the new structure will require maintenance schedules to promote the longevity of the structure. The current maintenance costs are mainly reactive and in response to the age of the structure.

7.3 The maintenance budget sits within the Parks Foreshore operational expenditure

8. Legal Implications Ngā Hīraunga ā-Ture

Statutory power to undertake proposals in the report Te Manatū Whakahaere Kaupapa

8.1 The Council has the power to undertake the activity proposed in this report. (Section 12 Local Government Act 2002 (LGA 02)).

Other Legal Implications Ētahi atu Hīraunga-ā-Ture

8.2 Proceeding to the detailed design phase will involve entering into contractual arrangements for the purchase of any necessary goods and services. There will also be a need for ongoing negotiations with the owners of the buildings that abut the wharf particularly in relation to their ongoing rights of access, both in the long term and during any construction period.

8.3 The assistance of Legal Services will be sought in respect of these and any other legal matters that may arise.

8.4 Current advice from Legal Services is that the Council has complied with its obligations in the Local Government Act 2002 for identifying and assessing options (s.77) and obtaining community views (s.78). Also, that the consultation process has been undertaken in accordance with the principles of consultation set out in s.82.

9. Risk Management Implications Ngā Hīraunga Tūraru

9.1 The decisions in this report are not expected to incur a significant risk

Attachments Ngā Tāpirihanga

No.	Title	Page
A	Akaroa Wharf Engineering Condition Report- Calibre 2021	19
B	Akaroa Wharf Concept Design- Plans and Graphics	68
C	Akaroa Wharf Renewal Option Report-Calibre-July2021	74
D	Akaroa Wharf location options-2019	130
E	Multi Criteria Assessment-Revised December 2021	131
F	Akaroa Wharf Submissions March 2022	203

Additional background information may be noted in the below table:

Document Name	Location / File Link
Not applicable	

Confirmation of Statutory Compliance Te Whakatūturutanga ā-Ture

Compliance with Statutory Decision-making Requirements (ss 76 - 81 Local Government Act 2002).
(a) This report contains:
  (i) sufficient information about all reasonably practicable options identified and assessed in terms of their advantages and disadvantages; and
  (ii) adequate consideration of the views and preferences of affected and interested persons bearing in mind any proposed or previous community engagement.
(b) The information reflects the level of significance of the matters covered by the report, as determined in accordance with the Council's significance and engagement policy.

Signatories Ngā Kaiwaitohu

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AKAROA WHARF CONDITION REPORT

PREPARED FOR CHRISTCHURCH CITY COUNCIL

709066 | 21 July 2021

Calibre Consulting Ltd

QUALITY ASSURANCE STATEMENT

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DOCUMENT CONTROL

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Appendices

1 EXECUTIVE SUMMARY

Christchurch City Council (CCC) has engaged Calibre to undertake a condition and structural assessment of the Akaroa wharf, and plan the repair work required to maintain the level of service required for operation of the wharf for the next five years. It is expected that while the wharf will be replaced in the next 5 years, elements that have failed or are likely to fail in the next 5 years have been recommended for repair and cost estimates prepared.

The Akaroa wharf is a 155m long jetty structure originally constructed in 1888. It is comprised primarily of hardwood timber elements, with softwood timber and steel used for repair work undertaken in the last 20 years.

Alongside the council owned wharf structure are some privately owned buildings, these buildings rely on support from the council owned piles but are not included in the scope of this report. The wharf consists of 40 bents, each bent is 7.2m wide and has 3 piles. Capping beams span across the piles with between 7 and 12 stringers spanning between the bents. Two pontoon structures, one on either side of the wharf, are recent additions to help the wharf service its predominant users, commercial fishing and tourism operators.

Calibre undertook two inspections via boat, one each at high and low tides. A dive survey was organised by Calibre and completed by Sub Aqua Solutions. The dive survey involved cleaning of piles noted as being in marginal condition during the 2018 inspection and the stairs.

During the inspections no immediate safety concerns were raised.

The surveys have identified significant deterioration of the wharf structure, which generally gets worse at the seaward end of the structure. The majority of timber members show signs of deterioration, with capping beams and stringers having substantial decay at the head of the wharf.

We have assessed the capacity of structure to resist gravity (vertical) loads. The wharf is able to support 5 kPa crowd loads and a limit of 3.5 tonne gross weight for general access vehicles. An overweight loading of 10 tonne gross weight (6t axel) has been assessed and could be supported once the recommended (priority 1-2) repairs are completed. We recommend vehicle access continues to be limited to 3.5t vehicles with access for larger vehicles granted via permit and assessed on a case-by-case basis. The repairs assume vehicle access is to be maintained up to bent 22, if vehicle access is prohibited, the scope and cost of repairs could be reduced.

Priority 2 repairs should be completed in the next 6 months, the cost of these repairs is approximately $107,000 excluding GST but including 20% contingency and professional fees. Priority 3 repairs should be completed in the next 2-3 years, the estimated cost of these repairs is $45,000 which includes 20% contingency and professional fees.

Our recommendations for Akaroa wharf are as follows;

- The repairs and maintenance in section 5 are completed.
- Planning advice is sought to confirm if the recommended repairs require a resource consent.
- The berthing of vessels is controlled and limited as per the existing signage.
- Vehicle access is limited to bents 0 – 23 where barrier is already installed. Vehicle size to be limited to 3.5t GVM. (10t GVM be permit only).
- The condition of the wharf below the buildings is discussed with the owners, this should be done within 3 months.
- Assessment of crane condition (or limit usage of crane)
- The wharf is replaced in the next 5 years.
- The wharf is inspected in two-year intervals until replacement, including inspection of the piles and removal of marine growth.

2 INTRODUCTION

2.1 Important Notes about this Report

This report has been prepared by Calibre Consulting Ltd (**Calibre**) at the request of Christchurch City Council (**CCC**) for the purpose of facilitating a discussion based on the Scope herein.

The sole purpose of this report is to present findings of recent survey of Akaroa wharf and to provide cost estimates for the anticipated work on the structures.

Where costs are included in the report, these are rough order engineer's estimates based on rates from previous maintenance projects. The rates are commercially sensitive so detailed cost breakdowns should not be published. Further advice should be sought when calculating budgets. GST and escalation are excluded from the figures.

Calibre has relied on and referenced certain reports and information prepared by third parties, including CCC, as well as other consultants and specialists. Calibre is not responsible for the accuracy, relevance, and completeness of such information. It is recommended that any reliance on the same is subject to independent review and assessment.

The report has been prepared by Calibre for CCC and Calibre accepts no liability or responsibility for or in respect of any use or reliance upon any of them by anyone other than CCC.

Calibre and/or any employee or sub-consultant of Calibre, do not accept liability for:

- The accuracy, reliability or completeness of any of the contents of this report;
- These limitations and disclaimers shall apply notwithstanding that the report may be made available to other third parties and for the purpose of public consultation.
- This report is limited to the description of the scope, and excludes anything which is not expressly recorded including (but not limited to):
    - The degree of compliance with the New Zealand Building Act or any other relevant codes or standards other than the structural aspects of the structure; and
    - The drawings included in Appendix A are for concept designs and are not final.

In accepting delivery of, and in using this report, CCC accepts and agrees that the report is subject to the disclaimers and exclusions contained herein, and indemnifies Calibre for all losses, expenses or claims arising from the use or reliance on this report by any third party, including but not limited to the users or occupiers of the structure.

2.2 Background

Christchurch City Council (CCC) owns the 155m long wharf at Akaroa. The wharf was built in 1888 and served as the main economic gateway for both passengers and goods until the mid-twentieth century.

Recently the wharf has again become of significant economic importance to Akaroa, receiving thousands of tourists from cruise ships and serving as a hub for the sight-seeing tours within the harbour. The wharf is also regularly used by commercial fishing vessels.

Prior to the COVID 19 global pandemic, 92 cruise ships visited Akaroa during the 2018-19 summer season with thousands of passengers using the wharf on a busy day. The cruise ship usage is not expected to return to this level following the opening of the cruise ship berth at Lyttelton in 2020.

The original construction drawings have been found by Calibre, these have been useful for identifying original timbers and understanding the origin of hollowing / holes observed during the inspection.

Several privately owned structures have been built alongside the wharf and are supported by piles from the CCC owned main wharf. The inspection of the buildings and supporting structure is outside the scope of this report, however we noted issues with the buildings and recommend CCC discuss this with the building owners.

Akaroa wharf is listed as a heritage structure in the Christchurch City Council district plan. The wharf is at the end of its economic life and is expected to be replaced within the next 5 years.

3 DESCRIPTION OF WHARF

3.1 Wharf Details

Akaroa Wharf is a linear wharf, 155m long. Alongside the council owned wharf are some privately owned buildings, supported by a combination of privately and council owned piles. The total area of council owned wharf deck is approximately 1125m². The wharf also has two floating pontoons, constructed approximately 15 years ago, that have a combined area of approximately 150m^2.

The deck of the wharf was originally formed by 8" x 4" (200 x 100mm) stringy bark planks. These have been replaced by 50x100mm softwood timbers planks on edge between bents 0-12 and bents 23-40. Running boards above the deck between bents 0 -12 have been installed to allow vehicle access. The deck between bents 12 and 23 is 100-200mm thick reinforced concrete.

The pile caps are typically 14" x 12" (350x270) hardwood, likely to be ironbark as they appear consistent with the original construction drawings. The stringer beams are 14" x 8" (355 x 200), many of the stringers have been replaced or made redundant by the addition of galvanised steel stringers alongside.

The piles comprise of a mixture of original ironbark piles and newer piles of various grades and species. More recently, FRP, concrete and steel jackets have been installed to rehabilitate the deteriorating piles.

The lateral load resisting system in the wharf is a combination of raking piles and bracing. Raking / chafing piles are located every fourth bent at the outer end of the wharf, this is consistent with the original construction drawings.

The majority of the original hardwood bracing has been replaced by steel tension only bracing. The little timber bracing that remains is at the inner end of the wharf and in poor condition.

Two pontoon structures, one on either side of the main wharf were constructed approximately 15 years ago. The pontoons are floating steel structures anchored in place by steel piles driven into the seabed. The pontoon on the south side of the wharf is approximately 68m^2 and the pontoon on the north side of the wharf is approximately 81m^2.

In the CCC district plan the Akaroa wharf is listed as a heritage structure and has been assessed as having a high heritage significance to the Christchurch District. This is based on its historical and social significance for its on-going role as the town's economic portal.

There are several privately owned buildings built alongside the wharf. The buildings rely on council owned piles along grid line C for structural support. The buildings have limited bracing and so may also rely on the council owned wharf for lateral load resistance. This will need to be considered during the replacement of the wharf.

3.2 Current Use of the Wharf

The wharf was originally constructed for coastal shipping and was the primary means of access for both goods and people. However, its use declined and access to Akaroa has been mainly via road since the middle of the twentieth century.

The main users of Akaroa Wharf are tourists, fishermen, cruise ship transfers and recreational walkers. There are several privately owned buildings built over the harbour directly adjacent to the wharf offering souvenirs and harbour tours. There is also a caravan on the wharf which sells fresh fish. Prior to the COVID 19 global pandemic, nearly 100 cruise ships visited Akaroa during the summer season with thousands of passengers using the wharf on a busy day. Cruise ship usage is not expected to return to this level following the opening of the cruise ship berth at Lyttelton in 2020.

Fishing vessels regularly moor at the wharf to restock and allow the crew off. Anecdotally, we understand vessels larger than the 10m limit continue to berth at the wharf.

4 SURVEY

The inspection survey of Akaroa Wharf was completed by Calibre on the 14th-15th June 2021. The wharf was inspected both from the wharf deck and from a boat during high and low tide. All structural members above water level were visually inspected.

Marine growth was scraped from members in the tidal zone (where there is a high incidence of decay) where necessary to ensure a sufficient inspection of the element could be completed. Handrails, ladders and lights were visually inspected, but not tested. The piles and bottom of stairs were cleaned by the divers, piles found to be in marginal or poor condition during the last inspection were prioritised for cleaning and close inspection.

A dive inspection of all piles was completed on 17 June 2021 by Sub Aqua Solutions. The results of that inspection have been included in Appendix C.

The CCC condition grade criteria (below) was used during the survey as a basis for the repair recommendations and prioritisation.

Condition Grade	Condition description	Description
1	Excellent	• Sound physical condition, design to appropriate standards and well maintained with no defects. • Likely to perform effectively under the current maintenance regime for 10+ years.
2	Good	• As for condition grade 1 but showing signs of superficial wear, tear and deterioration or not up to appropriate standards. • Normal maintenance needed to prevent initial stages of decay or dereliction commencing. • Deterioration has no significant impact on stability, safety or appearance of the structure. • In 5-10 years deterioration expected, but unlikely to fail. • Examples of defects include hairline crack, weathering of timber, staining of fastenings. No decay or scour of supports.
3	Moderate	• Functionally sound structure. • Early stages of decay or dereliction are becoming evident with minor components requiring replacement or repair, or reactive maintenance costs rising. • Some deterioration beginning to affect the stability, safety or appearance of the structure. • Failure unlikely within 3 years, but further deterioration likely and major replacement required within 10 yrs. • Examples of defects include cracks < 2.mm, minor spalling, slight decay of timber, mild corrosion of fastenings, surface staining, some loss of protective coating, vandalism. No scour of supports.
4	Poor	• Structure functioning but with significant defects and high maintenance costs arising. • Structural integrity becoming affected. • No immediate risk to health and safety but work required within 1-2 years to ensure asset remains safe. • Examples of defects include rotting and splitting of timber, loosening of fastenings, moderate scour of supports, loss of slip resistant features, cracks 2-5mm, spalling, staining of concrete.
5	Fail	• Serious structural problems having a detrimental effect on the performance of the asset. • Site safety at risk. • Failure imminent or maintenance costs excessive. • Major work or replacement required urgently.

Table 4.1 CCC Condition Grade Assessment Criteria

4.1 Survey Results

Member	Condition Grade (typical)	Useful remaining life
Deck	3	5 – 10 years
Bracing	3	5 – 10 years
Stringers	3 - 4	5 years
Capping Beams	3 - 4	5 years
Piles	3	5 – 10 years
Overall (average)	3 - 4	5 – 10 years

Table 4.2 Condition grade and remaining life

Structural drawings have been prepared showing the layout of the piles, capping beams & stringers and deck. The drawings use the same grid system as used on previous inspections and similar references.

A description of the findings of the survey are given below. The structural drawings, inspection records and photographs can be found in Appendix A, B and D respectively. This survey undertaken by Calibre and Sub Aqua Solutions was a visual inspection only and did not include any intrusive investigation, so any non-visible damage (e.g. due to worms) will not have been picked up in this assessment.

The surveys have identified significant deterioration of the wharf structure, which generally gets worse at the seaward end of the structure. The majority of timber members show signs of deterioration, with capping beams and stringers having substantial decay at the head of the wharf.

It has been found that the piles at Akaroa Wharf are infested with Teredo worm, however the only way to reliably confirm the extent of damage is to visually inspect by cutting wafers through the piles. This can only be done on piles which are no longer needed. The wharf is due to be replaced in the next 5-10 years so pile rehabilitation via Fibre Reinforced Plastic (FRP) wraps rather than replacement is favoured.

The majority of the load bearing piles were in moderate to poor condition, though some of the piles in poor condition are redundant with newer piles alongside. If the structure is to be used beyond 10 years, remediation will be required as the piles can be expected to continue deteriorating.

Two piles in the council owned area of the wharf require repair. The piles requiring remediation were based on the following factors: severe loss of section, location on wharf (subject to vehicle loading), heavy worm damage, and/or large hollowing of the pile.

The fenders on rows A and C are typically in moderate condition and should not require remediation through to the renewal of the wharf in the next 5-10 years. Similarly, the raking piles along grids A and C were typically in moderate condition with no remediation required.

Approximately 60 piles across the wharf have had jacket repairs undertaken previously. These are a mixture of concrete, FRP and steel jacket repairs. In some cases, the jacket repair has been used to splice a new softwood pile to the base of an existing hardwood pile.

The capping beams across all bents are mostly in moderate condition with early stages of decay evident but not affecting the structural functionality of the wharf. The capping beams at bents 1, 11, 19 & 24 exhibited splitting and hollowing and should be repaired. The capping beam in Bent 14 is a steel beam that is severely corroded, and as such has been classified as poor. It has not deteriorated significantly since the last inspection and should continue to be monitored.

Stringers are generally in moderate to poor condition, with early stages of decay. 15 no. have been identified as requiring remedial action. These are stringers that have exhibited large degrees of hollowing and decay, such that their function is close to becoming compromised. The condition generally deteriorates along the wharf as you move away from the beach. Where multiple poor condition stringers are in the same span, these have been prioritised.

In several locations it was noted that there was vegetation growth in the outer stringers, typically around the fenders. This can accelerate the decay of the stringer so should be removed.

Almost all the original hardwood bracing has decayed and has already been replaced, some redundant hardwood timber bracing is loose and should be removed as it can be a hazard and damage the wharf. The bracing was replaced with a mixture of stainless steel and galvanised steel bracing. Much of this bracing was replaced in 2019 and the replacement of bracing to a further five bents is recommended.

The bracing at Bent 7 has been installed in such a way that it relies on the bolt's bending capacity rather than the brace tension capacity. As the adjacent braced bays are in moderate condition and the lateral load demand at this location are likely to be minimal, no remedial action is required.

The deck (both timber and concrete sections) was in moderate to good condition. Some minor fire damage was noted to the underside of the deck in several locations, but this has not had a significant effect on the capacity of the deck. In some locations, the concrete decking was visible from the underside through old timber decking and formwork. This is not considered to be a major issue and no remedial action is required.

The pontoon structures are a recent addition to the wharf structure to give easier access to vessels, particularly during low tide. The pontoons are constructed primarily of steel, with timber decks and are showing very early signs of deterioration but should not require significant maintenance in the foreseeable future. Anecdotally, it was noted that during king tides, the ramps to the jetty were noted to be sloping upwards indicating the high tide exceeds the maximum allowed for in the design.

The ladders were visually inspected but not tested during the course of this assessment. We have noted one ladder that has broken and should be removed and another that requires new fixings to the wharf.

Handrails are located around a small portion of the deck. The condition and capacity of these handrails was not assessed as part of this report.

The abutment structure is a concrete structure approximately 33m long extending from the shoreline to meet the wharf. On the southern side of the abutment a large crack extends from the base up to the top of the wall, being a result of the severe liquefaction that occurred during the Canterbury Earthquakes. The structure has had several post-tensioned rods installed through the abutment to prevent further damage. The heads of these were in good condition. Inspection of the abutment showed large cracks at regular intervals and fine materials have been washed away leaving the aggregate exposed. The abutment does not require repair given the remaining life of the structure.

A caravan selling fresh fish is located between Bents 23-25. This has been put in place since the construction of the of the Black Cat building over the old fisherman's wharf. This caravan is located on the section of the wharf that is not designated for vehicle loading. We have recommended further stringers beneath the caravan are repaired.

During the inspection it was noted that the small crane, located on the concrete deck section of the wharf was in poor condition with surface corrosion widespread across the base. A detailed inspection of the crane is not within the scope of this report.

4.2 Dive Survey Results

The results of the dive inspection completed by Sub Aqua Solutions can be found in Appendix C. The sub-aqua report uses the CCC condition rating system but only covers the area of the pile below the low water line. The Calibre ratings consider the entire pile, including connection to the structure above so the condition ratings differ.

Two council owned piles were found to be in poor condition and repair via installation of FRP jackets is recommended, the piles are at grid 27A and 33A. A further two piles at grid 15E and 18D, below the privately owned piles were found to be close to failure, it is recommended this is discussed with the building owners. Videos of the pile inspection for these four piles, including commentary from the divers will be provided to CCC.

Drawings 710522.004 S100 & S101 show the results of the pile survey and where repairs are proposed. Some raking piles have been identified as being in marginal condition however it is not proposed that these be repaired, as it is more economic to repair the bracing.

4.3 Structure Below Privately Owned Buildings

Inspection of the wharf below the privately owned buildings is outside the scope of Calibre's report, however we note several defects that may require maintenance in the short term. We recommend that the condition of the structure below the buildings is raised with owners, and that this is done within the next 3 months. Refer to **Error! Reference source not found.** for photographs of the structural defects.

The buildings are supported by what appear to be elements of the original wharf along with more recent additions. Older timber structural beams have been repaired by the addition of steel beams, the steel is now in poor condition.

Following the 2018 inspection, urgent repairs to the fisherman's wharf below the recent extension to the Blackcat buildings were completed. The beams that were not repaired are in moderate condition and it is likely additional repairs will be needed in the next 5 years.

Of particular concern is the deterioration of the capping beams, these structural elements have little redundancy and failure of these beams could result in localised collapse. The capping beams are typically smaller than those on the council owned area of the wharf and have severe splitting.

Two piles below the buildings were rated as non-viable by Sub-Aqua, both piles were found to have severe worm damage and hollowing close to the seabed and are close to failure.

Underneath the deck of the wharf there are various cables, conduits and pipes that provide services to the end of the wharf. These are all in moderate condition but are untidy in places and hanging down. They are vulnerable to debris that may wash under the wharf during high tide.

There is a water leak below the Black Cat building near the fisherman's landing which is accelerating decay of the timber structure below.

5 REPAIR WORK

5.1 Background to Repairs

Described below are the anticipated repairs that are likely to be required to address the issues identified in the surveys and to maintain the wharf for its current functions until a new wharf is constructed in 5-10 years' time.

For consistency, we have prioritised repairs similar to previous reports and based on severity level in Table 5.1. As the wharf is due to be replaced, we have not recommended any priority 4 repairs.

Repair Priority	
1	Health & Safety Hazard to users Repair immediately These issues have been addressed via a separate memo (Appendix D)
2	Severe reduction in capacity Deterioration of defect will reduce structural integrity Repair or replace within 6 months
3	Moderate reduction in member capacity, repairs required to prolong life Repair or replace with 2-3 years
4	Minor reduction in member capacity Monitor and repair as required

Table 5.1 Repair priority

The wharf was originally designed for use as a commercial wharf, transporting people and goods to and from Akaroa. The current use, primarily tourism related, will impose lower load demands on the wharf than originally designed for. Therefore, the current loads can be safely carried despite the deterioration of some structural elements (members). With the cruise ships now using Akaroa Harbour as its main stop in Canterbury, crowd loading of 5 kPa is considered appropriate. Light vehicles also use the wharf on a regular base so a 3.5t GVM can be expected on the wharf.

Due to the nature of the tides and the cyclical weathering effect they have on timber structures, much of the deterioration has occurred in the tidal zone, affecting the piles, walers (where they are still present) and braces (diagonal members). As the high tide level can reach the underside of the deck the capping beams and stringers have also undergone the same cyclic weathering. In general, the deterioration has had a greater effect on the walers than on the braces. Most of the walers are completely lost, and the lower portions of most braces are decayed. Previously, braces have been replaced with steel rod braces, which are now also failing due to corrosion. The lost and damaged walers have been scheduled for repairs and replacement, as necessary.

Some structural elements such as the piles on the wharf approach remain essential, although in most cases some deterioration is permissible. It is proposed that 14 of the piles are repaired prior to the refurbishment/replacement of the wharf. The piles have been prioritised into groups based on the low tide inspection and dive survey results. These repairs are amongst the most urgent due to the relative lack of redundancy, and the stress that failed piles can place on the adjacent structure when the deck above sags.

The repair work is a permitted activity based on the ECAN "Regional Coastal Environment Plan for the Canterbury Region", statement; "The reconstruction, alteration, or extension of an Authorised Structure, or any part of an Authorised Structure, outside the Operational Area of a Port, provided that: (i) the reconstruction or alteration shall be for the purpose of repairing or maintaining the structure with like materials; and (ii) there shall be no change to the location or external dimensions of the structure as it was originally authorised." This means that the wharf can be repaired with similar materials and within the same area of the existing wharf.

The repair work will need to be carried out with minimal impact to the environment, a resource consent may be needed to confirm the environmental affects mitigation.

5.2 Details of Repairs

This section outlines the repairs required to maintain Akaroa wharf before it is replaced in the next 5 years. If the timeline for replacement is increased, then more repair work will be required to maintain the safe condition of the wharf.

The wharf is in poor condition and repairs and maintenance are recommended to keep the wharf suitable for pedestrian and vehicle access.

No new piles are planned to be driven during the maintenance. FRP wraps will be installed over the weakened section of pile. These are considered adequate to protect the most vulnerable pile sections (typically near the seabed or inter-tidal zones) until the wharf is replaced.

The cost estimates are based on rates from the 2019 maintenance and repair contract (4600002952), along with similar projects that Calibre have been involved with. We have added 10% to these costs for escalation and applied rounding.

The preliminary and general for the previous repair contract was 26% of the total project cost. This includes establishment and disestablishment, pedestrian management, SSSP, as-built / QA documentation and environment management plan.

Item	Quantity	Unit Cost	Total
P&G, professional fees, based on 26% of total costs			$23,500.00
Remove ladders in poor condition	1	$500.00	$500.00
Replace lowest tread to stairs at bent 29-30	1	$500.00	$500.00
Cap beam repairs, add PFC members either side of existing timber beam	3	$5,750.00	$17,250.00
Pile repairs, FRP wrap	3	$8,000.00	$24,000.00
Remove failed fender, and fixings protruding from face of wharf	2	$1,250.00	$2,500.00
Replace timber stringer with galvanised steel beam	12	$3,000.00	$36,000.00
Install tension bracing	3	$1,750.00	$5,250.00
Repair deck and strengthen support to lighting post	1	$3,000.00	$3,000.00
Contingency, 20% applied to above costs			$17,800.00
	Total (excluding GST)		$ 106,800.00

Table 5.2 Priority 2 repairs

Item	Quantity	Unit Cost	Total
P&G, professional fees, based on 26% of total costs			$12,000.00
Remove loose (failed) hardwood bracing	1	$1,250.00	$1,250.00
Reinstate fixing to ladder	1	$250.00	$250.00
Add packing between stringer and cap beam (per end of beam)	3	$150.00	$450.00
Cap beam repairs, add PFC members either side of existing timber beam	1	$5,750.00	$5,750.00
Pile repairs, FRP wrap	1	$8,000.00	$8,000.00
Repair connection between top of pile and beam	2	$3,250.00	$6,500.00
Replace timber stringer with galvanised steel beam	3	$3,000.00	$9,000.00
Install tension bracing	2	$1,750.00	$3,500.00
Repair deck and strengthen support to lighting post	1	$3,000.00	$3,000.00
Contingency, 20% applied to above costs			$7,540.00
	Total (excluding GST)		$45,240.00

Table 5.3 Priority 3 repairs Total (excluding GST)

6 RECOMMENDATIONS

Our recommendations for Akaroa wharf are as follows;

- The repairs and maintenance in section 5 are completed.
- Planning advice is sought to confirm if the recommended repairs require a resource consent.
- The berthing of vessels is controlled and limited as per the existing signage.
- Vehicle access is limited to bents 0 – 23 where barrier is already installed. Vehicle size to be limited to 3.5t GVM. (10t GVM be permit only).
- The condition of the wharf below the buildings is discussed with the owners, this should be done within 3 months.
- Assessment of crane condition (or limit usage of crane)
- The wharf is replaced in the next 5 years.
- The wharf is inspected in two-year intervals until replacement, including inspection of the piles and removal of marine growth.

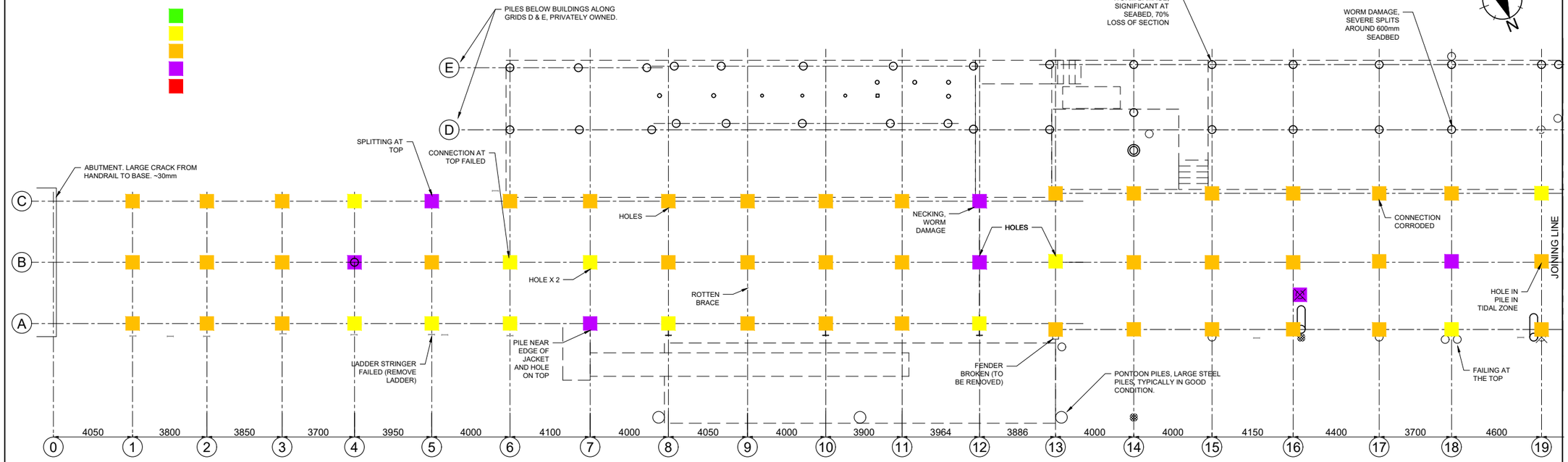
AKAROA WHARF CONDITION REPORT

Appendix A STRUCTURAL DRAWINGS

CHRISTCHURCH CITY COUNCIL

EXTG. PILE CONDITION		
KEY	STATUS	DESCRIPTION
	1: EXCELLENT	SOUND PHYSICAL CONDITION, LIKELY TO PERFORM EFFECTIVELY UNDER CURRENT MAINTENANCE REGIME FOR 10+ YEARS.
	2: GOOD	SOUND PHYSICAL CONDITION BUT SHOWING SIGNS OF SUPERFICIAL WEAR, TEAR AND DETERIORATION. DETERIORATION EXPECTED TO WORSEN IN NEXT 5 -10 YEARS BUT FAILURE UNLIKELY.
	3: MODERATE	FUNCTIONALLY SOUND STRUCTURE. EARLY STAGES OF DECAY. REQUIRES REPLACEMENT OR REPAIR. FAILURE UNLIKELY WITHIN 3 YEARS BUT REPLACEMENT REQUIRED WITHIN 10 YEARS.
	4: POOR	STRUCTURE FUNCTIONING BUT WITH SIGNIFICANT DEFECTS. STRUCTURAL INTEGRITY BECOMING AFFECTED. NO IMMEDIATE RISK TO HEALTH AND SAFETY OF USERS BUT REPAIR OR REPLACEMENT REQUIRED WITH 1 - 2 YEARS.
	5: FAIL	SERIOUS STRUCTURAL PROBLEM. FAILURE IMMINENT AND / OR MAJOR WORK OR REPLACEMENT REQUIRED URGENTLY. HEALTH AND SAFETY OF USERS AT RISK.

LEGEND:
- PILE
- BOLLARD PILE
- RAKING PILE
- PONTOON PILE 310UC158
- REDUNDANT PILE
- PILE WITH CONCRETE JACKET REPAIR
- PILE WITH STEEL JACKET REPAIR
- PILE WITH STEEL JACKET SPLICE TO SOFTWOOD PILE
- FRP JACKET REPAIR (2019)



PILE PLAN

1:100 (A1)
1:200 (A3)

Revision	App	Date

Surveyed	TA, WS & Sub-Aqua	06/21
Designed	BK	07/21
Drawn	MB	06/21
Reviewed	TA	072/21
Approved	-	-

Client: Christchurch City Council

Project Title: Akaroa Wharf
2021 Condition Survey

Sheet Title: Pile Plan
Sheet 1

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
calibreconsulting.co

calibre

Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
710552.012	S100	0

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Christchurch City Council

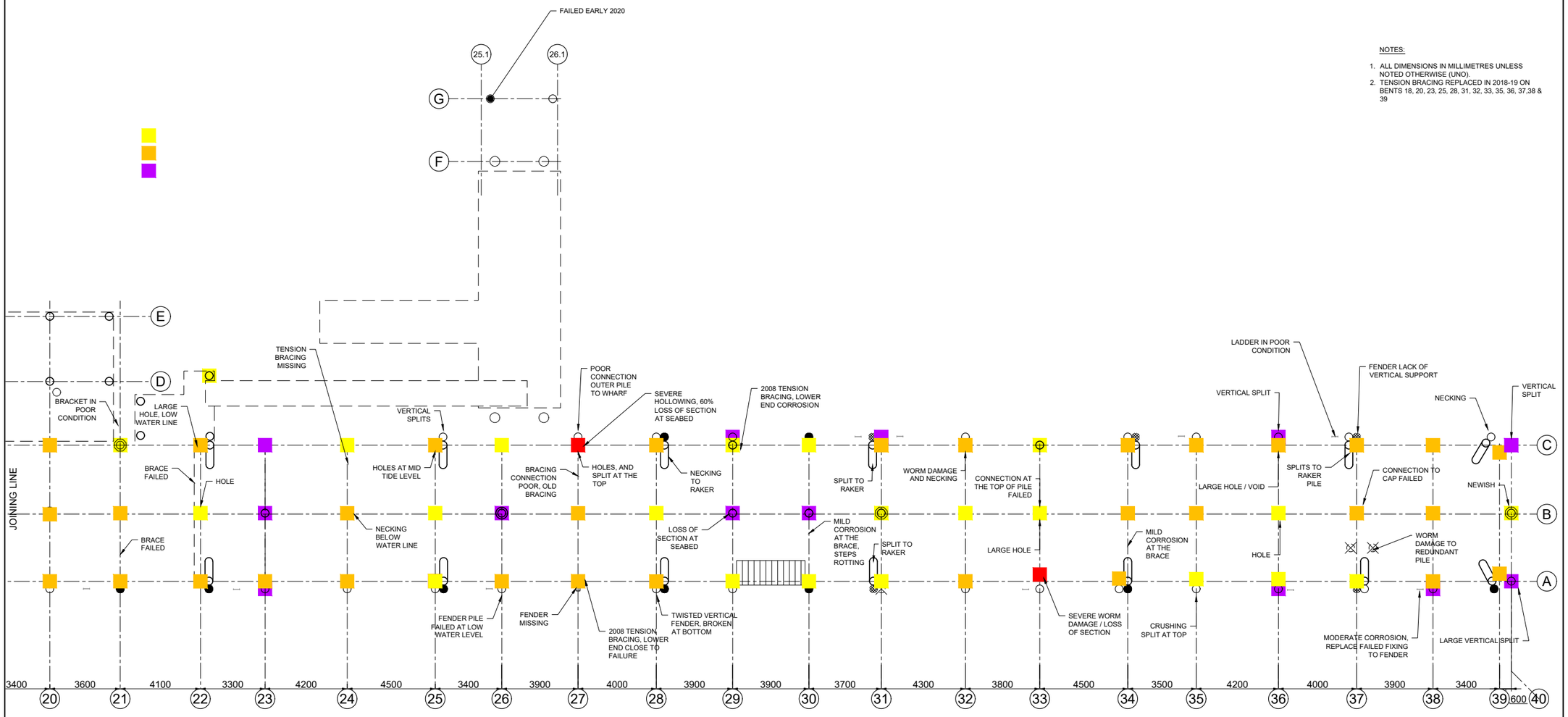
EXTG. PILE CONDITION		
KEY	STATUS	DESCRIPTION
	1: EXCELLENT	SOUND PHYSICAL CONDITION, LIKELY TO PERFORM EFFECTIVELY UNDER CURRENT MAINTENANCE REGIME FOR 10+ YEARS.
	2: GOOD	SOUND PHYSICAL CONDITION BUT SHOWING SIGNS OF SUPERFICIAL WEAR, TEAR AND DETERIORATION. DETERIORATION EXPECTED TO WORSEN IN NEXT 5 -10 YEARS BUT FAILURE UNLIKELY.
	3: MODERATE	FUNCTIONALLY SOUND STRUCTURE. EARLY STAGES OF DECAY. REQUIRES REPLACEMENT OR REPAIR. FAILURE UNLIKELY WITHIN 3 YEARS BUT REPLACEMENT REQUIRED WITHIN 10 YEARS.
	4: POOR	STRUCTURE FUNCTIONING BUT WITH SIGNIFICANT DEFECTS. STRUCTURAL INTEGRITY BECOMING AFFECTED. NO IMMEDIATE RISK TO HEALTH AND SAFETY OF USERS BUT REPAIR OR REPLACEMENT REQUIRED WITH 1 - 2 YEARS.
	5: FAIL	SERIOUS STRUCTURAL PROBLEM. FAILURE IMMINENT AND / OR MAJOR WORK OR REPLACEMENT REQUIRED URGENTLY. HEALTH AND SAFETY OF USERS AT RISK.

LEGEND:

- PILE
- BOLLARD PILE
- RAKING PILE
- PONTOON PILE 310UC158
- REDUNDANT PILE
- PILE WITH CONCRETE JACKET REPAIR
- PILE WITH STEEL JACKET REPAIR
- PILE WITH STEEL JACKET SPLICE TO SOFTWOOD PILE
- FRP JACKET REPAIR (2019)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE (UNO).
2. TENSION BRACING REPLACED IN 2018-19 ON BENTS 18, 20, 23, 25, 28, 31, 32, 33, 35, 36, 37,38 & 39



PILE PLAN
1:100 (A1)
1:200 (A3)

Revision	App	Date
Surveyed	TA, WS & Sub-Aqua	06/21
Designed	BK	07/21
Drawn	MB	06/21
Reviewed	TA	07/21
Approved	-	-

Client: Christchurch City Council

Project Title: Akaroa Wharf
2021 Condition Survey

Sheet Title: Pile Plan
Sheet 2

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
710552.012	S101	0

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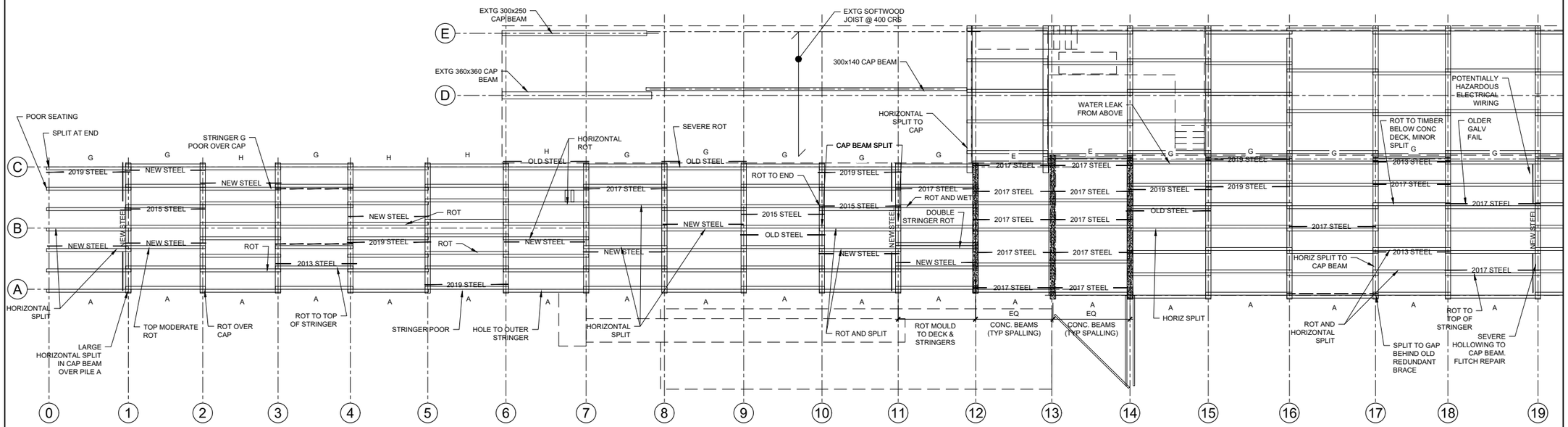
LEGEND:

- NEW STEEL — PROPOSED STEEL REPAIRS
- 2013 STEEL — ADDITIONAL STEEL ADDED IN 2013
- 2015 STEEL — ADDITIONAL STEEL ADDED IN 2015
- 2017 STEEL — ADDITIONAL STEEL ADDED IN 2017
- 2019 STEEL — ADDITIONAL STEEL ADDED IN 2019
- OLD STEEL — ADDITIONAL STEEL ADDED DATE UNKNOWN
- ADDITIONAL TIMBER ADDED DATE UNKNOWN
- CAP BEAM - 350x270 U.N.O.
- STRINGER
- REDUNDENT STRINGER
- A — STRINGER REFERENCE



CAP BEAM AND STRINGER PLAN

1:100 (A1)
1:200 (A3)

Revision	App	Date

Surveyed	TA & WS	06/21
Designed	BK	07/21
Drawn	MB	02/19
Reviewed	TA	07/21
Approved		

Client: Christchurch City Council

Project Title: AKAROA WHARF
2021 Condition Survey

Sheet Title: CAP BEAM
AND STRINGER PLAN
SHEET 1

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
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Scale (A1 Original) 1:100 (A3) 1:200

SCALE AS NOTED

Project No	Sheet	Revision
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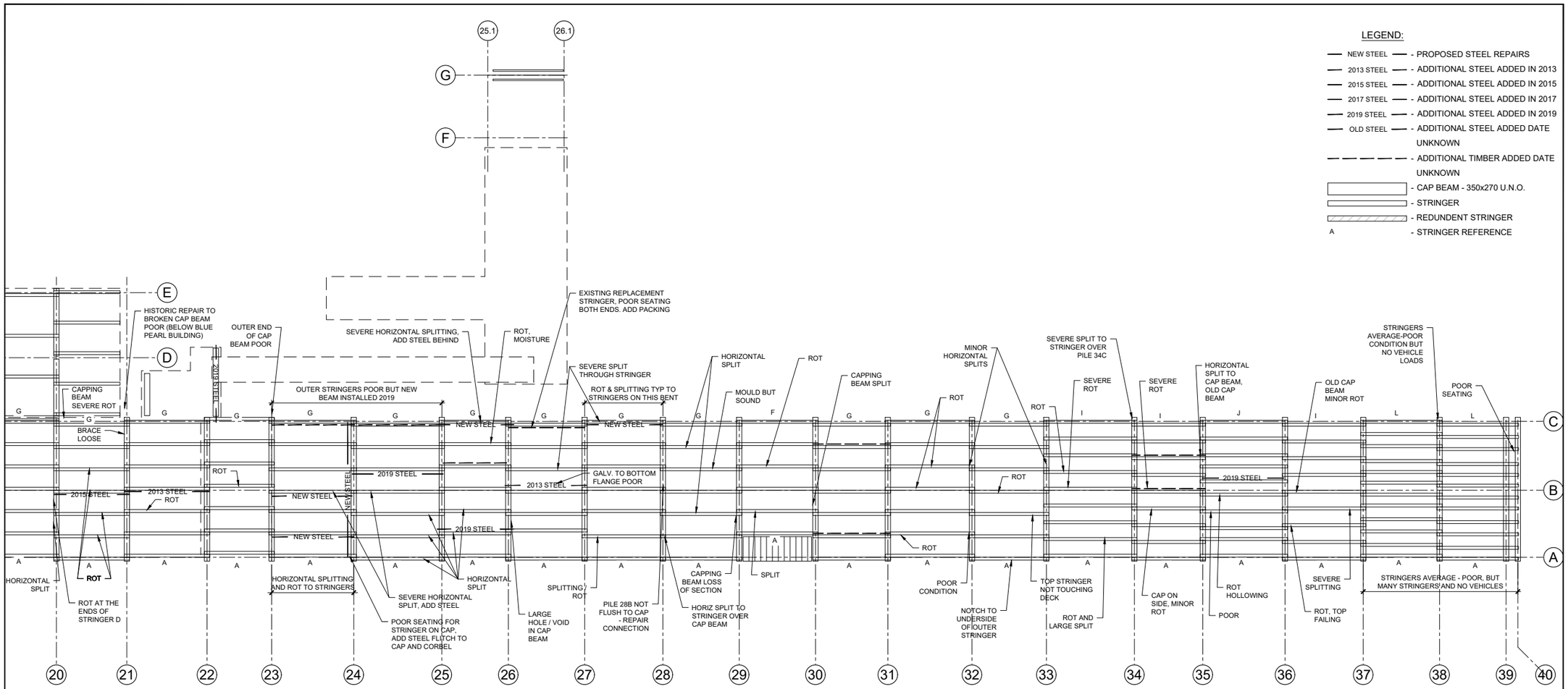

CAP BEAM AND STRINGER PLAN

1:100 (A1)
1:200 (A3)

Revision	App	Date

Surveyed	TA & WS	06/21
Designed	BK	07/21
Drawn	SC	02/19
Reviewed	TA	07/21
Approved		

Client: Christchurch City Council

Project Title: AKAROA WHARF
2021 Conditon Survey

Sheet Title: CAP BEAM
AND STRINGER PLAN
SHEET 2

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
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calibre

Scale (A1 Original) 1:100 (A3) 1:200
SCALE AS NOTED ## ## ### m

Project No	Sheet	Revision
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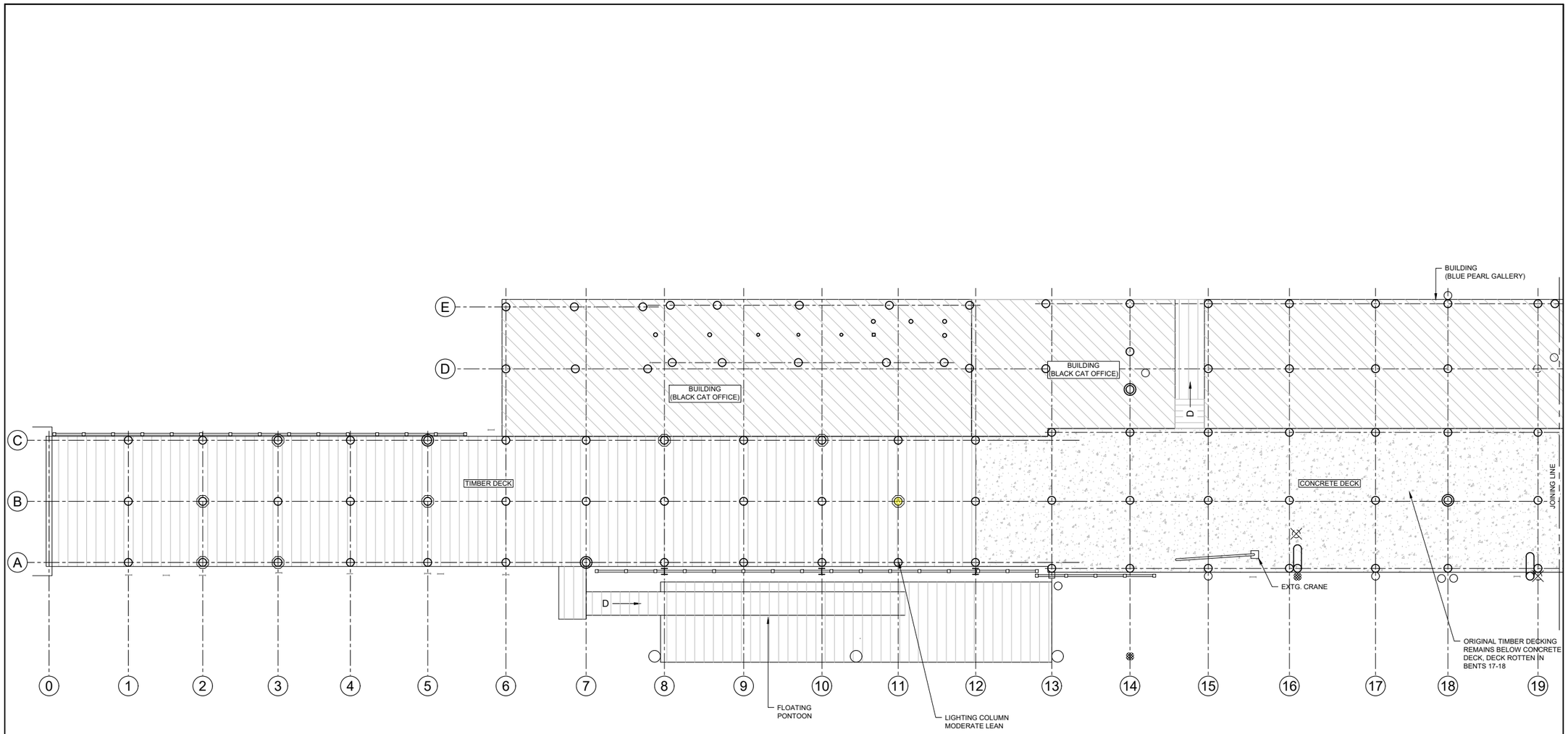

DECK LAYOUT PLAN

1:100 (A1)
1:200 (A3)

Surveyed	TA & WS	06/21	
Designed	BK	07/21	
Drawn	MB	02/19	
Reviewed	TA	07/21	
Approved			

Revision App Date

Client: Christchurch City Council

Project Title: Akaroa Wharf
2021 Condition Survey

Sheet Title: Deck Layout Plan
Sheet 1

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
calibreconsulting.co

Scale (A1 Original) 1:100 (A3) 1:200
SCALE AS NOTED

Project No	Sheet	Revision
710552.012	S104	0

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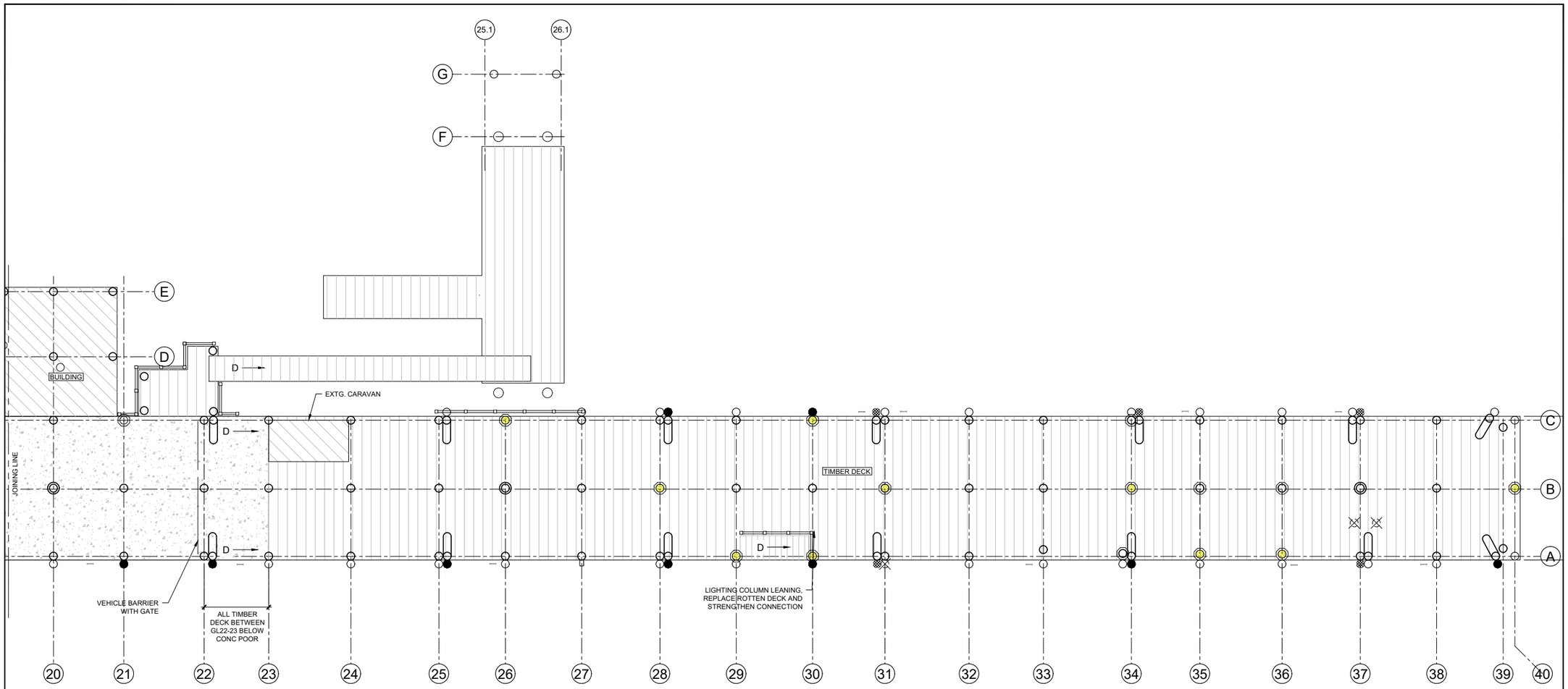

DECK LAYOUT PLAN

1:100 (A1)
1:200 (A3)

Surveyed	TA & WS	06/21	
Designed	BK	07/21	
Drawn	MB	02/19	
Reviewed	TA	07/21	
Approved			

Revision App Date

Client: Christchurch City Council

Project Title: Akaroa Wharf
2021 Condition Survey

Sheet Title: Deck Layout Plan
Sheet 2

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
calibreconsulting.co

Scale (A1 Original) 1:100 (A3) 1:200
SCALE AS NOTED ## ## ### m

Project No	Sheet	Revision
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AKAROA WHARF CONDITION REPORT

Appendix B INSPECTION RECORD

CHRISTCHURCH CITY COUNCIL

Akaroa Wharf Condition Report

Item Ref	Stringer Ref	Element Type	Location		Inspection Findings				2021 Surevy Photograph file name	Repair Recommendation	Repair Priority
			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
1		Vertical Pile	A	40	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Large vertical splitting at top, damage above cross bracing	4			
2		Vertical Pile	B	40	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Recent softwood pile	2	IMG_2398		
3		Vertical Pile	C	40	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Vertical splitting at top, damage above cross bracing	4	IMG_2400		
4		Vertical Pile	A	39	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Moderate splitting at top	3	IMG_2406		
5		Raking Pile	A	39	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
6		Fender	A	39	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
7		Vertical Pile	C	39	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Cap fixing failed	4	IMG_2400		
8		Raking Pile	C	39	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
9		Fender	C	39	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Necking	3	IMG_2404		
10		Vertical Pile	A	38	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
11		Fender	A	38	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	50% loss of section. Splitting at top	4			
12		Vertical Pile	B	38	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Necking	3	IMG_2407		
13		Vertical Pile	C	38	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	-	3	IMG_2406		
14		Vertical Pile	A	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
15		Raking Pile	A	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
16		Fender	A	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
17		Fender	A	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Ladder off horizontal fender. Fender lack of vertical support	3	IMG_2427		
18											
19		Vertical Pile	B	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Original fixing failed, necking to pile	3	IMG_2410		
20		Vertical Pile	C	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2424		
21		Raking Pile	C	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Longitudinal split to raker	3	IMG_2423		
22		Fender	C	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
23		Fender	C	37	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
24		Vertical Pile	A	36	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
25		Fender	A	36	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Hollowing at bolt hole at low water mark	4			
26		Vertical Pile	B	36	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Hole	3	IMG_2436		
27		Vertical Pile	C	36	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Large hole / void at mid tide level	4	IMG_2430		
28		Fender	C	36	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Vertical Split	4	IMG_2434		
29		Vertical Pile	A	35	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Recent softwood pile repair	2	IMG_2442		
30		Fender	A	35	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Crushing / split at the top of pile, adjacent pile sound so no repairs recommended	5	IMG_2442		
31		Vertical Pile	B	35	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2445		
32		Vertical Pile	C	35	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
33		Fender	C	35	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
34		Vertical Pile	A	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
35		Raking Pile	A	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Splitting	4			
36		Fender	A	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
37		Fender	A	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
38		Vertical Pile	B	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	150mm of water pooling on steel jacket, upper section recent softwood	3	IMG_2449		
39		Vertical Pile	C	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
40		Raking Pile	C	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
41		Fender	C	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
42		Fender	C	34	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
43		Vertical Pile	A	33	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Severe worm damage near seabed, close to failure	5	IMG_2461, Pile 33A Video	Jacket Repair	2
44		Fender	A	33	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2457		
45		Vertical Pile	B	33	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Connection at top failed, and large hole at mid tide level	3	IMG_2453, IMG_2455		

Akaroa Wharf Condition Report

Item Ref	Stringer Ref	Element Type	Location		Inspection Findings				2021 Surevy Photograph file name	Repair Recommendation	Repair Priority
			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
46		Vertical Pile	C	33	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Recent softwood pile repair	2			
47		Vertical Pile	A	32	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Large hole, worm damage and necking	4	IMG_2468		
48		Fender	A	32	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
49		Vertical Pile	B	32	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		4	IMG_2464		
50		Vertical Pile	C	32	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Large hole, worm damage and necking	4	IMG_2466		
51		Fender	C	32	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
52		Vertical Pile	A	31	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2473		
53		Raking Pile	A	31	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Split to raker	3	IMG_2473		
54		Fender	A	31	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2473		
55											
56		Vertical Pile	B	31	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Steel Jacket below LWM	2			
57		Vertical Pile	C	31	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2475		
58		Raking Pile	C	31	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Split to raker	3	IMG_2475		
59		Fender	C	31	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2475		
60		Fender	C	31	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2475		
61		Vertical Pile	A	30	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Lamp post leaning towards pile b	4	IMG_5198		
62		Fender	A	30	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
63		Vertical Pile	B	30	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Hollowing at bolt hole	4			
64		Vertical Pile	C	30	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
65		Fender	C	30	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
66		Vertical Pile	A	29	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2497		
67		Fender	A	29	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2497		
68		Vertical Pile	B	29	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	30% loss of section, 40mm fluking at bottom	4			
69		Vertical Pile	C	29	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		2	IMG_2495		
70		Fender	C	29	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		2	IMG_2495		
71		Vertical Pile	A	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
72		Raking Pile	A	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2500		
73		Fender	A	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Vertical fender is twisted with lower end broken (Raker pile behind is ok)	3	IMG_2505	Remove fender	2
74		Fender	A	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2505		
75		Vertical Pile	B	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Steel Jacket 1m below LWM, pile not flush to cap beam	4	IMG_2512, IMG_2776	Reinstate connection to cap	2
76		Vertical Pile	C	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
77		Raking Pile	C	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
78		Fender	C	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
79		Fender	C	28	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
80		Vertical Pile	A	27	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile necking and connection at top poor	4	IMG_2510		
81		Fender	A	27	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Fender pile failed (missing)	5	IMG_2510		
82		Vertical Pile	B	27	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	20% loss of section	3			
83		Vertical Pile	C	27	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Hole, split at top. Severe hollowing 60% loss of section at bottom	5	IMG_2516, Pile 27C Video	Jacket Repair	2
84		Fender	C	27	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Connection at top of pile poor, single severely bent fixing remains.	4	IMG_2516, IMG_2518, IMG_2519	Reinstate connection	3
85		Vertical Pile	A	26	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	30% loss of section	3			
86		Fender	A	26	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Fender pile failed (missing)	5	IMG_2532, IMG_2512		
87		Vertical Pile	B	26	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Concrete jacket repair finishes 1m above LWM. 40mm flukes	4			
88		Vertical Pile	C	26	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Recent softwood pile	2			
89		Vertical Pile	A	25	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019	2			
90		Raking Pile	A	25	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			

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			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
91		Fender	A	25	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Vertical split	3			
92		Fender	A	25	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
93		Vertical Pile	B	25	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019	2			
94		Vertical Pile	C	25	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Holes at tidal	3	IMG_2538		
95		Raking Pile	C	25	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
96		Fender	C	25	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
97		Vertical Pile	A	24	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2546		
98		Fender	A	24	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2546		
99		Vertical Pile	B	24	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Necking below water level, 30% loss of section	3	IMG_2541		
100		Vertical Pile	C	24	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	50% loss of section	4			
101		Vertical Pile	A	23	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	20% loss of section	3			
102		Fender	A	23	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
103		Vertical Pile	B	23	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	40% loss of section	4			
104		Vertical Pile	C	23	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	40% loss of section	4	IMG_2553		
105		Vertical Pile	A	22	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
106		Raking Pile	A	22	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
107		Fender	A	22	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
108		Vertical Pile	B	22	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019, holes around high water line.	3	IMG_2551		
109		Vertical Pile	C	22	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
110		Raking Pile	C	22	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
111		Vertical Pile	C	22	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Hole at low water line, moderate splitting to top of pile	4	IMG_2564, IMG_2565		
112		Vertical Pile	D	22	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	20% loss of section	2			
113		Vertical Pile	A	21	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_4285		
114		Fender	A	21	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
115		Vertical Pile	B	21	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
116		Vertical Pile	C	21	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		4	IMG_2567		
117		Vertical Pile	C	21	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Split to outer rigger	3	IMG_2805		
118		Vertical Pile	D	21	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
119		Vertical Pile	A	20	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
120		Fender	A	20	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
121		Vertical Pile	B	20	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Concrete Jacket	3	IMG_2581		
122		Vertical Pile	C	20	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Steel Jacket	3			
123		Vertical Pile	A	19	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2593		
124		Raking Pile	A	19	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2591		
125											
126											
127		Vertical Pile	B	19	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Hole	3	IMG_2835		
128		Vertical Pile	C	19	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
129		Vertical Pile	A	18	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile Repairs 2019	2	IMG_2602		
130		Fender	A	18	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Failing at top	3	IMG_2595		
131		Fender	A	18	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2595		
132		Vertical Pile	B	18	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Damage above and below jacket repair	4			
133		Vertical Pile	C	18	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	20% loss of section	3			
134		Vertical Pile	A	17	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Waler and brace	3	IMG_2615		
135		Fender	A	17	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Waler and brace	3	IMG_2615		
136		Vertical Pile	B	17	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	20% loss of section, connection corroded	3	IMG_2610		

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			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
137		Vertical Pile	C	17	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	connection corroded	3	IMG_2613		
138		Vertical Pile	A	16	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2617		
139		Raking Pile	A	16	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2617		
140		Fender	A	16	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2617		
141		Vertical Pile	B2	16	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Redundant Pile	4			
142		Vertical Pile	B	16	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
143		Vertical Pile	C	16	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
144		Vertical Pile	A	15	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
145		Fender	A	15	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
146		Vertical Pile	B	15	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
147		Vertical Pile	C	15	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
148		Vertical Pile	A	14	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
149		Vertical Pile	B	14	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
150		Vertical Pile	C	14	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
151		Vertical Pile	A	13	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
152		Fender	A	13	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Fender broken at bottom	5		Remove redundant fender	2
153		Vertical Pile	A	13	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2905		
154		Vertical Pile	B	13	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	worm damage, necking	4	IMG_2636		
155		Vertical Pile	C	13	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Rotting	4	IMG_2638		
156		Vertical Pile	A	12	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Rusting connection, necking	3	IMG_2642	Jacket Repair	2
157		Vertical Pile	B	12	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	worm damage, necking	4	IMG_2636		
158		Vertical Pile	C	12	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019	2			
159		Vertical Pile	A	11	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile and decay, lamp post over 11a leaning	3	IMG_5173, IMG_5177		
160		Vertical Pile	B	11	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
161		Vertical Pile	C	11	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	30% loss of section	3			
162		Vertical Pile	A	10	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Slight necking	3	IMG_2650		
163		Vertical Pile	B	10	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
164		Vertical Pile	C	10	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Slight necking	3	IMG_2652		
165		Vertical Pile	A	9	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2657		
166		Vertical Pile	B	9	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2655		
167		Vertical Pile	C	9	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	20% loss of section	3			
168		Vertical Pile	A	8	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019	2			
169		Vertical Pile	B	8	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
170		Vertical Pile	C	8	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Hole	3	IMG_2659, IMG_2660		
171		Vertical Pile	A	7	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Concrete jacket off centre, hole	4	IMG_2666, IMG_2668, IMG_5166		
172		Vertical Pile	B	7	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	2 x Hole, Necking	4	IMG_2662,IMG_5170		
173		Vertical Pile	C	7	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	30% loss of section. Split at top	3			
174		Vertical Pile	A	6	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019	2			
175		Vertical Pile	B	6	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019, connection to cap beam failed	3	IMG_5162		
176		Vertical Pile	C	6	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
177		Vertical Pile	A	5	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019	2			
178		Vertical Pile	B	5	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
179		Vertical Pile	C	5	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Large split at top of pile, above encasement repair	4	IMG_5157,IMG_4161		
180		Vertical Pile	A	4	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019	3	IMG_5155		
181		Vertical Pile	B	4	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Spliting and loss of section near seabed	4	IMG_5153	Jacket Repair	3

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			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
182		Vertical Pile	C	4	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Pile repaired 2019	4			
183		Vertical Pile	A	3	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	Slight necking	3	IMG_5149		
184		Vertical Pile	B	3	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	20% loss of section	3	IMG_5151		
185		Vertical Pile	C	3	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
186		Vertical Pile	A	2	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
187		Vertical Pile	B	2	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
188		Vertical Pile	C	2	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	30% loss of section	3			
189		Vertical Pile	A	1	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3	IMG_2689		
190		Vertical Pile	B	1	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021		3			
191		Vertical Pile	C	1	Sub-Aqua, TA & WS	14th, 15th & 17th June 2021	bracing member critically splitted, hole	3	IMG_5139		
192											
193		Abutment	A-C	0	TA & WS	14 & 15 June 2021		3			
194											
195		Ledger	A-C	0	TA & WS	14 & 15 June 2021	Splitting	4			
196		Capping Beam	A-C	1	TA & WS	14 & 15 June 2021	Large horizontal split over pile A	4	IMG_2689	Flitch plate	2
197		Capping Beam	A-C	2	TA & WS	14 & 15 June 2021		3			
198		Capping Beam	A-C	3	TA & WS	14 & 15 June 2021	Poor capping beam condition	4	IMG_4147		
199		Capping Beam	A-C	4	TA & WS	14 & 15 June 2021		3			
200		Capping Beam	A-C	5	TA & WS	14 & 15 June 2021	Rotting. Ends split	4	IMG_4173		
201		Capping Beam	A-C	6	TA & WS	14 & 15 June 2021		3			
202		Capping Beam	A-C	7	TA & WS	14 & 15 June 2021		3			
203		Capping Beam	A-C	8	TA & WS	14 & 15 June 2021	horizontal split	3	IMG_2952		
204		Capping Beam	A-C	9	TA & WS	14 & 15 June 2021		3	IMG_2657		
205		Capping Beam	A-C	10	TA & WS	14 & 15 June 2021		3			
206		Capping Beam	A-C	11	TA & WS	14 & 15 June 2021	Fire damage over pile A, hollowing	4	IMG_5174, IMG_5175, IMG_2936	Add steel if vehicles over	2
207		Capping Beam	A-C	12	TA & WS	14 & 15 June 2021	Splitting and hollowing	4	IMG_2646		
208		Capping Beam	A-C	13	TA & WS	14 & 15 June 2021	capping beam split	3	IMG_2906		
209		Capping Beam	A-C	14	TA & WS	14 & 15 June 2021	Steel Beam	4			
210		Capping Beam	A-A2	14	TA & WS	14 & 15 June 2021		3			
211		Capping Beam	A-C	15	TA & WS	14 & 15 June 2021		3			
212		Capping Beam	A-C	16	TA & WS	14 & 15 June 2021	Rotting and horizontal splitting	4			
213		Capping Beam	A-C	17	TA & WS	14 & 15 June 2021	Horizontal split to capping over grid A	4	IMG_2824, IMG_2851		
214		Capping Beam	A-C	18	TA & WS	14 & 15 June 2021	Splitting and hollowing	3			
215		Capping Beam	A-C	19	TA & WS	14 & 15 June 2021	hole / hollowing to cap beam, near stringer B (below 2017 steel)	4	IMG_2822, IMG_2837. IMG_2839	Steel flitch	3
216		Capping Beam	A-C	20	TA & WS	14 & 15 June 2021	Steel connection ineffective, cap beam severe rot, horiz split	4	IMG_2586, IMG_2810, IMG_4290, IMG_4298		
217		Capping Beam	A-C	21	TA & WS	14 & 15 June 2021	Brace poor	4	IMG_4293		
218		Capping Beam	C-D	21	TA & WS	14 & 15 June 2021	Repair to corroded bracket	4	IMG_2567		
219		Capping Beam	C-D	22	TA & WS	14 & 15 June 2021		3			
220		Capping Beam	A-C	22	TA & WS	14 & 15 June 2021		3			
221		Capping Beam	A-C	23	TA & WS	14 & 15 June 2021		3			
222		Capping Beam	A-C	24	TA & WS	14 & 15 June 2021	Horizontal splitting along cap beam, poor seating over pile A	4	IMG_2696, IMG_2721	Steel flitch and add corbel to cap beam	2
223		Capping Beam	A-C	25	TA & WS	14 & 15 June 2021		3			
224		Capping Beam	A-C	26	TA & WS	14 & 15 June 2021	Hole in cap beam	4	IMG_2757, IMG_2758, IMG_2759		
225		Capping Beam	A-C	27	TA & WS	14 & 15 June 2021	Hollowing	4			
226		Capping Beam	A-C	28	TA & WS	14 & 15 June 2021		3			
227		Capping Beam	A-C	29	TA & WS	14 & 15 June 2021	Capping beam loss of section, splits along top of beam at upper end of stairs	4	IMG_2793, IMG_2795, IMG_2796		
228		Capping Beam	A-C	30	TA & WS	14 & 15 June 2021	Splitting	4	IMG_4252		
229		Capping Beam	A-C	31	TA & WS	14 & 15 June 2021		3			
230		Capping Beam	A-C	32	TA & WS	14 & 15 June 2021	minor horizontal split	4	IMG_4245		
231		Capping Beam	A-C	33	TA & WS	14 & 15 June 2021	minor horizontal split	4	IMG_4243		
232		Capping Beam	A-C	34	TA & WS	14 & 15 June 2021		3			
233		Capping Beam	A-C	35	TA & WS	14 & 15 June 2021	horizontal Split	4	IMG_4213		
234		Capping Beam	A-C	36	TA & WS	14 & 15 June 2021		3			
235		Capping Beam	A-C	37	TA & WS	14 & 15 June 2021		3			
236		Capping Beam	A-C	38	TA & WS	14 & 15 June 2021	Horizontal Splitting	4			
237		Capping Beam	A-C	39	TA & WS	14 & 15 June 2021		3			
238		Capping Beam	A-C	40	TA & WS	14 & 15 June 2021		3			
239		Stringer			TA & WS	14 & 15 June 2021		3			
240	a	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Rotting	4			
240	b	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Rot	4	IMG_4194		
240	c	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Splitting at end (typical)	4			
240	d	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Splitting at end (typical)	4			
240	e	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Splitting at end (typical)	4			
240	f	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Splitting at end (typical)	4			
240	h	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Severe rotting and hollowing	4			
240	i	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021		3			
240	j	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Splitting along underside	4			
240	k	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	Splitting along underside	4			
240	l	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021		3			
240	g	Stringer	A-C	38-39	TA & WS	14 & 15 June 2021	poor seating, rot	4	IMG_4197	Add packing	3
241	a	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021		3			
241	b	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021	Hollowing. Rot at top of stringer	4			
241	c	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021		3			
241	d	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021		3			

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			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
241	e	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021	Splitting	4			
241	f	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021		3			
241	g	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021		3	IMG_4199		
241	h	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021		3			
241	i	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021		3			
241	j	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021	Splitting along underside	4			
241	k	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021	Splitting along underside	4			
241	l	Stringer	A-C	37-38	TA & WS	14 & 15 June 2021	Splitting	4			
242	a	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021		3			
242	b	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021	Splitting	4			
242	c	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021	Rot and splitting, top is failing	4	IMG_4239, IMG_4240, IMG_4241		
242	d	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021	Splitting, minor rotting	4	IMG_4202		
242	e	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021	old capping beam rot minor	4	IMG_4207		
242	f	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021		3			
242	g	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021		3			
242	h	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021		3			
242	i	Stringer	A-C	36-37	TA & WS	14 & 15 June 2021		3			
243	a	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021		3			
243	b	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021		3			
243	c	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021		3			
243	d	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021	stringer poor	4	IMG_4210		
243	e	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021	hollowing rot stringer	4	IMG_4207		
243	f	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021		3			
243	g	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021	Severe hollowing	5			
243	h	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021		3			
243	i	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021		3			
243	j	Stringer	A-C	35-36	TA & WS	14 & 15 June 2021		3			
244	a	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021		3			
244	b	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021		3			
244	c	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021	stringer gap on side minor rot	4	IMG_4217		
244	d	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021		3			
244	e	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021	Split. New stringer alongside so redundant	4	IMG_4219, IMG_4220		
244	f	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021		3			
244	g	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021	Split. New stringer alongside so redundant	2	IMG_4223		
244	h	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021		3			
244	i	Stringer	A-C	34-35	TA & WS	14 & 15 June 2021		3			
245	a	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021		3			
245	b	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021		3			
245	c	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021		3			
245	d	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021		3			
245	e	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021	Split over capping beam, rot	4	IMG_4230, IMG_4232		
245	f	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021	rot	4	IMG_4227		
245	g	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021	Splitting	4			
245	h	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021		3			
245	i	Stringer	A-C	33-34	TA & WS	14 & 15 June 2021	Fire damage. Large split	4	IMG_4224		
246	a	Stringer	A-C	32-33	TA & WS	14 & 15 June 2021	Notch to underside of stringer	4	IMG_4234		
246	b	Stringer	A-C	32-33	TA & WS	14 & 15 June 2021	top stringer not touching deck	4	IMG_4234		
246	c	Stringer	A-C	32-33	TA & WS	14 & 15 June 2021		3			
246	d	Stringer	A-C	32-33	TA & WS	14 & 15 June 2021	Rotten. Horizontal splitting	4	IMG_4236		
246	e	Stringer	A-C	32-33	TA & WS	14 & 15 June 2021	Rotten. Horizontal splitting	4			
246	f	Stringer	A-C	32-33	TA & WS	14 & 15 June 2021	Rotten. Horizontal splitting	4			
246	g	Stringer	A-C	32-33	TA & WS	14 & 15 June 2021		3			
247	a	Stringer	A-C	31-32	TA & WS	14 & 15 June 2021		3			
247	b	Stringer	A-C	31-32	TA & WS	14 & 15 June 2021		3			
247	c	Stringer	A-C	31-32	TA & WS	14 & 15 June 2021		3			
247	d	Stringer	A-C	31-32	TA & WS	14 & 15 June 2021	rot	4	IMG_4248		
247	e	Stringer	A-C	31-32	TA & WS	14 & 15 June 2021	rot	4	IMG_4247		
247	f	Stringer	A-C	31-32	TA & WS	14 & 15 June 2021		3			
247	g	Stringer	A-C	31-32	TA & WS	14 & 15 June 2021		3			
248	a	Stringer	A-C	30-31	TA & WS	14 & 15 June 2021		3			
248	b	Stringer	A-C	30-31	TA & WS	14 & 15 June 2021		3			
248	c	Stringer	A-C	30-31	TA & WS	14 & 15 June 2021	Rotten, however member is redundant by additon of adjacent timber stringer	2			
248	d	Stringer	A-C	30-31	TA & WS	14 & 15 June 2021		3			
248	e	Stringer	A-C	30-31	TA & WS	14 & 15 June 2021		3			
248	f	Stringer	A-C	30-31	TA & WS	14 & 15 June 2021	Severe rot. Has been made redundant by addition of timber stringer	2			
248	g	Stringer	A-C	30-31	TA & WS	14 & 15 June 2021		3			
249	a	Stringer	A-C	29-30	TA & WS	14 & 15 June 2021	decking rotten	4	IMG_5195		
249	b	Stringer	A-C	29-30	TA & WS	14 & 15 June 2021	split	4	IMG_4264		
249	c	Stringer	A-C	29-30	TA & WS	14 & 15 June 2021		3			
249	d	Stringer	A-C	29-30	TA & WS	14 & 15 June 2021	rot	3	IMG_4262		
249	e	Stringer	A-C	29-30	TA & WS	14 & 15 June 2021		3			
249	f	Stringer	A-C	29-30	TA & WS	14 & 15 June 2021		3			
250	a	Stringer	A-C	28-29	TA & WS	14 & 15 June 2021	Rotting and horizontal splitting	3			
250	b	Stringer	A-C	28-29	TA & WS	14 & 15 June 2021	Continuous stringer split	4	IMG_2800		
250	c	Stringer	A-C	28-29	TA & WS	14 & 15 June 2021	Horizontal split	4	IMG_2791		
250	d	Stringer	A-C	28-29	TA & WS	14 & 15 June 2021		3			
250	e	Stringer	A-C	28-29	TA & WS	14 & 15 June 2021		3			
250	f	Stringer	A-C	28-29	TA & WS	14 & 15 June 2021	Horizontal split	4	IMG_2787		
250	g	Stringer	A-C	28-29	TA & WS	14 & 15 June 2021		3			
251	a	Stringer	A-C	27-28	TA & WS	14 & 15 June 2021	Rotting and horizontal splitting (typical throughout 27-28)	4			
251	b	Stringer	A-C	27-28	TA & WS	14 & 15 June 2021	Hole/rot	4	IMG_2772		
251	c	Stringer	A-C	27-28	TA & WS	14 & 15 June 2021		4			
251	d	Stringer	A-C	27-28	TA & WS	14 & 15 June 2021	Horizontal split	4	IMG_2774		
251	e	Stringer	A-C	27-28	TA & WS	14 & 15 June 2021		4			
251	f	Stringer	A-C	27-28	TA & WS	14 & 15 June 2021		4			
251	g	Stringer	A-C	27-28	TA & WS	14 & 15 June 2021	Severe split through stringer	4	IMG_2781, IMG_2782, IMG_2783	Add steel	2
252	a	Stringer	A-C	26-27	TA & WS	14 & 15 June 2021		3			

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Item Ref	Stringer Ref	Element Type	Location		Inspection Findings				2021 Surevy Photograph file name	Repair Recommendation	Repair Priority
			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
252	b	Stringer	A-C	26-27	TA & WS	14 & 15 June 2021		3			
252	c	Stringer	A-C	26-27	TA & WS	14 & 15 June 2021		3			
252	d	Stringer	A-C	26-27	TA & WS	14 & 15 June 2021	2013 Steel galv exposed - bottom	3	IMG_2762		
252	e	Stringer	A-C	26-27	TA & WS	14 & 15 June 2021	Severe horizontal split	4	IMG_2770		
252	f	Stringer	A-C	26-27	TA & WS	14 & 15 June 2021	Split through centre	4			
252	g	Stringer	A-C	26-27	TA & WS	14 & 15 June 2021	New stringer poor seating both ends	4	IMG_2765, IMG_2766	Add packing (both ends)	3
253	a	Stringer	A-C	25-26	TA & WS	14 & 15 June 2021		3			
253	b	Stringer	A-C	25-26	TA & WS	14 & 15 June 2021	Splitting and rot	5			
253	c	Stringer	A-C	25-26	TA & WS	14 & 15 June 2021	Horizontal split	4	IMG_2742		
253	d	Stringer	A-C	25-26	TA & WS	14 & 15 June 2021	Horizontal split, steel along side with poor galvanising	3	IMG_2744, IMG_2762, IMG_2763		
253	e	Stringer	A-C	25-26	TA & WS	14 & 15 June 2021	New timber	1	IMG_2746		
253	f	Stringer	A-C	25-26	TA & WS	14 & 15 June 2021	Moderate splitting	4			
253	g	Stringer	A-C	25-26	TA & WS	14 & 15 June 2021	Stringer poor	4	IMG_2751	Add steel	2
254	a	Stringer	A-C	24-25	TA & WS	14 & 15 June 2021	Horizontal Splitting	4	IMG_2731, IMG_2732		
254	b	Stringer	A-C	24-25	TA & WS	14 & 15 June 2021	Horizontal Splitting	4	IMG_2732		
254	c	Stringer	A-C	24-25	TA & WS	14 & 15 June 2021	Horizontal Splitting	4	IMG_2723, IMG_2724		
254	e	Stringer	A-C	24-25	TA & WS	14 & 15 June 2021	Severe rotting and hollowing	5	IMG_2728		
254	f	Stringer	A-C	24-25	TA & WS	14 & 15 June 2021		3			
254	d	Stringer	A-C	24-25	TA & WS	14 & 15 June 2021	Severe horizontal split to cap beam, steel alongside so no repair	4	IMG_2721		
254	g	Stringer	A-C	24-25	TA & WS	14 & 15 June 2021	Horizonta splitting, new timber alongside	4	IMG_2714, IMG_2715		
255	b	Stringer	A-C	23-24	TA & WS	14 & 15 June 2021	Rotting, severe split	5	IMG_2691, IMG_2693	Add steel	2
255	d	Stringer	A-C	23-24	TA & WS	14 & 15 June 2021	Rot	4	IMG_2701, IMG_2702, IMG_2703	Add steel	2
255	a	Stringer	A-C	23-24	TA & WS	14 & 15 June 2021	Rotting, poor bearing	4	IMG_2696, IMG_2734, IMG_2735, IMG_2737		
255	c	Stringer	A-C	23-24	TA & WS	14 & 15 June 2021	Horizontal split	4	IMG_2698, IMG_2699		
255	e	Stringer	A-C	23-24	TA & WS	14 & 15 June 2021	Mould timber, horizontal splits	4	IMG_2707, IMG_2708		
255	f	Stringer	A-C	23-24	TA & WS	14 & 15 June 2021	Horizontal split	4	IMG_2710		
255	g	Stringer	A-C	23-24	TA & WS	14 & 15 June 2021	Horizontal splitting	4			
256	a	Stringer	A-C	22-23	TA & WS	14 & 15 June 2021		3			
256	b	Stringer	A-C	22-23	TA & WS	14 & 15 June 2021	Horizontal splitting	4	IMG_4270		
256	c	Stringer	A-C	22-23	TA & WS	14 & 15 June 2021		3			
256	d	Stringer	A-C	22-23	TA & WS	14 & 15 June 2021		3			
256	e	Stringer	A-C	22-23	TA & WS	14 & 15 June 2021	stringer rot	4	IMG_4276		
256	f	Stringer	A-C	22-23	TA & WS	14 & 15 June 2021	Horizontal splitting	4			
256	g	Stringer	A-C	22-23	TA & WS	14 & 15 June 2021	Horizontal splitting. Rotting	5			
257	a	Stringer	A-C	21-22	TA & WS	14 & 15 June 2021		3			
257	b	Stringer	A-C	21-22	TA & WS	14 & 15 June 2021		3			
257	c	Stringer	A-C	21-22	TA & WS	14 & 15 June 2021	rot at top, steel alongside	4	IMG_4282, IMG_4295		
257	d	Stringer	A-C	21-22	TA & WS	14 & 15 June 2021	Made redundant by installation of steel beam	3	IMG_4279		
257	e	Stringer	A-C	21-22	TA & WS	14 & 15 June 2021		3			
257	f	Stringer	A-C	21-22	TA & WS	14 & 15 June 2021		3			
257	g	Stringer	A-C	21-22	TA & WS	14 & 15 June 2021		3			
258	a	Stringer	A-C	20-21	TA & WS	14 & 15 June 2021		3			
258	b	Stringer	A-C	20-21	TA & WS	14 & 15 June 2021		3			
258	c	Stringer	A-C	20-21	TA & WS	14 & 15 June 2021	Rot	4	IMG_4304		
258	d	Stringer	A-C	20-21	TA & WS	14 & 15 June 2021	Hollowing. Has been made redundant by the installation of new steel beam	4	IMG_4287, IMG_4301		
258	e	Stringer	A-C	20-21	TA & WS	14 & 15 June 2021		3			
258	f	Stringer	A-C	20-21	TA & WS	14 & 15 June 2021		3			
258	g	Stringer	A-C	20-21	TA & WS	14 & 15 June 2021		3			
259	a	Stringer	A-C	19-20	TA & WS	14 & 15 June 2021		3			
259	b	Stringer	A-C	19-20	TA & WS	14 & 15 June 2021		3			
259	c	Stringer	A-C	19-20	TA & WS	14 & 15 June 2021		3			
259	d	Stringer	A-C	19-20	TA & WS	14 & 15 June 2021		3			
259	e	Stringer	A-C	19-20	TA & WS	14 & 15 June 2021		3			
259	f	Stringer	A-C	19-20	TA & WS	14 & 15 June 2021		3			
259	g	Stringer	A-C	19-20	TA & WS	14 & 15 June 2021		3			
260	a	Stringer	A-C	18-19	TA & WS	14 & 15 June 2021		3			
260	b	Stringer	A-C	18-19	TA & WS	14 & 15 June 2021	Steel on stringer	2	IMG_2830		
260	c	Stringer	A-C	18-19	TA & WS	14 & 15 June 2021	rot to top of stringer	4	IMG_2832		
260	d	Stringer	A-C	18-19	TA & WS	14 & 15 June 2021		3			
260	e	Stringer	A-C	18-19	TA & WS	14 & 15 June 2021		3			
260	f	Stringer	A-C	18-19	TA & WS	14 & 15 June 2021		3			
260	g	Stringer	A-C	18-19	TA & WS	14 & 15 June 2021		3			
261	a	Stringer	A-C	17-18	TA & WS	14 & 15 June 2021	split to gap behind ocd redundant brace	4	IMG_2851		
261	b	Stringer	A-C	17-18	TA & WS	14 & 15 June 2021	rot/horizontal split	4	IMG_2842		
261	c	Stringer	A-C	17-18	TA & WS	14 & 15 June 2021	rot/horizontal split	4	IMG_2845,IMG_2847		
261	d	Stringer	A-C	17-18	TA & WS	14 & 15 June 2021		3			
261	e	Stringer	A-C	17-18	TA & WS	14 & 15 June 2021	minor split, rot to timber below conc deck	3	IMG_2855, IMG_2856, IMG_2860		
261	f	Stringer	A-C	17-18	TA & WS	14 & 15 June 2021	Galvansing to steel beam failed	3	IMG_2853, IMG_2854		
261	g	Stringer	A-C	17-18	TA & WS	14 & 15 June 2021		2			
262	a	Stringer	A-C	16-17	TA & WS	14 & 15 June 2021	Poor splice repair	4	IMG_2619		
262	b	Stringer	A-C	16-17	TA & WS	14 & 15 June 2021	Rot to decking	3	IMG_2826		
262	c	Stringer	A-C	16-17	TA & WS	14 & 15 June 2021		3			
262	d	Stringer	A-C	16-17	TA & WS	14 & 15 June 2021		3			
262	e	Stringer	A-C	16-17	TA & WS	14 & 15 June 2021		3			
262	f	Stringer	A-C	16-17	TA & WS	14 & 15 June 2021		3			
262	g	Stringer	A-C	16-17	TA & WS	14 & 15 June 2021	Rotting	4			
263	a	Stringer	A-C	15-16	TA & WS	14 & 15 June 2021		3			
263	b	Stringer	A-C	15-16	TA & WS	14 & 15 June 2021		3			
263	c	Stringer	A-C	15-16	TA & WS	14 & 15 June 2021		3			
263	d	Stringer	A-C	15-16	TA & WS	14 & 15 June 2021		3			
263	e	Stringer	A-C	15-16	TA & WS	14 & 15 June 2021	Severe Rot, steel alongside	5			
263	f	Stringer	A-C	15-16	TA & WS	14 & 15 June 2021		3	IMG_2874		
263	g	Stringer	A-C	15-16	TA & WS	14 & 15 June 2021	Severe Rot, steel alongside	5			
264	a	Stringer	A-C	14-15	TA & WS	14 & 15 June 2021		3			
264	b	Stringer	A-C	14-15	TA & WS	14 & 15 June 2021	Rot and splitting	4			

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			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
264	c	Stringer	A-C	14-15	TA & WS	14 & 15 June 2021		3			
264	d	Stringer	A-C	14-15	TA & WS	14 & 15 June 2021	Severe horizontal split, steel beam repairs to adjacent so no repair recommended.	4	IMG_2877, IMG_2878		
264	e	Stringer	A-C	14-15	TA & WS	14 & 15 June 2021	steel unknown date	1	IMG_2880		
264	f	Stringer	A-C	14-15	TA & WS	14 & 15 June 2021	Severe rotting, new steel alongside	5			
264	g	Stringer	A-C	14-15	TA & WS	14 & 15 June 2021	spliting, new steel alongside	4	IMG_2884		
265	a	Stringer	A-C	13-14	TA & WS	14 & 15 June 2021	Concrete beam spalling, steel alongside	4	IMG_2905		
265	b	Stringer	A-C	13-14	TA & WS	14 & 15 June 2021	Concrete beam spalling, steel alongside	4	IMG_2902		
265	c	Stringer	A-C	13-14	TA & WS	14 & 15 June 2021	Concrete beam spalling, steel alongside	4			
265	d	Stringer	A-C	13-14	TA & WS	14 & 15 June 2021	Concrete beam spalling, steel alongside	4	IMG_2903		
265	e	Stringer	A-C	13-14	TA & WS	14 & 15 June 2021	Concrete beam spalling, steel alongside	4			
265	f	Stringer	A-C	13-14	TA & WS	14 & 15 June 2021	Concrete beam spalling, steel alongside	4			
265	g	Stringer	A-C	13-14	TA & WS	14 & 15 June 2021	Concrete beam spalling, steel alongside	4			
266	a	Stringer	A-C	12-13	TA & WS	14 & 15 June 2021	Additional Steel beams added to support concrete deck. Spalling	4			
266	b	Stringer	A-C	12-13	TA & WS	14 & 15 June 2021	cracked concrete/spalling	4	IMG_2902		
266	c	Stringer	A-C	12-13	TA & WS	14 & 15 June 2021		3			
266	d	Stringer	A-C	12-13	TA & WS	14 & 15 June 2021	Rot	4			
266	e	Stringer	A-C	12-13	TA & WS	14 & 15 June 2021	horizontal split	4	IMG_2900		
267		Stringer	A-C	12-13	TA & WS	14 & 15 June 2021		3			
268	b	Stringer	A-C	11-12	TA & WS	14 & 15 June 2021	Severe rot and horizontal splitting. Poor seating over bent 12 cap	4	IMG_2919, IMG_2920, IMG_2928	Add steel	2
268	a	Stringer	A-C	11-12	TA & WS	14 & 15 June 2021		3			
268	c	Stringer	A-C	11-12	TA & WS	14 & 15 June 2021	Double stringer, both in poor condition (rot)	4	IMG_2907, 2928		
268	d	Stringer	A-C	11-12	TA & WS	14 & 15 June 2021		3			
268	e	Stringer	A-C	11-12	TA & WS	14 & 15 June 2021	rot and wet	3	IMG_2926		
268	f	Stringer	A-C	11-12	TA & WS	14 & 15 June 2021		3			
268	g	Stringer	A-C	11-12	TA & WS	14 & 15 June 2021	Corrosion	3	IMG_2930		
269	a	Stringer	A-C	10-11	TA & WS	14 & 15 June 2021		3			
269	b	Stringer	A-C	10-11	TA & WS	14 & 15 June 2021	Splitting	4			
269	c	Stringer	A-C	10-11	TA & WS	14 & 15 June 2021	hole, rot and split	4	IMG_2936, IMG_2940	Add steel	2
269	d	Stringer	A-C	10-11	TA & WS	14 & 15 June 2021	Rot and splitting	4	IMG_2938		
269	e	Stringer	A-C	10-11	TA & WS	14 & 15 June 2021		3			
269	f	Stringer	A-C	10-11	TA & WS	14 & 15 June 2021	capping beam split	4	IMG_2934		
269	g	Stringer	A-C	10-11	TA & WS	14 & 15 June 2021	Severe hollowing, steel installed alongside	5			
270	a	Stringer	A-C	9-10	TA & WS	14 & 15 June 2021		3			
270	b	Stringer	A-C	9-10	TA & WS	14 & 15 June 2021		3			
270	c	Stringer	A-C	9-10	TA & WS	14 & 15 June 2021		3			
270	d	Stringer	A-C	9-10	TA & WS	14 & 15 June 2021	Mould	3			
270	e	Stringer	A-C	9-10	TA & WS	14 & 15 June 2021	rot to end (steel along side)	5	IMG_2942, IMG_2943, IMG_2947		
270	f	Stringer	A-C	9-10	TA & WS	14 & 15 June 2021		3			
270	g	Stringer	A-C	9-10	TA & WS	14 & 15 June 2021		3			
271	a	Stringer	A-C	8-9	TA & WS	14 & 15 June 2021		3			
271	b	Stringer	A-C	8-9	TA & WS	14 & 15 June 2021		3			
271	c	Stringer	A-C	8-9	TA & WS	14 & 15 June 2021		3			
271	d	Stringer	A-C	8-9	TA & WS	14 & 15 June 2021		3		Add Steel	3
271	e	Stringer	A-C	8-9	TA & WS	14 & 15 June 2021	rot to end, horizontal splitting	4	IMG_2942		
271	f	Stringer	A-C	8-9	TA & WS	14 & 15 June 2021		3			
271	g	Stringer	A-C	8-9	TA & WS	14 & 15 June 2021	severe rot	5	IMG_2947, IMG_2950	Add Steel, fix drain above	2
272	a	Stringer	A-C	7-8	TA & WS	14 & 15 June 2021		3			
272	b	Stringer	A-C	7-8	TA & WS	14 & 15 June 2021		3			
272	c	Stringer	A-C	7-8	TA & WS	14 & 15 June 2021		3			
272	d	Stringer	A-C	7-8	TA & WS	14 & 15 June 2021	Horizontal split to stringer	4	IMG_2957		
272	f	Stringer	A-C	7-8	TA & WS	14 & 15 June 2021		3			
272	g	Stringer	A-C	7-8	TA & WS	14 & 15 June 2021	Stringer supporting buildings	3			
272	e	Stringer	A-C	7-8	TA & WS	14 & 15 June 2021	Horizontal split to stringer	4	IMG_2954, IMG_2955	Add Steel	3
273	a	Stringer	A-C	6-7	TA & WS	14 & 15 June 2021	Hole to outer stringer	4	IMG_4189, IMG_4191		
273	b	Stringer	A-C	6-7	TA & WS	14 & 15 June 2021		3			
273	c	Stringer	A-C	6-7	TA & WS	14 & 15 June 2021		3			
273	d	Stringer	A-C	6-7	TA & WS	14 & 15 June 2021	horizontal split, rot	4	IMG_4187	Add Steel	2
273	e	Stringer	A-C	6-7	TA & WS	14 & 15 June 2021		3			
273	f	Stringer	A-C	6-7	TA & WS	14 & 15 June 2021		3			
273	g	Stringer	A-C	6-7	TA & WS	14 & 15 June 2021		3	IMG_4184		
273	h	Stringer	A-C	6-7	TA & WS	14 & 15 June 2021		3			
274	a	Stringer	A-C	5-6	TA & WS	14 & 15 June 2021	End severely split, new steel installed alongside 2019	4			
274	b	Stringer	A-C	5-6	TA & WS	14 & 15 June 2021		3			
274	c	Stringer	A-C	5-6	TA & WS	14 & 15 June 2021	Rotting	3	IMG_4182		
274	d	Stringer	A-C	5-6	TA & WS	14 & 15 June 2021	Rotting	4			
274	e	Stringer	A-C	5-6	TA & WS	14 & 15 June 2021		3			
274	f	Stringer	A-C	5-6	TA & WS	14 & 15 June 2021	Rotting	4			
274	g	Stringer	A-C	5-6	TA & WS	14 & 15 June 2021		3			
274	h	Stringer	A-C	5-6	TA & WS	14 & 15 June 2021		3			
275	a	Stringer	A-C	4-5	TA & WS	14 & 15 June 2021	Rot at end. Split right through	4	IMG_4173		
275	b	Stringer	A-C	4-5	TA & WS	14 & 15 June 2021		3			
275	c	Stringer	A-C	4-5	TA & WS	14 & 15 June 2021		3			
275	d	Stringer	A-C	4-5	TA & WS	14 & 15 June 2021	Rot and splitting, new steel alongside	5			
275	e	Stringer	A-C	4-5	TA & WS	14 & 15 June 2021	Rot	4	IMG_4164	Add Steel	2
275	f	Stringer	A-C	4-5	TA & WS	14 & 15 June 2021		3			
275	g	Stringer	A-C	4-5	TA & WS	14 & 15 June 2021	Splitting	4			
275	h	Stringer	A-C	4-5	TA & WS	14 & 15 June 2021	Severe rot and horizontal splitting	4			
276	a	Stringer	A-C	3-4	TA & WS	14 & 15 June 2021		3			

Akaroa Wharf Condition Report

Item Ref	Stringer Ref	Element Type	Location		Inspection Findings				2021 Surevy Photograph file name	Repair Recommendation	Repair Priority
			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
276	b	Stringer	A-C	3-4	TA & WS	14 & 15 June 2021	Splitting and rot	4	IMG_4168		
276	c	Stringer	A-C	3-4	TA & WS	14 & 15 June 2021	Horizontal splitting. New beam added adjacent	3	IMG_4158		
276	d	Stringer	A-C	3-4	TA & WS	14 & 15 June 2021	Rotting. Has been made redundant by steel beam adjacent	2			
276	e	Stringer	A-C	3-4	TA & WS	14 & 15 June 2021	End splitting	4			
276	f	Stringer	A-C	3-4	TA & WS	14 & 15 June 2021		3			
276	g	Stringer	A-C	3-4	TA & WS	14 & 15 June 2021		3			
277	a	Stringer	A-C	2-3	TA & WS	14 & 15 June 2021	Horizontal splitting, rot over cap beam (bent 2)	4	IMG_4153, IMG_4154, IMG_4155		
277	b	Stringer	A-C	2-3	TA & WS	14 & 15 June 2021		3			
277	c	Stringer	A-C	2-3	TA & WS	14 & 15 June 2021		2	IMG_4151		
277	d	Stringer	A-C	2-3	TA & WS	14 & 15 June 2021		3			
277	e	Stringer	A-C	2-3	TA & WS	14 & 15 June 2021		3			
277	f	Stringer	A-C	2-3	TA & WS	14 & 15 June 2021		3			
277	g	Stringer	A-C	2-3	TA & WS	14 & 15 June 2021	Poor over cap beam	4	IMG_4147, IMG_4148, IMG_4149	Add steel	3
277	h	Stringer	A-C	2-3	TA & WS	14 & 15 June 2021		3			
278	c	Stringer	A-C	1-2	TA & WS	14 & 15 June 2021	Hollowing, rot & surface mould	4	IMG_2985, IMG_2986, IMG_4140	Add steel	2
278	g	Stringer	A-C	1-2	TA & WS	14 & 15 June 2021	Moderate splitting. Major split at end	5		Add steel	2
278	a	Stringer	A-C	1-2	TA & WS	14 & 15 June 2021		3			
278	b	Stringer	A-C	1-2	TA & WS	14 & 15 June 2021		3			
278	d	Stringer	A-C	1-2	TA & WS	14 & 15 June 2021	Hollowing, rot & surfade mould	4	IMG_2983		
278	e	Stringer	A-C	1-2	TA & WS	14 & 15 June 2021	Severe rot. Steel beam adjacent	2			
278	f	Stringer	A-C	1-2	TA & WS	14 & 15 June 2021		3			
279	c	Stringer	A-C	0-1	TA & WS	14 & 15 June 2021	Hollowing, rot & surface mould	4	IMG_2976, IMG_2978	Add Steel	2
279	a	Stringer	A-C	0-1	TA & WS	14 & 15 June 2021	Horizontal splitting to inside face of stringer	4			
279	b	Stringer	A-C	0-1	TA & WS	14 & 15 June 2021	Rot and surface mould	4			
279	d	Stringer	A-C	0-1	TA & WS	14 & 15 June 2021	Horizontal splitting and severe rot	4	IMG_2973,		
279	e	Stringer	A-C	0-1	TA & WS	14 & 15 June 2021	Horizontal splitting and rot	4			
279	f	Stringer	A-C	0-1	TA & WS	14 & 15 June 2021	poor seating	4	IMG_2970		
279	g	Stringer	A-C	0-1	TA & WS	14 & 15 June 2021	Large horizontal splits at end, steel added alongside in 2019	5	IMG_2966, IMG_2968		
280		Deck			TA & WS	14 & 15 June 2021		3			
281											
282		Tie Backs			TA & WS	14 & 15 June 2021		3			
284		Bracing	A-C	1	TA & WS	14 & 15 June 2021		3			
285		Bracing	A-C	2	TA & WS	14 & 15 June 2021		3			
286		Bracing	A-C	3	TA & WS	14 & 15 June 2021		4			
287		Bracing	A-C	4	TA & WS	14 & 15 June 2021		3			
288		Bracing	A-C	5	TA & WS	14 & 15 June 2021		3			
289		Bracing	A-C	6	TA & WS	14 & 15 June 2021		3			
290		Bracing	A-C	7	TA & WS	14 & 15 June 2021	Corroding. Bolt in bending	3	IMG_2662		
291		Bracing	A-C	8	TA & WS	14 & 15 June 2021		3			
292		Bracing	A-C	9	TA & WS	14 & 15 June 2021	Rotten brace, moderate corrosion to bracing	5	IMG_2655	Remove old timber brace	3
293		Bracing	A-C	10	TA & WS	14 & 15 June 2021	Moderate corrosion	3			
294		Bracing	A-C	11	TA & WS	14 & 15 June 2021	Moderate corrosion	3			
295		Bracing	A-C	12	TA & WS	14 & 15 June 2021	Moderate corrosion	3	IMG_2644		
296		Bracing	A-C	13	TA & WS	14 & 15 June 2021	Moderate corrosion	3	IMG_2640		
297		Bracing	A-C	14	TA & WS	14 & 15 June 2021	Loose timber brace	4			
298		Bracing	A-C	15	TA & WS	14 & 15 June 2021		3			
299		Bracing	A-C	16	TA & WS	14 & 15 June 2021	Loose brace	3			
300		Bracing	A-C	17	TA & WS	14 & 15 June 2021	Corrosion to bracing	4	IMG_2610		
301		Bracing	A-C	18	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019, Hardwood brace rotten (low connection failed)	5			
302		Bracing	A-C	19	TA & WS	14 & 15 June 2021	Brace Connection nearing failure	4	IMG_2595		
303		Bracing	A-C	20	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2	img_2581		
304		Bracing	A-C	21	TA & WS	14 & 15 June 2021	Bracing failed	5	IMG_2571, IMG_2572, IMG_2573	Replace bracing	2
305		Bracing	A-C	22	TA & WS	14 & 15 June 2021	Bracing failed	5	IMG_2561	Replace bracing	2
306		Bracing	A-C	23	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
307		Bracing	A-C	24	TA & WS	14 & 15 June 2021	Missing brace	5	IMG_2544	Replace bracing	2
308		Bracing	A-C	25	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
309		Bracing	A-C	26	TA & WS	14 & 15 June 2021	Connection poor, old steel	4	IMG_2528	Replace bracing	3
310		Bracing	A-C	27	TA & WS	14 & 15 June 2021	Bracing connection poor, old bracing	4	IMG_2523, IMG_2526	Replace bracing	3
311		Bracing	A-C	28	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
312		Bracing	A-C	29	TA & WS	14 & 15 June 2021	Old bracing, moderat condition	3			
313		Bracing	A-C	30	TA & WS	14 & 15 June 2021	Mild Corrosion	3	IMG_2480, IMG_2485		
314		Bracing	A-C	31	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
315		Bracing	A-C	32	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
316		Bracing	A-C	33	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2	IMG_2459		
317		Bracing	A-C	34	TA & WS	14 & 15 June 2021	Moderate Corrosion, two bays of bracing	3	IMG_2449		
318		Bracing	A-C	35	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
319		Bracing	A-C	36	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
320		Bracing	A-C	37	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
321		Bracing	A-C	38	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
322		Bracing	A-C	39	TA & WS	14 & 15 June 2021	Tension bracing replaced 2019	2			
323		Ladder	A	0-1	TA & WS	14 & 15 June 2021	Moderate corrosion	3			
324		Ladder	A	1-2	TA & WS	14 & 15 June 2021		2			
325		Ladder	A	2	TA & WS	14 & 15 June 2021		3			
326		Ladder	A	3	TA & WS	14 & 15 June 2021		3			
327		Ladder	A	4	TA & WS	14 & 15 June 2021		2	IMG_4170, IMG_5155		
328		Ladder	A	5	TA & WS	14 & 15 June 2021	Stringer snapped	5	IMG_4180	Remove ladder	2
329		Ladder	A	5-6	TA & WS	14 & 15 June 2021	Moderate corrosion	2	IMG_4179		
330		Ladder	C	6	TA & WS	14 & 15 June 2021	Moderate corrosion	3	IMG_2963		
331		Ladder	A	14-15	TA & WS	14 & 15 June 2021	Moderate corrosion	3	IMG_2875		
332		Ladder	A	19	TA & WS	14 & 15 June 2021	Moderate corrosion, tyre hanging from ladder	3	IMG_2597		
333		Ladder	A	20-21	TA & WS	14 & 15 June 2021	Moderate corrosion	3	IMG_2577, IMG_2578		
334		Ladder	A	22-23	TA & WS	14 & 15 June 2021		3			
335		Ladder	A	26	TA & WS	14 & 15 June 2021	Moderate corrosion	3	IMG_2534		
336		Ladder x2	C	31	TA & WS	14 & 15 June 2021	Moderate corrosion, bottom covered in muscles	3	IMG_2471		

Akaroa Wharf Condition Report

Item Ref	Stringer Ref	Element Type	Location		Inspection Findings				2021 Surevy Photograph file name	Repair Recommendation	Repair Priority
			Row	Bent	Inspected by	Inspection Date	Comment	Condition Grade			
337		Ladder	A	33	TA & WS	14 & 15 June 2021	Moderate corrosion, bottom covered in muscles	3	IMG_2461, IMG_2462		
338		Ladder	C	35	TA & WS	14 & 15 June 2021					
339		Ladder	A	36	TA & WS	14 & 15 June 2021	Moderate corrosion	3	IMG_2440		
340		Ladder	C	37	TA & WS	14 & 15 June 2021	Corrosion, paint system failed	3	IMG_2427, IMG_2428		
341		Ladder	A	38	TA & WS	14 & 15 June 2021	Moderate corrosion, fixing to horizontal fender failed	4	IMG_2415, IMG_2416, IMG_2417	Replace fixing	2
342		Lighting Post	A	30	TA & WS	14 & 15 June 2021	Leaning due to poor condition of decking below base of post	4	IMG_5199, IMG_5200, IMG_5201, IMG_5202, IMG_5203,	Replace decking, add blocking for stringer	2
343		Lighting Post	A	11	TA & WS	14 & 15 June 2021	Moderate lean	3	IMG_5178	Replace decking, add blocking for stringer	3
344		Lighting Post	A	38	TA & WS	14 & 15 June 2021		2			

AKAROA WHARF CONDITION REPORT

Appendix C DIVE SURVEY RESULTS

CHRISTCHURCH CITY COUNCIL

Bent	Pile	Cond. Grade	Cond. Desc	Circ Top	Circ Bot	Comments
1	A	2	G	1155	1130	Slight worm damage
	B	2	G	1290	1210	
	C	2	G	1340	1200	
2	A	2	G	1085		Steel jacket
	B	2	G	1320		Steel jacket
	C	2	G	1390	1340	
3	A	2	G	1340		Steel jacket
	B	2	G	1360	1155	
	C	2	G	1210		Steel jacket
4	A	2	G	1150		Fiberglass jacket
	B	3	M	1295	1165	Scalloping and cracking
	C	2	G	1240		Fiberglass jacket
5	A	2	G	1110		Fiberglass jacket, slight worm damage
	B	2	G	1050		Steel jacket
	C	2	g	1120		Fiberglass jacket
6	A	2	G	1030		Fiberglass jacket
	B	2	G	1105		Fiberglass jacket
	C	3	M	1250	1150	Scalloping 700mm above seabed, worm damage
	D	3	M	1110	1075	Scalloping from seabed up 400mm, worm damage
	E	3	M	1035	915	General wasting, cracks all over pile
7	A	2	G	1100		Concrete jacket
	B	2	G	1125		Fiberglass jacket
	C	3	M	1060	995	Scalloping throughout pile, worm damage
	D	2	G	1180	1230	
	E	3	M	1140	1000	General wasting, cracks all over pile
8	A	2	G	1030		Fiberglass jacket
	B	3	M	1150	970	Worm damage, Scalloping all over, worm damage
	C	2	G	1045		Steel jacket
	D	2	G	845	805	
	E	2	G	1170	1145	
	E1	3	M	845	770	Scalloping from 1m above seabed up
9	A	2	G	1130	1100	
	B	2	G	1210	1170	
	C	2	G	1280	1150	
	D	2	G	1020	1110	
	E	3	M	840	970	Scalloping seabed up 1mtr
10	A	2	G	1175	1170	
	B	3	M	1085	850	Scouring/scalloping from seabed 700mm up

Bent	Pile	Cond. Grade	Cond. Desc	Circ Top	Circ Bot	Comments
	C	2	G	1020		Steel jacket
	D	3	M	945	990	Cracking, scouring, scalloping
	E	2	g	1185	1120	Light worm damage
11	A	2	G	1380	1330	
	B	1	E	985		Steel jacket new pile
	C	3	M	1160	1060	Scalloping 700mm above seabed, worm damage
	D	2	G	950	1130	
	E	2	G	1110	1060	
12	A	3	M	1195	1080	General wasting, cracks all over pile
	B	2	G	1135	1060	
	C	2	G	1115		Fiberglass jacket
	D	2	G	1000	920	
	D1	2	G	1025	1090	
	E	2	G	915	850	
13	Brace	2	G	960	900	
	Fender	3	M			Square, split
	A	2	G	1235	1250	
	B	2	G	1060		Fiberglass jacket
	C	2	G	1215	1090	
	D	2	G	885	1005	
	E	2	G	860	900	
14	Brace	2	G	1300	1130	
	A	2	G	100	840	
	B	2	G	1205	1090	
	C	E	G	1190	1070	
	D	2	G	845	800	
	E	3	M	1160	1100	Scalloping throughout pile, worm damage
15	Fender	2	G	980	900	
	A	3	M	1175	970	Scouring at base, fluking
	B	2	G	1195	1115	
	C	2	G	1245	1120	
	D	3	M	1255	930	Worm damage, fluking, wasting
	E	5	F	1005	870	Worm damage, 70% loss of section. Refer to video 15 E
16	Fender	2	G	Umphy	1220	
	Raker	2	G	1210	1200	
	A	2	G	1160	1080	
	A1	2	G	1140	1070	
	B	2	G	1065	870	Minor scalloping

Bent	Pile	Cond. Grade	Cond. Desc	Circ Top	Circ Bot	Comments
	C	3	M	1115	980	General wasting from 1400mm up to surface
	D	3	M	1125	860	Scalloping from seabed up 1400mm
	E	3	M	1035	1080	Scalloping at base
17	Fender	2	G	1100	980	
	A	2	G	875		Steel jacket
	B	2	G	1175	940	Slight scouring
	C	2	G	1190	1165	
	D	3	M	1135	960	Warn scalloping around base 600mm up
	E	2	G	1220	1140	
	Fender	2	G	1190	980	
18	Fender	2	G	1140	1090	
	A	2	G	1130		Fiberglass jacket
	B	3	M	1275	1170	Midwater jacket worm damage above and below
	C	2	G	1205	1090	
	D	5	F	1115	760	Severe splits and scalloping in 700mm zone above seabed. Refer to video 18 D
	E	2	G	1155	1000	
	Fender	2	G	1000	990	
19	Fender	2	G	1140		
	Raker	2	G	1230	1190	
	A	1	E	1175		New pile and steel jacket
	B	2	G	1155	1140	
	C	2	G	1120	990	Light worm damage
	D					No pile D
	E	3	M	1155	1170	Worm damage at base
	E1	2	G	1170	1165	
20	Fender	2	G		960	
	A	2	G	1195	1140	
	B	2	G	1175	1060	Old style midwater fiberglass jacket
	C	2	G	1095		Steel jacket
	D	2	G	855	960	
	D1	2	G	1210	1175	
	E	2	G	1095	1165	
21	Fender	2	G			To close to other pile to get measurement
	A	2	G		1140	
	B	2	G	1220	1150	Slight scalloping
	C	1	E	990		New pile and jacket
	C1	2	G	1190	1240	Landing
	D	2	G	1230	1210	

Bent	Pile	Cond. Grade	Cond. Desc	Circ Top	Circ Bot	Comments
	D1	2	G	1220	1240	
	E	2	G	1190	1120	
22	Fender	2	G		970	Could not measure top
	Raker	2	G	1040	990	
	A	2	G	1080	1200	
	B	2	G	1180		Fiberglass jacket
	C	2	G	1060	930	
	Raker	2	G	1190	1060	
	D	2	G	1070	1120	Landing
23	Fender	2	G	860	710	
	A	2	G	1230	1280	Slight scalloping
	B	2	G	1040	860	Mild scalloping, worm damage
	C	2	G	1220	810	Mild scalloping
24	Fender					
	A	2	G		1080	Could not measure top
	B	2	G	1160	1110	
	C	2	G	1130		Fiberglass jacket
25	Fender	2	G		1060	
	Cam	2	G	800	780	
	Raker	2	G	1050	980	
	A	2	G	1050		Fiberglass jacket
	B	2	G	750		Fiberglass jacket
	C	3	M	1060	920	Scalloping and scouring bottom section
	Raker	2	G	900	1080	
	Fender	2	G	1150	1180	
26	A	2	G	1220	1090	
	B	3	M	1020		Old style fiberglass jacket, scalloping below jacket
	C	1	E	1070		Steel jacket, new pile
27	A	2	G	950	1010	Mild scalloping
	B	2	G	1080	1060	Mild scalloping
	C	5	F	1190	800	Refer to video 27 C
	Fender	2	G	1040	720	
28	Fender	2	G	1180	1190	
	Cam	2	G	1040	950	
	Raker	2	G	1020	1020	
	A	2	G	990	1080	Mild scalloping
	B	1	E	1040		Steel jacket, new pile
	C	2	G	1120	1140	Light worm damage, scalloping

Bent	Pile	Cond. Grade	Cond. Desc	Circ Top	Circ Bot	Comments
	Raker	2	G	1020	1090	
	Cam	2	G	980	920	
	Fender	2	G	1000	980	
29	Fender	2	G		870	Top is square
	A	1	E	1120		Steel jacket, new pile
	B	3	M	940	890	Scalloping at base
	C	2	G	920	930	Mild scalloping
	Cam	2	G	850	890	
30	Fender	2	G	980		Umphy at top
	A	1	E	870		Steel jacket, new pile
	B	2	G	910	920	
	C	1	E	870		Steel jacket, new pile
	Fender	2	G		950	Could not measure top
31	Fender	2	G	1010	980	
	Cam					Redundant pile
	Raker	2	G	1030	950	
	A	2	G	1100	1030	
	B	1	E	1150		Steel jacket, new pile
	C	1	E	1050		Steel jacket, new pile
	Raker	2	G	1050	980	
	Cam	2	G	1000	1020	
	Fender	2	G	1080	970	
32	Cam	2	G	1050	1010	
	A	2	G	1210	1130	
	B	2	G	1120		Fiberglass jacket
	C	2	G	1050	990	Light scalloping at base
	Fender	2	G	1020	1050	
33	Cam	2	G	990	950	
	A	4-5	P/F	860	710	Refer to Video 33 A
	B	2	G	1070		Fiberglass jacket
	C	1	E	960		Steel jacket, new pile
34	Fender	2	G	950	900	
	Cam	2	G	980		Could not measure bottom
	Raker	2	G	870	900	
	A	2	G		1180	Midwater steel jacket
	B	1	E	1000		Steel jacket, new pile
	C	1	E	1040		Steel jacket, new pile
	Raker	2	G	1000	970	

Bent	Pile	Cond. Grade	Cond. Desc	Circ Top	Circ Bot	Comments
	Cam	2	G	1050	1000	
	Fender	2	G	1200	1140	
35	Cam	2	G	1020		Could not measure bottom
	A	1	E	930		Steel jacket, new pile
	B	3	M			Steel jacket stops 80mm from bottom, wear underneath
						Could not measure
	C	2	G	1010	990	
	Cam	2	G	920	1060	
36	Cam	2	G		1140	Could not measure top
	A	1	E	970		Steel jacket, new pile
	B	2	G	1150		Steel jacket
	C	2	G	1090	1040	
	Cam	2	G			Could not measure
37	Fender	2	G	1210	1100	
	Cam	2	G	1000	1020	
	Raker	2	G	1040	950	
	A	1	E	1100		Steel jacket, new pile
	B	2	G		790	could not measure top
	C	2	G	1210	1100	
	Raker	2	G	980	1030	
	Cam	2	G	910	950	
	Fender	2	G	890	920	
38	Cam	2	G	950	1010	
	A	2	G	1150	960	
	B	2	G	1030	1070	
	C	2	G	1120	990	
39	Fender	2	G	1150	1080	
	Raker	2	G	1290	1090	
	A	2	G	1200	1180	
	B					No pile B
	C	G	G	1270	1230	
	Raker	2	G	1020	1030	
	Cam	2	G	940	960	
40	A	5	F			Eaten out above cross bracing
	B	1	E	1140		Steel jacket, new pile
	C	5	F			Eaten out above cross bracing

AKAROA WHARF CONDITION REPORT

Appendix D PHOTOGRAPHS

CHRISTCHURCH CITY COUNCIL

Typical hole approx. 70mm Ø in intertidal zone on an original vertical pile, extract from original construction drawings showing hole is consistent with where fixing was located.

Poor connection at top of fender pile at grid 27C. Severely bent bolt fixing visible to the right of pile.

Lower bracing connection to pile 27A, bracing close to failure due to severe corrosion

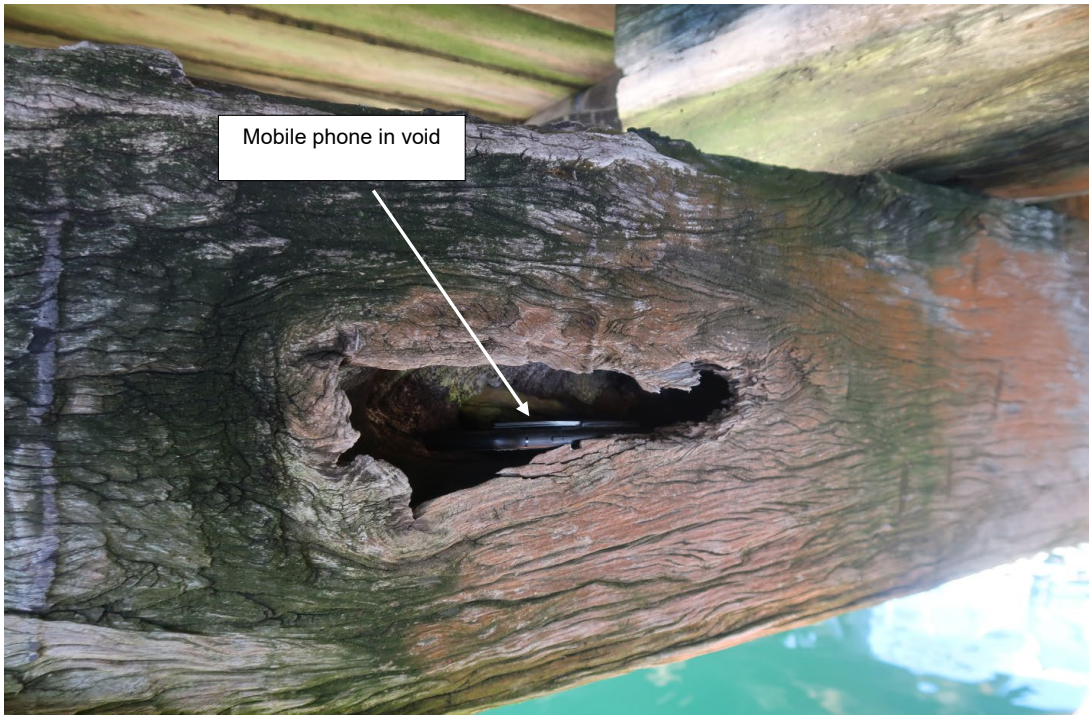
Failed vertical fender to pile 28A, timber fender is twisted about single remaining fixing

Failure of fender pile 26A at low water line

Top of pile 24A Failed tension bracing. Note, original iron connection detailing present to pile cap and fender pile

Failed Bracing to bents 21 (left) & 22 (right)

Cap beam at pile 21C, supporting northern end of Blue Pearl Building. Old splice repair in poor condition



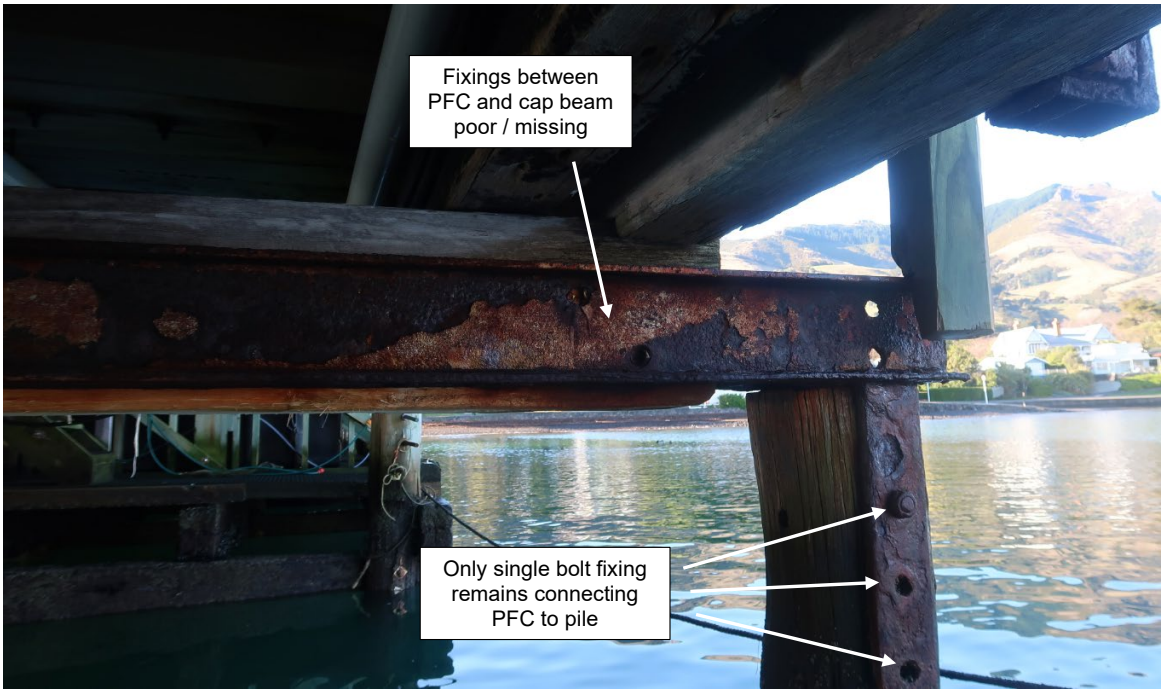
Cap beam on grid 26, large hole in beam.

Poor seating to stringer g on bent 26-27. Both ends require packing to fill gap to cap beam

Severe splitting to outer stringer g, bent 27-28. Split approx. 1.5m long through width of section

Cap beam on grid 19, severe hollowing. There is a large void, which the entire screwdriver could fit in

Rot to timber below concrete deck between bents 17-18. Two deck timbers have failed and have dropped away from deck.



Connection between cap beam and pile 16E. Timber cap beam does not sit over pile, support dependent on corroded steel PFC in this area is below Blue Pearl building. Bolted fixings between PFC and timber cap very poor.

The timber cap beam is in extremely poor condition, there is more recent steel PFC beam which has moderate corrosion, but this is not supporting the stringer beam above. Area near pile 20C below Blue Pearl building

Severe splitting to cap beam over pile 14D, below Black Cat building

Severe splitting to cap beam along gird line D, between bents 11 & 12, below Black Cat building

Severe rot and splitting to stringer b, between bents 11 & 12

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Illustrative Drawing - Proposed Wharf Conceptual Drawing

Akaroa Wharf.
Proposed wharf key elements.

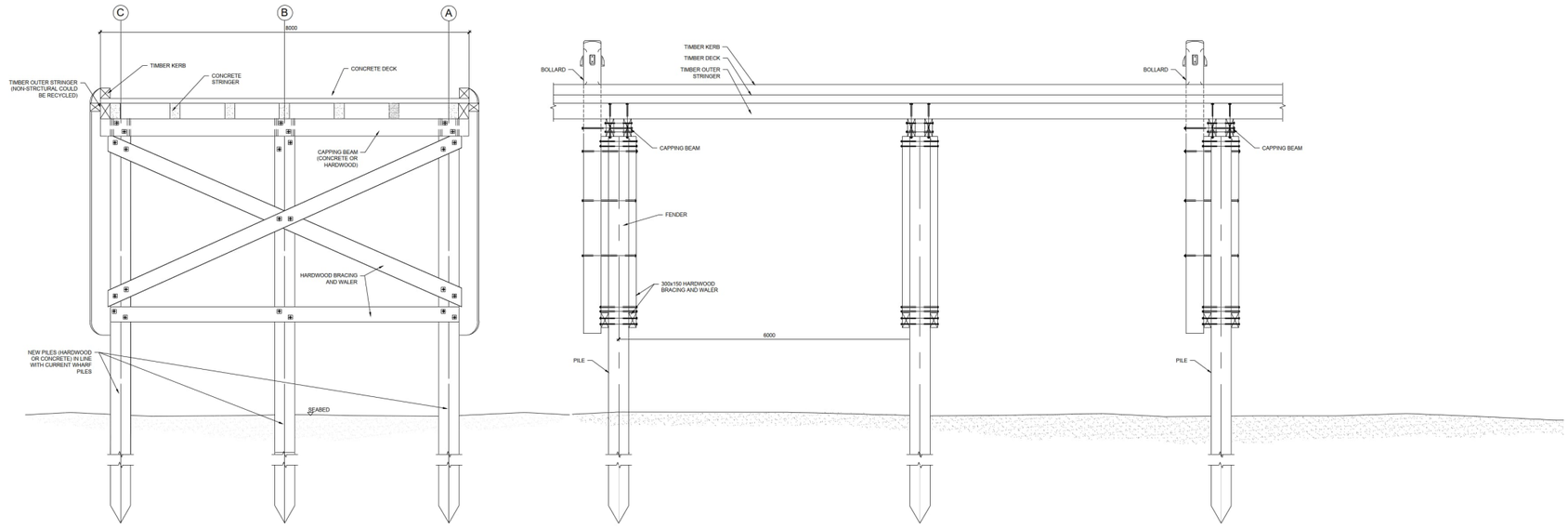
Isthmus.

Akaroa Wharf. ***Block Model image of wharf concept looking southwest***

Wharf overview.

Akaroa Wharf. ***Block Model image of wharf concept looking south***
Wharf view from the North.

Akaroa Wharf. ***Block Model image of wharf concept facing north***
Wharf view from the South



· WHARF WITH A MIX OF CONCRETE AND HARDWOOD TIMBER.

CONCEPT ONLY
FOR COMMENTS

Revision	App	Date
A MATERIALS & DIMS UPDATED	TA	03/22

Surveyed		
Designed	Tom Arthur	11/19
Drawn	Lorena Balili	11/19
Reviewed	Tom Arthur	11/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: NEW WHARF
MIX OF CONCRETE AND HARDWOOD TIMBER

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Project No	Sheet	Revision
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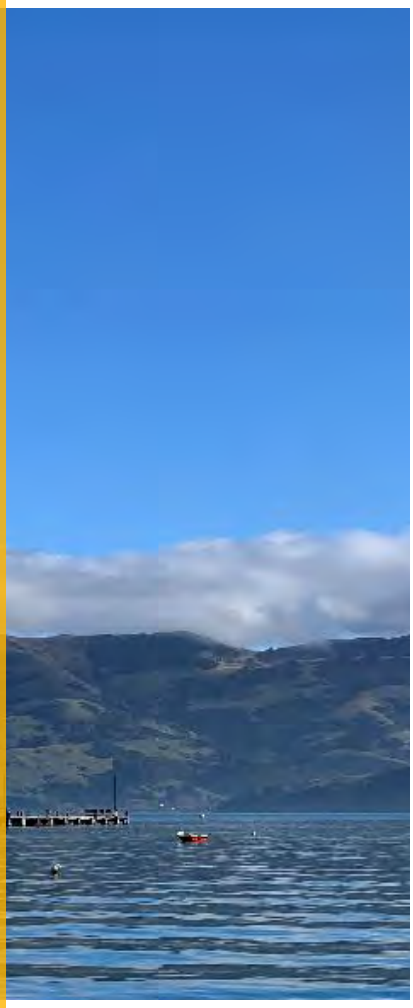
AKAROA WHARF RENEWAL OPTIONS



PREPARED FOR CHRISTCHURCH CITY COUNCIL (CCC)

711779 | 08 December 2021

Calibre Consulting Ltd

QUALITY ASSURANCE STATEMENT

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DOCUMENT CONTROL

ISSUE	DATE	ISSUE DETAILS	AUTHOR	CHECKED	APPROVED
03	08/12/2021	Final	TA	BW & PO	DC

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Appendices

1 EXECUTIVE SUMMARY

The Akaroa Wharf is a 155 m long timber wharf originally constructed in 1887. The public space on the wharf is owned and maintained by Christchurch City Council (CCC). The condition of the wharf is such that in order for it to remain safe for public use, significant investment would be required. To keep the wharf operating until a new wharf is constructed, repair works have been completed and further works may be required to allow for the continued use of the structure.

The purpose of this report is to document location and material options for the wharf upgrade for public consultation and Council decision-making and to outline the development of a preferred location, the rebuild back of the wharf in its current location but with an increase in height based on projected sea level rise.

The scope of repairs and maintenance anticipated over the next 10 - 20 years in order to keep the wharf functioning would be close to a full rebuild and completing this work piecemeal would be disruptive and ultimately more expensive than rebuilding the wharf.

A number of options were identified during a public consultation process between 28th May and 26th June 2019. In order to shortlist the options, a workshop was held on 4th October 2019, attended by engineers from Calibre Consulting Ltd, planners, quantity surveyor, CCC heritage experts, urban planner, the Harbour Master, CCC Parks staff and CCC officers. Feedback from the public via written submissions was discussed and a series of options were developed based on the viability of each option as well as public support.

This report provides an overview of the location and material options. Conceptual drawings for the each of the options were prepared by Calibre, refer to Appendix A

- Baseline Option 0 / Restore existing wharf in its current location, no change to structural form.

The preliminary location options assessed are shown in figure 1 and described below:

- Option A: Construct a new wharf in the same location as the existing wharf.
- Option B: Construct a new wharf along the north side of the existing wharf.
- Option C: Construct a new wharf off Church Street and on the site of the original town wharf.
- Option D: Construct a new wharf from Akaroa Recreation Field / Children's Bay.

Figure 1: Location Options

The preliminary construction material options assessed include:

- Option 1: New wharf structure with like-for-like hardwood timber.
- Option 2: New wharf structure with mixture of concrete and hardwood timber, visible members would be hardwood
- Option 3: New wharf structure made from concrete

The options were further analysed in December 2019 / January 2020 through a Multiple Criteria Analysis (MCA). The MCA was facilitated by BECA with input from Calibre, planners, quantity surveyor, CCC heritage experts, Ōnuku Rūnanga, urban planner, the Harbour Master, CCC Parks staff, CCC officers and the Akaroa community board.

The options do not consider the size, height, alignment of the wharf, these items will be part of a developed design based on the preferred location option. In particular, the connection to the land and how this has an impact on the heritage of the existing wharf abutment and other heritage items nearby. Similarly, a mixture of traditional and modern construction is being discussed with the intention to balance the function and longevity of the structure with keeping with the aesthetic of the Akaroa Historic Waterfront.

The final wharf design will be developed based on location Option A and material Option 2.

Option 0, restoration of the wharf like for like was considered in the MCA. This option was not favoured as it limits the opportunity to increase the amenity of the new wharf and does not address sea level rise.

Options A & B are for rebuilding the wharf in the current location and alongside to the north respectively, these both scored similarly but Option A scored highest and is being developed.

Rebuilding the wharf using like for like hardwood timber would require materials to be imported. This presents a procurement risk as the global supply chain has been disrupted by the pandemic. Much of the structural timbers are hidden from view and the cost difference between using modern and traditional materials is minor. The discrete use of modern materials is to be considered as Options 1 & 2 score similarly in the MCA. Re-using traditional materials from existing wharves is also being investigated.

This report does not include cost estimates but the Options are ranked in order of cost and the costs were considered in the MCA ranking process.

2 INTRODUCTION

2.1 Background

The Akaroa Wharf was built in 1887 and served as the main economic gateway for both passengers and goods until the mid-twentieth century. Christchurch City Council (CCC) is responsible for the maintenance and operation of the public area of the wharf. There are two privately-owned buildings that are structurally connected to the Council-owned wharf.

The wharf is of significant recreational, heritage and commercial importance to Akaroa and the wider Canterbury region. It is widely recognised as a focal point for the town. Additionally, Akaroa Wharf serves as a community and recreational hub for the harbour with the wharf regularly used by visitors, local residents, commercial fishing and tourism operations.

In recent years and following the 2010 / 2011 Canterbury earthquakes with the need to redirect cruise ships from the damaged Lyttelton cruise ship terminal, Akaroa has become a popular cruise and regional tourism destination. There have been concerns about overcrowding on and around the wharf during the summer season. Cruise tourism numbers are uncertain at present due to COVID-19, however it is anticipated that cruise ship tourism will return in the future in some form and once the pandemic settles globally. The completion of the new Lyttelton cruise berth is anticipated to reduce pressure on the Akaroa Wharf once cruise ships resume.

Regular structural inspections of the wharf are undertaken to identify the condition of the wharf and to recommend any short or longer term maintenance repairs. Inspections of the wharf have been completed in 2015, 2018 and most recently in June 2021. The 2018 and 2021 reports by Calibre assessed the condition of the wharf to be moderate to poor. The wharf is over 130 years old and a large amount of the original material has been replaced, but these new materials are now also deteriorating.

CCC completed repairs on the wharf in 2019 - 2020 which included new stringer beams and replacement bracing as well as upgrades to 16 piles. These repairs will provide the necessary improvements to allow the wharf to operate for 3 to 5 years in conjunction with continued inspections and maintenance. Additional repairs were identified in the 2021 condition assessment which CCC are arranging to be completed.

Calibre completed a ‘Preliminary Options Report’ (May 2019) which set out structural approaches for the repair or replacement of the wharf and provided options for construction materials and location (new and existing) of the structure. The options were developed as a starting point for discussion between CCC, the project team and the community. CCC released the report to the public on 28 May 2019 and held two public drop-in sessions and a ‘Have your say’ process. Consultation was completed in mid-2019 through which 95 submissions were received for consideration by the project team.

This consultation process provided new ideas and gave valuable insight into the priorities for the community, and these were considered in a further workshop held in October 2019 where the options were chosen to be included in a multi criteria analysis (MCA) assessment.

This report refers to various structural members that form wharf structures, an annotated diagram is provided in Appendix B for guidance.

2.2 Scope of this Report

The scope and purpose of this report is to provide an overview into the development of a preferred option for the wharf to be used for public consultation and Council decision-making. This report is based on the input and advice of project engineers, heritage consultants, quantity surveyors, Rūnanga, urban designer, planners and ECAN harbourmaster’s office as well as review and input from CCC staff.

2.3 Description of Current Wharf

Akaroa Wharf is a linear wharf, 155 m long in addition to a 30 m long solid abutment. The area of the wharf deck is approximately 1,125 m² excluding the area of the privately owned buildings which have a footprint of around 460 m². There are also two floating pontoons, further described below. The wharf in its current configuration is shown in Appendix D.

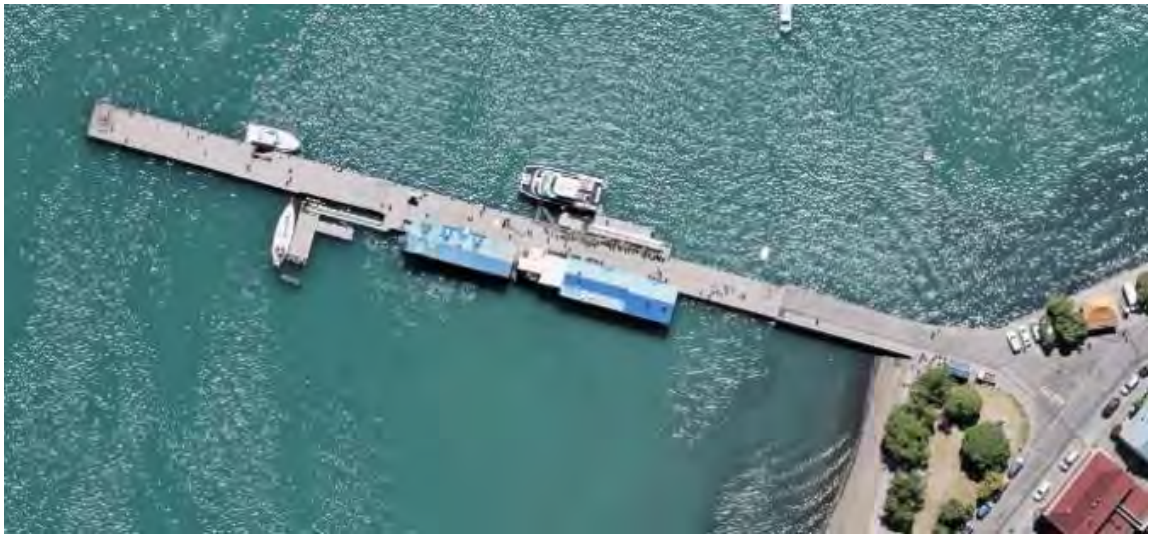

Figure 2: Aerial image of Akaroa Wharf Layout circa 2017 (Source: LINZ Data Service)

Appendix C. The drawings indicate that some of the original form and fabric of the structure remains, generally the original stringers and piles remain, but a large amount of decking, bracing and walers have been replaced. Numerous piles and stringers have been installed over the years, typically alongside the deteriorated original timbers.

The wharf is approximately 25 m longer than shown on the archival construction drawings. Photographs taken shortly after the wharf was completed are consistent with the drawings, other than additional bents added near the shore. Several buildings have been added in the last 60 years to replace the original goods shed. The wharf width is 7.3 m (24'), excluding pontoons and buildings.

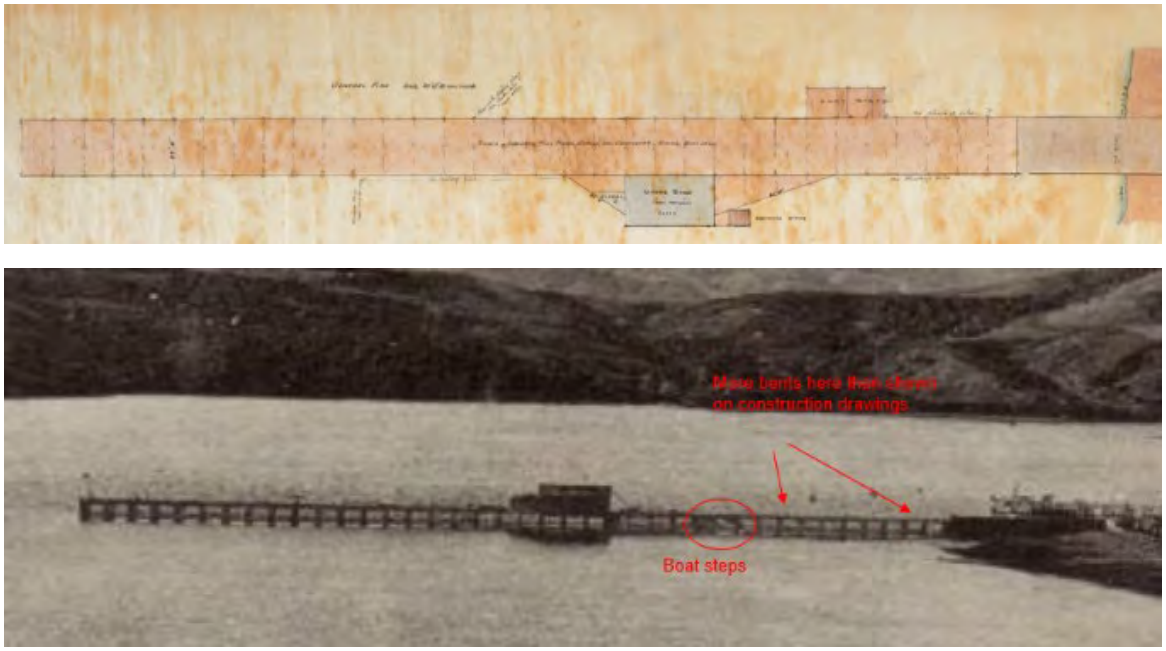

Figure 3: Comparison of 1878 construction drawings and photograph from 1905.

Two pontoon structures, one on either side of the main wharf were constructed around 2008. The pontoons are floating structures anchored in place by steel piles driven into the seabed. The pontoon on the south side of the wharf is 68 m² and orientated perpendicular to the main wharf. The northern pontoon is 68 m² and orientated parallel to the main wharf.

Infrastructure for the delivery of diesel fuel is located on Akaroa wharf. The fuel pump is situated around 80m from the wharf entrance on the northern side of the wharf. The fuel tank is located in front of the wharfinger's office near the wharf entrance with the fuel line suspended below the wharf deck.

A crane is located around 60 m from the wharf entrance. The crane is at least 40 years old and was originally used for unloading seafood from commercial vessels.

In early 2021 CCC commissioned Enviser Ltd to prepare a User Requirements document to identify the key requirements of the current wharf users with a focus on marine operations for wharf renewal works and to identify future infrastructure requirements.

The wharf is a key component of the Akaroa historic waterfront area and further detail on the potential impact of the wharf upgrade can be found in the Draft Akaroa Main Wharf Conservation Plan dated May 2019 by Origin Consultants.

The wharf and its setting is scheduled as a Significant Heritage item in the Christchurch District Plan, along with the Wharfinger's Office, the 'Britomart' cannon and The Fisherman's Rest Shelter which all sit within the setting of the wharf. The land adjacent to the current wharf is also located within the Akaroa Heritage Area.

2.4 Condition of Wharf

An Opus condition report (2015) for the wharf identified several piles and stringers that required repair and noted that the useful remaining life of the wharf was 10 years, provided remedial works were carried out on an ongoing basis.

The structure was inspected by Calibre in 2018 and 2021 and found to be in a moderate to poor condition with numerous elements nearing the end of their life. Many of the original structural elements have been made redundant by the addition of new piles, steel bracing and steel and concrete beams. Repairs completed in the last 10-15 years include the addition of galvanised steel beams where the original timber beams had deteriorated and stainless-steel bracing replacing the original timber bracing where it had failed.

Figure 4: Deteriorated timber beam with new galvanised steel installed alongside

Figure 5: Steel tension bracing replacing missing hardwood timber bracing.

A large proportion of the galvanised and stainless-steel tension bracing installed around 10 years ago is in poor condition and much of the steel bracing was replaced in early 2020. The new bracing can be expected to last another 5-10 years before needing replacement again. Repairs have recently been completed to several piles, stringers and capping beam connections, intended to keep the structure in use for five years. It is expected that the structure will be replaced within this time frame.

Many of the original piles remain but have been repaired or made redundant by the addition of approximately 20 piles. A dive inspection in August 2018 and June 2021 indicated widespread teredo worm damage. The extent of degradation is highly variable but is typically confined to the intertidal zone. Once marine borer are in the piles there is little that can be done to mitigate the deterioration except to replace the piles and to install a barrier covering the intertidal zone to prevent future infestation.

During the Canterbury Earthquake Sequence (2010-2011), the 30m concrete abutment reportedly suffered damage from liquefaction with visible severe cracking in the walls. The abutment could suffer further damage due to liquefaction should a significant seismic event occur in the future.

The two pontoons which were added to the structure around 2008 are in good condition.

The original wharf piles appear to be still in place as fixings consistent with the 1878 construction drawings can still be identified. However these piles and fixings are now in poor condition.

Figure 6: Corrosion to fixing at top of pile. Fixing consistent with original 1878 detailing.

Figure 7: Pile with necking and concrete encasement repair.

2.5 On-going maintenance of current wharf

Several submissions received during the consultation were in favour of completing the 'minimum' repairs required to keep the wharf in its current form. The condition of the wharf has been assessed by two independent engineering consultants, both of which have indicated that even with regular maintenance, the remaining life of the structure is considered to be less than 10 years.

A large amount of repair work is needed to keep the wharf operational and the volume, cost of repairs and level of disruption can be expected to continue increasing. Doing 'minimum' repairs periodically would be less efficient and more expensive than completing a rebuild of the structure which is considered in the Baseline / Option 0. The prioritisation of piecemeal repairs is difficult as much of the deterioration is hidden and a rebuild removes the increasing risk of wharf failure due to unseen defects in the ageing structure. Examples of hidden defects include marine borer eating the piles from the inside and the rotting of timber stringers from the top down.

3 OPTIONEERING PROCESS

Christchurch City Council has recognised the need to investigate the options for replacing or repairing the Akaroa Wharf and has included budget in the 2021 to 2031 LTP to support this work. The budget does not include any upgrading to areas adjacent to the wharf (Britomart Reserve and Akaroa waterfront areas) or for any buildings on or attached to the wharf structure.

The process for the development of a preferred option for the repair/replacement of the Akaroa wharf followed the key phases described below.

3.1 Preliminary Engineering and Conservation Plans

Following the structural condition assessment undertaken by Calibre in August 2018, an options report was prepared by Calibre in May 2019 which discussed initial options for the wharf renewal / replacement with particular attention paid to the form, materials and location of the wharf. Indicative concept drawings were prepared for some of the options.

A Conservation Plan was developed, by Origin Consultants in May 2019 to discuss the heritage and cultural aspects of the wharf and Akaroa waterfront and to inform the next phase of the design process.

3.2 Public Engagement

In May 2019, background information including the Calibre Options Report and the Origin Conservation Plan was made available on the CCC website and publicised within the Akaroa community and to affected stakeholders for discussion.

CCC held public consultation meetings at the Akaroa Bowling Club on 12th and 13th June 2019, with approximately 20 members of the public attending. Consultation closed on 26th June 2019 with 95 submissions received. A more in-depth summary of the feedback is given in Section 5, with some of the key themes identified from the feedback being:

- The wharf forms a critical part of the Akaroa landscape.
- The wharf should be shared by all users (public, commercial operators, recreational fishing etc.) and there should be sufficient space to allow all of these activities to occur simultaneously.
- Traffic congestion is an issue in Akaroa, and this is exacerbated by coaches for cruise ship visitors.

3.3 Development of options

After the public consultation, the project team met to develop several options to take through into the next phase of consultation with the Council, Community Board, wharf stakeholders and wider public. A workshop was held on 4 October 2019 to discuss the consultation feedback, the approach to the wharf redevelopment process and the design inputs for the renewal.

The workshop was attended by the following parties who have or will contribute to the specialist advice required for assessing the options under engagements with CCC:

- Kristine Bouw. Project Manager, CCC
- Sylvia Doherty. Senior Project Coordinator, CCC
- Ian Fox. Harbourmaster, ECAN
- Paul Devlin. Head Ranger, Port Hills & Banks Peninsula, CCC
- Tom Arthur, William Southby and Deborah Curd. Structural Engineers, Calibre
- Luke Donnelly. Quantity Surveyor, WT Partnership
- Matt Bonis and Livi Whyte. Consultant Planners, Planz Consultants
- Boyd Barber, Urban Designer, CCC

Some of the key outputs/ discussions from the workshop included:

- Further discussion is required around the proposed 100-year design life and what that means for the design, including sea level rise, and potential future users. This is important as it is necessary to understand how the wharf will function as part of the Akaroa natural, economic and cultural environment for the next 100 years, rather than just considering the wharf as a stand-alone structure.

- Consideration should be given to all the marine structures in Akaroa Harbour as a network, not just the Akaroa Wharf in isolation. This includes which structures may be used as temporary loading facilities during construction as the Akaroa waterfront does not have sufficient space for construction set down.
- If the decision is made to move the wharf to a new location, this location will be limited by water depth and coastal profile, and investigations into the context of the size of ships that the wharf will be designed for will be needed. This will be determined as a result of public consultation and discussion between CCC and ECAN.
- New wharf in different location versus staged rebuild option to be further investigated. Due to the location of the wharf and the businesses operating out of the wharf buildings, this will be a crucial input into the decisions regarding the form and location of the new wharf (should this option be chosen).

Alongside the workshop, a number of reports have been prepared for CCC to provide inputs into the development of the options. These are listed in the in section 9.

4 DESIGN CONSIDERATIONS

4.1 Wharf usage

4.1.1 Current Use of the Wharf

The wharf was originally constructed for coastal shipping and was the primary means of access for both goods and people. A report outlining the current and future Wharf User Requirements (Akaroa Wharf User Requirements Needs Assessment) March 2021 has been prepared by Enviser Ltd.

The main use of Akaroa Wharf is tourism, recreational fishing and recreational use. There are two privately-owned commercial buildings built directly adjacent to the wharf. There is also a caravan on the wharf which sells fresh fish. The wharf is known to get very busy during the summer season including up to 4,000 cruise ship passengers arriving via tenders from cruise ships on a single day.

In the past, fishing boats used the wharf when seeking shelter of the inner harbour during inclement weather in the fishing grounds beyond the Akaroa Heads. This is no longer permitted given the current condition of the wharf. Feedback during the June 2019 public consultation indicated that both recreational and commercial fishing are seen as an important use of the wharf.

Further consultation with the commercial operators is required in order to better understand the amenity and operational requirements of the new wharf, and to balance these requirements with cost and the needs of other user groups.

4.1.2 Future Use of the Wharf

In recent years and following the 2010 / 2011 Canterbury earthquakes, with the need to redirect cruise ships from the damaged Lyttelton cruise ship terminal, Akaroa has become a popular cruise ship and regional tourism destination. There have been concerns about overcrowding on and around the wharf during the summer season. Cruise tourism numbers are uncertain at present due to COVID-19; although it is anticipated that cruise ship tourism will return in the future in some form. The completion of the new Lyttelton cruise ship berth is anticipated to reduce pressure on Akaroa Wharf once cruise ship visits resume.

The consultation in mid-2019 asked a few questions about the wharf to gain a sense of the key aspects to consider in the future design of the wharf.

Those consulted suggested that the future wharf should include:

- Improved access for local fishing and tourism operators as well as recreational boaters
- Make it larger – wider and more capacity and with better water and land access for all
- Heritage structure and character of Akaroa is important to new wharf
- More commercial – restaurant / café
- More amenities - seating, shelter
- Working wharf is important
- Important to be able to buy fresh fish from the wharf
- Fuelling options – petrol, diesel

This feedback has been included in the development of the User Requirements Document by Enviser Ltd which further identified a list of required and desirable infrastructure requirements.

4.2 Dimensions of the Wharf

The existing Akaroa Wharf is 7.3m wide. During the consultation process a number of submissions stated that based on current operation of the wharf, the existing width of the deck was not adequate. It should be noted that there are multiple locations on the existing wharf where parts of the wharf have been narrowed as the function of the wharf has evolved, in some places closer to 4 metres (Figure 8: Akaroa Wharf -Usable and Non-navigable areas (Source: LINZ Data Service) Usable and non-navigable areas analysis below).

Moving forward, further analysis will be required to confirm an appropriate width which fits within the project budget. One method of deciding the width could be to design to potentially accommodate a crowd with sufficient space for a light goods vehicle (3.5t) to safely use the wharf (possibly including safety barriers).

Ultimately the width of the wharf will be determined as a part of the layout of the user functions of the wharf and including the location and position of pontoon structure, wharf utilities and access and ensuring that any future buildings connected to the wharf do not reduce the usable space of the wharf.

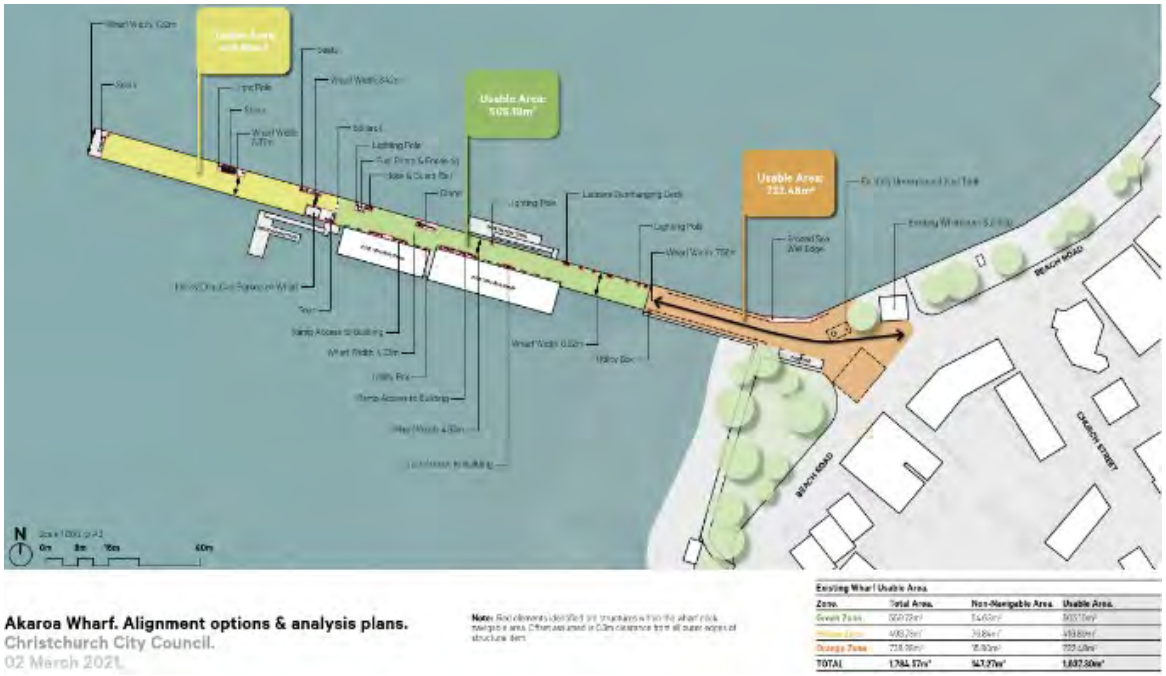

Figure 8: Akaroa Wharf -Usable and Non-navigable areas (Source: LINZ Data Service)

Further discussion will need to be had during the detailed design phase with wharf users regarding vehicle access for maintenance, and with the fishing industry regarding the size of vehicles that would be used for unloading fishing/ mussel boats.

The length of the wharf will depend on the location of the new wharf and the layout of pontoon structures and user access. In some locations, a longer wharf may be required to reach a suitable water depth.

4.3 Wharf Deck Height

Sea level rise due to climate change is predicted to inundate the current wharf deck height and much of the surrounding area. A report has been completed by Jacobs (2020, 2021) on the projected sea level rise in Akaroa over the next 100 years which estimates sea level rise based on a combination of mean high-water spring tides and an additional storm surge.

Jacobs estimated future sea level rise based on internationally recognised IPCC climate scenarios; referred to as Representative greenhouse gas Concentration Pathways (RCPs). The RCP 8.5+ scenario predicts a sea level rise of 0.58m in 2070, the wharf height is proposed to be around 0.65m higher than the existing structure. The height was recommended as a compromise between allowance for future sea level rise and functionality in the short term including how the wharf connects to the waterfront.

With the higher deck level, more pontoons will be considered to give access to smaller vessels. The deck height will also have an impact on the connection to existing buildings and will be a part of ongoing discussions with building owners.

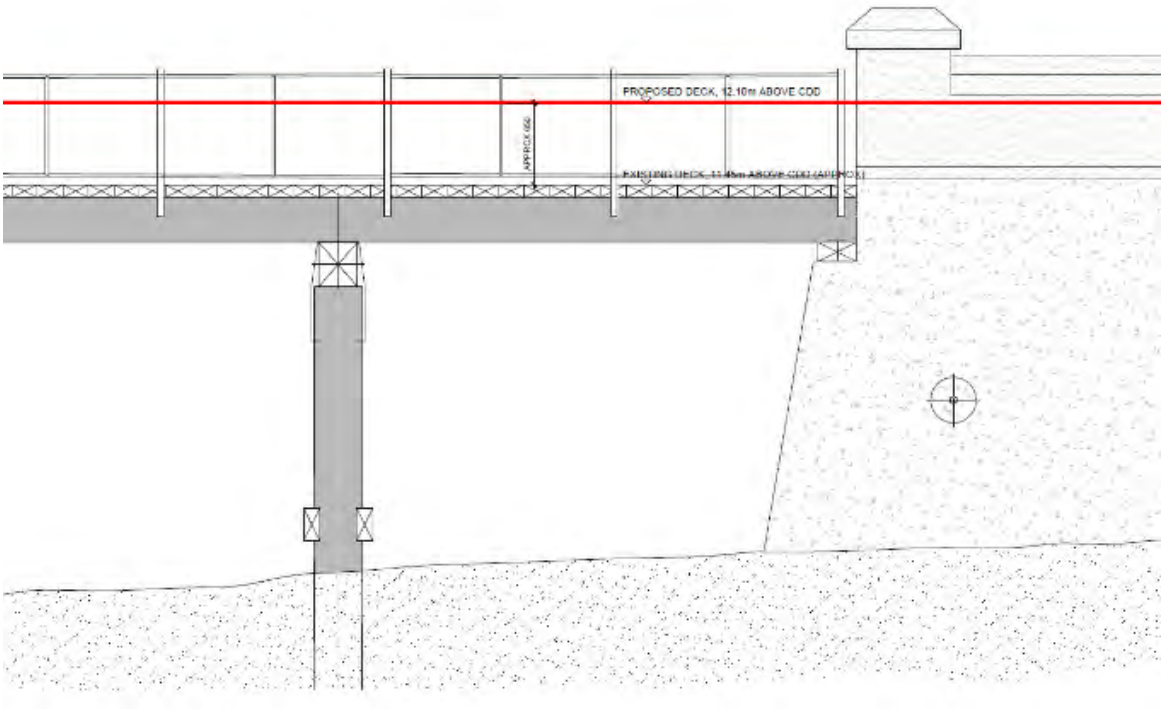

Figure 9: Proposed deck height vs existing wharf

4.4 Connection of Wharf to the Shore

The construction of a new wharf will require a new connection to be constructed from the land. The rebuilt wharf is expected to be 0.65 m above the current deck height with the difference to be made up at the start of the wharf with a ramp. The commercial and recreational uses of the wharf also require areas for loading and unloading of materials as currently exist next to the Britomart reserve. The location of the new wharf in the same location supports these important transport connections to the town and beyond.

The retention of the existing abutment was considered as an option for the rebuild of the wharf either in the same location or adjacent to the existing wharf. The retention of the wharf represented a good heritage outcome for the renewal project, however a number of issues with the retention of the 134 year old structure were identified including;

- The condition of the abutment is moderate to poor. There is cracking throughout the abutment walls and the condition of the inner structure is unknown.
- The abutment was damaged in the Canterbury earthquake sequence. For the structure to be retained, CCC would need to accept the risk of damage from moderate earthquakes in the future.
- The proposed wharf deck is 500mm higher than the existing abutment, a sloping section would need to be created over the abutment or at the start of the main wharf. Modification of the abutment will be needed in the medium term
- The condition of the existing abutment is such that strengthening / modifying the structure would present programme and cost risk
- Based on the above, piling works required for the new wharf structure would have an uncertain impact on the abutment structure and it is uncertain whether the structure would remain intact during the construction works.

Two high level options for the retention of the abutment were considered and include the following;

1. Concrete abutment
2. Seawall abutment option

4.4.1 Concrete Abutment

A solid approach, similar to that used on the current wharf could be designed such that the inner lower end of the ramp could be raised to make a horizontal access should the waterfront be raised in the future. The solid approach could also be designed to accommodate the addition of a stronger and higher parapet in the future.

4.4.2 Wharf connects directly to sea wall

This option would include an elevated and open structure and would be a less costly option than a solid / concrete option.

The existing solid abutment acts as a groyne, altering the beach either side of the wharf. It is likely the removal of the solid abutment would alter the shoreline locally.

4.5 Construction Materials

Australian hardwoods were used for the construction of most 19th century New Zealand wharves. The timber sections used for the original (late 1880's) part of the wharf were large with the stringers being typically 350mm deep x 150mm wide x 7900mm long.

Procuring hardwood timber in the volume needed for this project represents a significant programme risk. The timber is most readily available from South America and has a lead time of around six months. The global pandemic has resulted in volatility in the global supply chain affecting both costs and delivery times.

The selective harvesting of timber from South American sources contributes to rainforest deforestation. A careful balance must be found between minimising the environmental impact of sourcing hardwood timber and minimising the heritage impact of using modern materials.

There are Australian suppliers who confident they can supply sustainably managed hardwood timber similar to that used for the original wharf. The ability to provide hardwood timber in the sizes and volumes required is a programme risk.

Treated softwood timber is significantly weaker and cannot be substituted like for like with the hardwoods that the existing wharf is built from. Engineered timbers are not suitable for an aggressive marine environment.

Due to the poor condition of the timber on the current wharf, reusing these timbers for the new wharves is not recommended for load bearing elements.

Concrete can be designed to provide a design life of up to 100 years by providing sufficient cover to the reinforcement and specifying an appropriate concrete mix design.

Careful selection of construction materials can protect timber elements. For example the use of an impermeable concrete will prevent freshwater ingress. A concrete deck would however make maintenance more difficult as the structural members below are more difficult to access.

We are investigating options for using recycled timber from wharves. This would reduce the environmental impact of replacing the wharf.

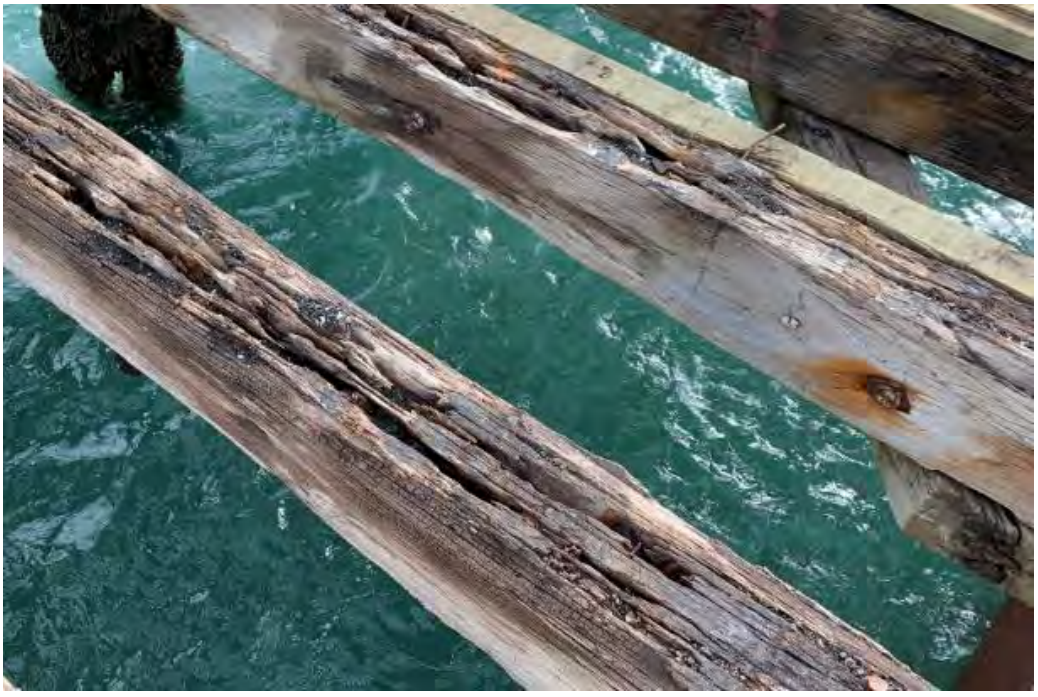

Figure 10: Stringer deterioration from freshwater ingress, typical for traditional hardwood structures

Hardwood timber is prone to marine borer such as Toredo worm which can reduce the life of the structure. The existing main wharf in Akaroa has widespread Toredo worm damage to the piles. The risk of deterioration from marine borer can be partially mitigated by the use of timber treatments. Providing barriers around the piles such as fibre-reinforced plastic (FRP) jackets or Denso wrap is effective at reducing worm damage. Although visually intrusive these treatments can be hidden behind timber fenders.

Figure 11: Marine borer damage to hardwood pile

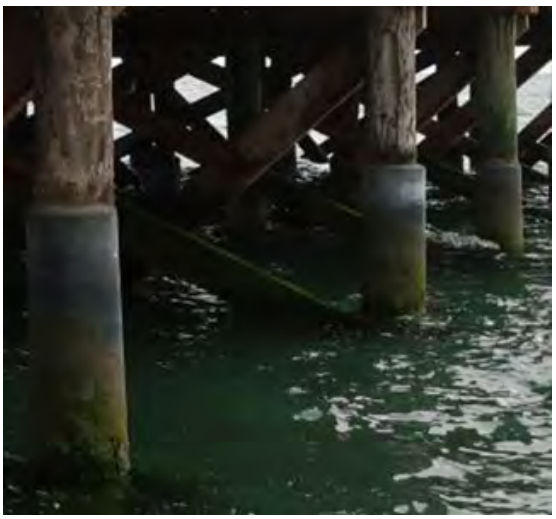

Figure 12: Timber piles with FRP jackets

4.6 Provision of Buildings on / next to wharf

Retaining the current alignment of the wharf will allow the current buildings to remain alongside the new wharf. Further detail around the future of the existing buildings connecting to the wharf is an important part of the consultation process and will include discussions with building owners on the proposed options moving forward.

Suggestions from the consultation process have included recommendations for additional commercial buildings including tour booking offices and a restaurant as occupants. Council has advised that the proposed budget included in the 2021 – 2031 Long Term Plan does not allow for the inclusion of any buildings.

4.7 Bathymetry Survey

A bathymetric survey has been completed for the seabed at each of the proposed option sites which has aided in the development of options for the wharf and the review of the preferred location and sub options. The survey will be used for locating berthing and pontoons to ensure there is sufficient draft for the vessels that are planned to use these facilities.

4.8 Heritage

The Akaroa Wharf has significant heritage value for Akaroa and the wider harbour. A draft Conservation Plan has been prepared for the Akaroa Wharf which considers both the heritage and cultural values of the wharf and options for the future of the wharf. The Conservation Plan is not a static document and is developed to be regularly revised and kept up to date (consistent with ICOMOS New Zealand Charter 2010). The project team is currently working in partnership with Ōnuku Rūnanga on updating the Conservation Plan and any policies and recommendations for the wharf.

The Akaroa Wharf is classified as a Group 2 – Significant item in the CCC Schedule of Significant Historic Heritage but is not included in the Heritage New Zealand Pouhere Taonga (HNZPT) list.

The Draft Conservation Plan identified the Akaroa wharf as one of the most significant heritage structures in the town and noted that the cultural heritage is highly significant to the town and wider district. The draft Conservation Plan made the following assessment of the wharf as having:

- High historical and social value
- High cultural and spiritual value
- Moderate architectural and aesthetic value
- Moderate technological and craftsmanship value
- High contextual value
- Moderate archaeological and scientific significance value

Despite the heritage significance of the wharf, the existing structure is in poor condition with many elements nearing the end of life. Many of the original hardwood elements have been replaced and major repairs are now required to a majority of the structure.

While the main structural elements of the existing wharf will be removed, the existing heritage abutment is an element that could be retained as part of an option for the rebuild of the wharf in parallel to the existing wharf. As described above a new elevated structure that connects the land to the main wharf structure could be built which does not replicate the abutment but rather draws attention to the heritage structure and allows for interpretation and future uses.

Moving forward a plan is required that recognises the heritage of the wharf but that also looks to the construction of a new wharf structure that will create a new heritage for the community including selected design elements of the existing wharf (character, form, bracing details) and which could include elements of the current wharf in furniture and urban design features on and around the wharf structure. The interpretation and story of the previous wharves (1850 and 1887) also represents an opportunity for development in future stages.

4.9 Cultural

Council staff have been working in partnership with and receiving input from Ōnuku Rūnanga on the cultural opportunities the new wharf brings. Three overarching concepts for cultural integration – mana motuhake, whakapapa and mahinga kai – have been developed.

While the wharf structure as an isolated element is more closely associated with the Pākeha history of Akaroa, it is located within a landscape of high significance to two hapū, Ngāi Tārewa and Ngāti Irakehu. These hapu are the tangata whenua of the takiwā which covers the Akaroa Harbour, surrounding coastal environment and hills as defined by the Ngāi Tahu Claims Settlement Act 1998.

The wharf is a prominent form within a cultural landscape embedded with whakapapa. It extends into the heart of Ngāi Tārewa and Ngāti Irakehu identity and way of life which was centred around mahinga kai.

The abutment to Akaroa Main Wharf also interfaces with Britomart Reserve, an area which for Ngāi Tahu holds special significance. This was the place where approximately 500 Ngāi Tahu gathered in 1848 to discuss the sale of land which would later be known as Kemp's Deed. This event also marked the beginning of land alienation and a multi-generational battle to have the principles of Kemp's Deed honoured.

The integration of both heritage and cultural elements in the design of the new wharf is a key consideration that will be explored in subsequent design phases.

5 MULTIPLE CRITERIA ANALYSIS (MCA) 2019 CONCEPT OPTIONS

The following options were identified during the workshop held on 4th October 2019 in Christchurch as most likely to meet the form, function, cost and environmental requirements for the wharf renewal. These were prepared for consideration in the MCA and the descriptions and inputs described in this section were as advised in December 2019 / January 2020.

All the options will require the Council to work closely with current wharf building owners and tenants on construction timing and approaches.

5.1 Baseline Option 0: Restore existing wharf in its current location, no change to structural form.

This option is for the staged demolition and replacement of the wharf in its existing location and form and at its existing height. Where possible existing timber members would be used, however a large proportion would be expected to require replacement due to their current condition. The majority of the material that could be retained is unlikely to be from the original 1887 construction due to the extent to which the structure has been repaired and updated over time.

This option would satisfy feedback received favouring repairs only, whilst also maintaining the structural integrity of the wharf for many years to come. This option would require either a complete shutdown of the wharf or a staged construction to allow for the ongoing use of the wharf. Staging would likely include the demolition and reconstruction of the outer end of the wharf first. The landward side and the abutment of the wharf would then be demolished with a temporary access provided to the new outer section.

With this option, the existing privately-owned commercial buildings could remain with structural improvements required. The construction process would be complicated by the need to ensure adequate support to the buildings at all stages of the rebuild, and by the need to manage the risk of damaging the buildings. Building within the existing footprint of the wharf limits the ability to improve use of the wharf space due to the presence of building access ramps.

Building the new wharf in the current location would be the most disruptive option during construction, as it is assumed the current wharf will need to continue to function during this period.

The heritage and economic benefit of replacing the wharf in its current form and location would need to be balanced against the need for modifications to allow the wharf to best meet the future needs of all wharf users. One way to do this may be to allow for the installation of some additional pontoons to provide extra capacity for recreational users and commercial fishing, however the location of these will need to be carefully considered to ensure that larger vessels could still berth against the wharf. Potential future locations for additional pontoons will be investigated during the detailed design stage and once a preferred option has been confirmed.

The Heritage New Zealand Pouhere Taonga (HNZPT) submission on the wharf rebuild states that HNZPT would not consider this to be a true refurbishment as many of the existing structural members are to be replaced with new hardwood timbers, losing the fabric of the original wharf. The ICOMOS New Zealand Charter for the Conservation of Places of Cultural Heritage Value (ICOMOS New Zealand Charter 2010) defines the process of restoration as typically involving reassembly and reinstatement and is based on using the existing fabric. The level of maintenance required would be more in line with the definition of reconstruction in the Charter, which is distinguishable from restoration by the introduction of new materials.

Option 0, or the baseline option, would retain the current deck height. The current Mean High-Water Spring plus storm surge level is already at the underside of the deck so it is expected that the wharf would become increasingly prone to flooding.

Figure 13: Baseline Option, Option 0, Restore existing wharf in its current location

5.2 Concept Location Options

The following options cover the location of a new wharf. The locations were refined based on input from the public consultation, and the four location options are shown in context below. It should be noted the wharf alignments are indicative only.

The relative costs of each option is listed below ranked from lowest to highest cost.

OPTION	DESCRIPTION	MCA RANKING	COST RANKING
Option A	Current Location	1	lowest cost (tied)
Option B	North of Existing	2	lowest cost (tied)
Option C	Church Street	3	median cost
Option D	Children's Bay	4	highest cost

Table 1: Location Option cost hierarchy

Figure 14: Preliminary location options

5.2.1 Option A: Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width

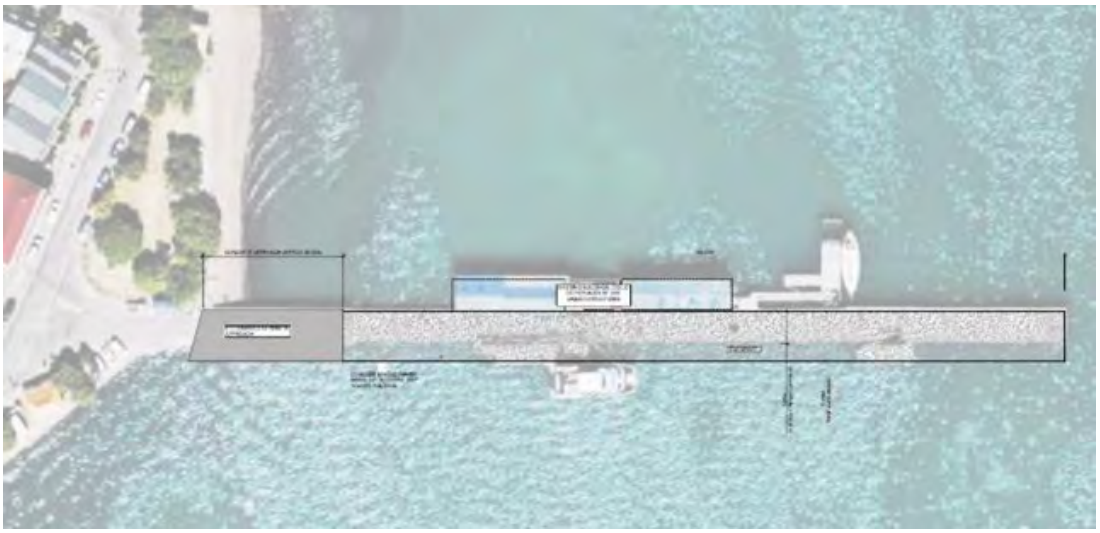

Figure 15: Option A: Wharf in location of existing wharf

With this option the original abutment would be completely removed and a new abutment constructed that is fit for purpose. Additionally, the deck height would be increased to allow for sea level rise.

This option is for the staged demolition and replacement of the wharf in its existing location with an increase in deck height.

The original abutment would need to be rebuilt to accommodate a likely increase in width and raised deck height.

There would be similar disruption during construction to the baseline option as the current wharf will need to continue to function during this period. The cost for this option is estimated between greater than Option 0 and similar to Option B depending on the materials chosen.

Maintaining the privately owned buildings without modification is seen as challenging for this option. The new deck level will likely be higher than the existing, and the buildings rely on the wharf piles for vertical support. In addition, the piles connected to the building would need to be upgraded as a part of the overall wharf rebuild.

Planz Consultants noted in their 2019 report on the planning considerations that this option was anticipated to have the least restrictive consenting requirements under the Christchurch District Plan, Canterbury Regional Coastal Plan and the New Zealand Coastal Policy Statement.

5.2.2 Option B: Construct a new wharf along the north side of the existing wharf using the existing abutment

This option is based on the complete removal of the original abutment and a new abutment constructed that is fit for purpose. Further discussion with the project team on the heritage significance of the original abutment has led to a potential alternate approach to Option B where the original abutment could be retained, and a new elevated abutment (not solid) could be constructed. This Option would further emphasise the heritage significance of the existing abutment structure.

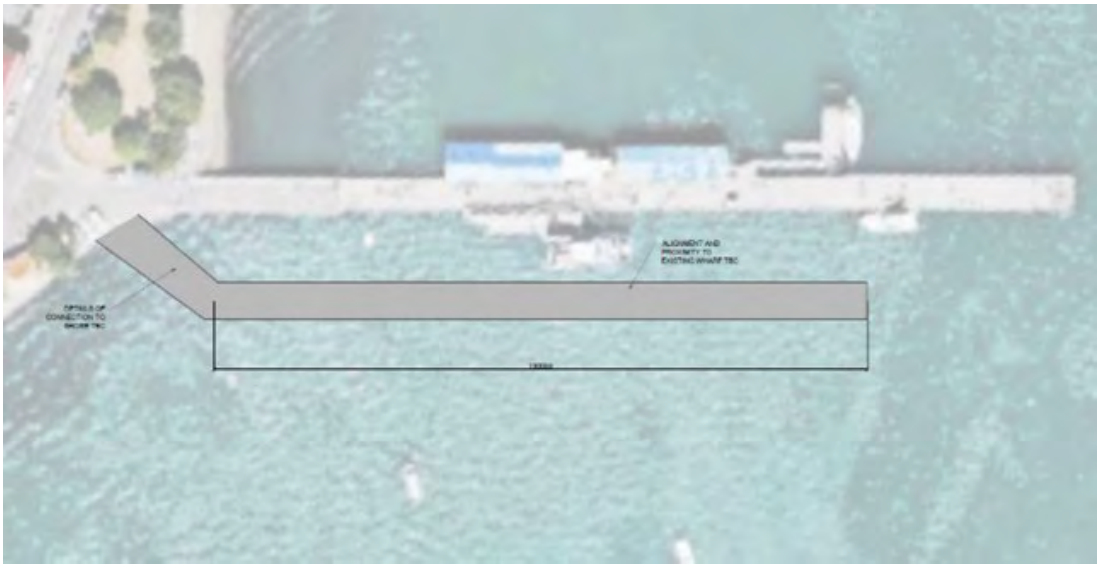

Figure 16: Option B: Construct a new wharf along the north side of the existing wharf

This option consists of a new wharf built either directly parallel to the existing wharf or on an angle off of the existing alignment. The abutment location would need to be investigated through further discussion with building owners, stakeholders and the community. The alignment of the wharf would be confirmed as part of the detailed design phase. Further investigation would also be needed into:

- Location of new connection to the land
- Heritage and cultural impact
- Construction and staging issues (current uses on north side of the wharf relocated during construction of new wharf)
- Impacts on commercial and recreational use of the wharf during construction

There would be some disruption during construction for this option as the current wharf will need to continue to function during this period. The cost for this option is estimated between greater than Option 0 and similar to Option A depending on the materials chosen.

5.2.3 Option C: Construct a new wharf off Church Street on the site of the original wharf

This option would alleviate some of the construction challenges present with Option A depending on the final alignment and position (e.g. locating the wharf directly parallel to the wharf would result in more construction impact than positioning the new wharf on an angle). This would allow the existing wharf to keep some level of service while the new wharf is being built. The demolition of the existing wharf can be staged around the new wharf construction.

Figure 17: Option C: Construct a new wharf off Church Street and on the site of the original town wharf

Option C includes building a new wharf out from the end of Church Street which is the location of the original 1850s jetty so this location would have some heritage weighting. A location plan from 1887 for the construction of the current wharf is included in Appendix C on drawing MD1333 which shows the position and alignment of this earlier jetty.

With this option the abutment to the original wharf would be retained.

An advantage of this option is that it will allow for the current wharf to operate while the new wharf is constructed and further would allow for the retention of the existing heritage abutment.

This option would create a significant change of the function and character of the historic waterfront area with the construction of a new abutment within the heritage setting in Akaroa. In addition, this option will create disruption to the transport system along Beach Road during the abutment construction period and beyond as there is less space available in and around Church Road and its existing commercial environment for car and bus circulation as well as the loading and unloading of fishing vessels.

Option C is estimated to have higher costs than Options A & B.

5.2.4 Option D: Construct a new wharf from Akaroa Recreation Field/ Children's Bay.

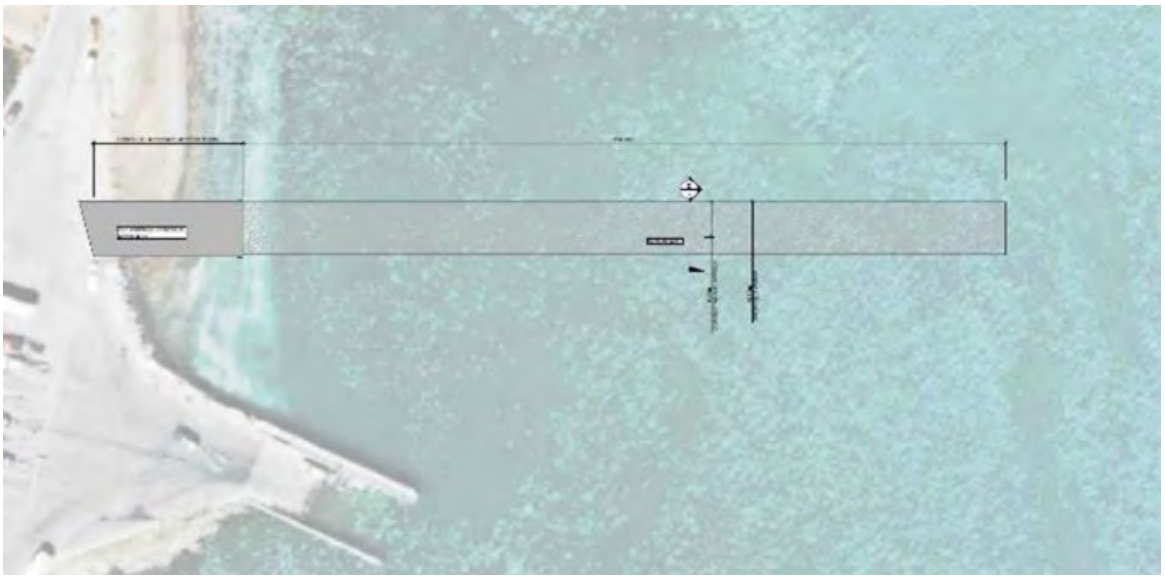

Figure 18: Option D Construct a new wharf from Akaroa Recreation Field/ Children's Bay

This option was proposed in multiple public submissions during the consultation process as a part of a solution for the high tourist and visitor volumes on and around the existing wharf. Some submissions suggested that in consideration of cruise ship tourism the Council look to consider two wharves, a new one to serve cruise ship needs and a refurbished wharf in the existing location.

With this option the abutment to the original wharf would be retained.

The relocation of the wharf to the other side of Akaroa is likely to have a significant impact on the heritage of the waterfront. Building the new wharf far away from the existing wharf would minimise the disruption to the current wharf users during construction. However the limited existing commercial presence around location Option D is seen to be a negative factor.

One of the main issues with the construction of a new wharf in this location is the depth of the water in Childrens Bay. While the area is dredged annually to maintain use of the slipway which is currently located there, the relocation of the wharf in this area would require the structure to extend significantly into the harbour and a significant dredging programme will be required to ensure suitable water depth is available for all vessels at all tides.

It is expected that the environmental impact and the relevant Resource Consent requirements would be more significant at this site than the other location options.

Building a new wharf in Childrens Bay would mean construction would be occurring in a Coastal Marine Environment not currently modified by human use to the same extent. The New Zealand Coastal Policy Statement imposes prescriptive impediments on structures within the Coastal Marine Environment that means this option would require a much higher degree of assessment and mitigation controls on the surrounding areas.

The report on Coastal Hazards shows the area around Childrens Bay is vulnerable to both sea level rise and inundation and it is likely that significant flood protection work would be required to the surrounding area.

Option D has the highest estimated cost and due to anticipated dredging. Flood protection works for the surrounding area are excluded from the cost estimate.

5.3 Concept Structural (Material) Options

The options analysis considered the construction materials for the structural 'form' of the wharf and include traditional, modern and a combination of both types of materials. The use of traditional hardwoods for wharf construction is discussed in Section 4.5.

Figure 19: 3D scanner image of existing wharf, showing concrete abutment and hardwood wharf beyond

It is expected that a new solid abutment would be built using concrete projecting from the seawall which would be consistent with the materials used for the existing structure. The detail of this construction would be developed during the concept design phase. The level of the new wharf is proposed to be higher than the adjacent shore so an incline will be necessary near the wharf entrance. The connection between the wharf and shore is a key design feature with implications on the heritage areas around the wharf entrance.

The materials options below refer to the construction materials and form of the wharf beyond the abutment.

5.3.1 Option 1: New Wharf Structure with like-for-like hardwood timber

This option is for a new wharf comprising similar materials and structural form to the existing main wharf but designed for future usage.

A traditional hardwood wharf would utilise timber piles, bracing, capping beams, stringers and decking. The shape and function of the wharf would not be significantly restricted by the use of hardwood timber.

Traditional wharf construction using hardwood is a niche market which may limit the number of contractors who have experience building this type of structure. More significantly, the availability and cost of timber materials in the volume that would be required for Akaroa require careful consideration. Another challenge is the use of timber decking. While timber decking allows relatively easy access to the structure below, it also allows fresh water to pass through and greatly accelerate the deterioration of the timber structure below.

5.3.2 Option 2: New wharf structure with a mix of concrete and hardwood timber. Visible members would be hardwood

This option would provide a mixture of materials based primarily on material durability, performance in maritime conditions and maintenance costs. For example, timber members would be recommended where they are prominent and concrete in discreet places.

With this option, the structure could be designed to pay homage to the original wharf's form, though all structural members would be constructed out of concrete for example. Original timbers taken from the wharf during demolition could be used as trimming members to hide modern construction materials and give the wharf an older feel. Refer to Appendix A

It is proposed that diagonal bracing be installed to provide the distinctive wharf 'silhouette' which gives the structure some of its character.

The piles can be concrete or hardwood timber and the appearance of the wharf structure from a distance would be similar. Timber fendering and decking could reduce the visual impact of concrete and help maintain the appearance and character of a traditional hardwood wharf.

Figure 20: Rona Bay Wharf, timber piles and bracing with concrete edge beam and deck

5.3.3 Option 3: New wharf structure made from concrete.

This option is for a modern concrete structure using concrete for all the structural elements. This concept is less defined than the others as the design is less constrained by the form of the existing structure. A modern concrete wharf would typically consist of piles and capping beams but without diagonal bracing which gives traditional timber wharves some of their distinctive character.

Concrete elements can span further than hardwood so fewer piles would be required. A 10m wide wharf, may require three piles per bent at 10m centres. Where vessels are berthing at the wharf, fender piles would be driven outside the main piles with intermediate fender piles between bents. Depending on the size of the vessels berthing on the outer end of the wharf additional piles may be required to provide resistance to the lateral loads exerted on the structure by larger vessels

Steel pile casings could be driven into the seabed and then filled with concrete. The capping beam could be formed with a precast shell beam or it could be cast in situ. The deck could be formed using pre-cast ‘double T’ sections which would form a safe working platform for the topping to be poured in situ.

Figure 21: UCSD Nimitz Wharf. Example of reinforced concrete wharf

Figure 22: Rangitoto Island Wharf, Auckland. Example of reinforced concrete wharf

5.4 Consideration of Options

6 MULTI-CRITERIA ANALYSIS (MCA) RESULTS

To compare and score the options, a MCA was completed in December 2019 / January 2020 over two workshops.

The MCA was undertaken to guide decision-making regarding suitable location and high-level structural design options. The MCA was facilitated by BECA with input from Planz Consultants, Calibre Group, WT Partnership (WTP), ECan, Community Board Members, Council Heritage and Urban Design. Input from Ōnuku Rūnanga was obtained following the workshops and considered in the MCA.

The MCA identified that preliminary location Options A and B are favoured, the scores were similar with Option A scoring highest. Options 0 and D score significantly lower. Sensitivity analysis did not affect the order of preference.

Preliminary Location Options				
Option 0	**Option A**	**Option B**	**Option C**	**Option D**
-2425	2350	1900	1550	-3475

Figure 23: MCA Weighted scores for preliminary location options (BECA)

Option 0 scores highly in the cultural objective due to it maintaining the current location and materials from the existing wharf. It scores negatively in most other aspects due to the inability of the wharf to be altered to meet the needs of the community, and the impact on the wharf users during construction.

Options A and B scored similarly in most areas. They scored highly on the ability of the upgraded wharf to meet the current and future demand of the wharf by all user groups. They scored quite poorly on the impacts on the existing wharf during construction and the impact on the natural environment. Option A was scored better in some of the cultural topics.

Option C scored similarly to Options A and B on the ability to cater for wharf user demands but was scored more negatively due to its cultural impact due to the change in location having a negative impact on the waterfront area.

Option D scored poorly due to its cultural and environmental impacts and the significant increase in cost associated with this site.

The MCA identified that preliminary structural Options 1 and 2 are favoured with Option 1 scoring slightly better. These options favour retaining traditional wharf character for the new structure. Option 1 was more favourable in regard to feasibility and the cultural aspect with the heritage form of the wharf able to be maintained, even if the materials are being replaced. Option 2 scored favourably in the feasibility and affordability aspects. Option 3 scored poorly in the cultural objectives as the current form and historic feel of the wharf would be lost by constructing it from modern materials.

Structural Options 1 & 2 have similar scored and cost estimates and so both will be considered in the developed design.

Preliminary Structural Options			
Option 0	**Option 1**	**Option 2**	**Option 3**
-375	1025	775	-1000

Figure 24: MCA Weighted scores for preliminary structural options (BECA)

Further discussion of the MCA results, including details of the sensitivity analysis, can be found in the BECA report.

The options developed in the MCA assumed the retention of the existing wharf abutment. Further investigation and preliminary review of construction methodology has identified that the 134-year old abutment would need to be removed as a part of a rebuild for Options A and B.

7 DEVELOPMENT OF PREFERRED OPTION

7.1 Location Option

Based on the MCA the project team looked into the development of location Options A & B. The Options have similar cost estimates with Option A; rebuilding the current wharf location is the preferred option based on the following.

- less onerous planning requirements
- maintains the iconic setting, look and feel of the wharf within the greater Akaroa landscape and coastal context;
- link to the land is simplified, makes use of the existing transport linkages to Akaroa township;
- allows for easier connection for the existing, privately-owned buildings that currently attach to the wharf;
- lesser environmental impact on the seabed;
- annual dredging not required;
- requires the least restrictive consenting requirements under the Christchurch District Plan, Canterbury Regional Coastal Plan and the New Zealand Coastal Policy Statement; and
- provides an opportunity to integrate mana whenua identity and values into the design of the wharf and acknowledge the significance of the foreshore location and connection to the Britomart Reserve.

7.2 Material / Structural Option

Material Options 1 & 2 are favoured, both will be considered as part of the developed design. Option 1 is rebuilding using like for like materials and Option 2 is a mixture of traditional and modern materials.

There is a cost saving from using modern materials of around 1% of the total capital expenditure. The sourcing of hardwood timber needs to be done with consideration of the impact on the environment.

Re-using timber materials from the existing wharf has been considered. The poor condition of the piles, beams and decking precludes their use in volume. Repurposing timber beams to form timber decking has been discussed with timber mills. Typically they are reluctant to do this due to the hardwood being onerous on their saws and the presence of metal fixings being hazardous.

Calibre are investigating the availability of timber from a large hardwood wharf that is being partially replaced. There is a very large volume of timber available, and it is hoped using recycled hardwood decking is an option for Akaroa.

7.3 Design Principles and Objectives

Isthmus Group have summarising the functional, cultural and contextual priorities the new wharf. This has led to the development of the concept renders for the new wharf shown below.

Figure 25: Render of wharf from north (Isthmus)

Figure 26: Render of wharf from west (Isthmus)

7.4 Next Steps

The recommended next steps in the process are to include the following:

- Consult on developed options: 1 December 2021- 31 January 2022
- Collate community and stakeholder feedback: February 2021
- Report to Te Pātaka o Rākaihautū-Banks Peninsula Community Board, then to Council for approval to design, consent and construct March – April 2022
- Procure design team and specialists May – June 2022
- Complete final design 2022 - 2023
- Implement tender and consent process 2023
- Construction 2025 - 2025
- Completion 2025

8 CONSTRUCTION

The methodology and timing of the construction of the wharf will be determined once further information is determined on a preferred option for the structure as this will drive the staging and process that is developed by Council.

8.1 Environmental Impact

The Cawthron Institute has recently completed a preliminary ecological risk assessment of cruise ship visits in the Akaroa Harbour (Johnston, 2019), which provides a suitable background on the risks associated with undertaking works in the Akaroa Harbour and provides a good foundation for further works.

It is recommended that CCC engage an environmental consultant to undertake a study on the effects that the proposed option will have on the local flora and fauna. The study should include both the marine and terrestrial impact during and after construction.

The construction has an increased level of environmental risk so we recommend marine ecologists review the construction methodology and provide feedback on how to mitigate impact on the environment. An environmental effect and impacts report will be required for a resource consent application.

8.2 Level of Service During Construction

Due to the critical nature of the wharf within the Akaroa community the construction methodology will need to allow some degree of continued use during construction. The level of use will need to be agreed between the affected stakeholders and CCC and may vary seasonally. The final option chosen for detailed design will also have a major impact on the level of use available during construction. Some factors to consider regarding the level of service include:

- What is the minimum area of wharf that can be publicly accessible during construction.
- How many passengers need to be able to be accommodated at one time, for tour operators.
- Size and location of lay down area. It is likely that the lay down area will need to be away from the wharf due to space requirements, with plant and equipment barged to the site. There will still need to be some area on the wharf set aside for construction laydown.
- Restriction on harbour navigation during construction, particularly during the pile driving phase. This may affect the construction scheduling to ensure that piling doesn't occur during peak times.
- Restriction of access / use of privately owned buildings next to wharf, extent / timing of removal. This will depend on the option chosen but will need to be discussed with the building owners and the CCC legal and property team.
- Facilities for fishing/mussel vessels

8.3 H&S Considerations

It is important to consider health and safety early in the project to ensure that any significant hazards are mitigated by design where possible. Some key health and safety considerations for this project include:

- Conflict between construction traffic and tourist traffic, including both pedestrian traffic and vessels.
- Separation of public and commercial operations both during construction and once the wharf is fully opened.
- Construction and future maintenance works will need to be completed over water so thought should be given to how to minimise this risk, i.e., provide access from above. A safety in design analysis and report is recommended.
- Identify hazards and maintain the project risk register

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10 LIMITATIONS AND DISCLAIMERS

This report has been prepared by Calibre Consulting Ltd (**Calibre**) at the request of or Christchurch City Council (**CCC**) for the purpose of facilitating a discussion based on the Scope herein. This report has been prepared on the terms of the CCC Panel Agreement for the Provision of Design and Advisory Services Marine Structures (dated 1 January 2018), and as per the Akaroa Wharf Rebuild – Technical Support and Planning Offer of Professional Services dated 20 September 2019.

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- These limitations and disclaimers shall apply notwithstanding that the report may be made available to other third parties and for the purpose of public consultation.
- This report is limited to the description of the scope, and excludes anything which is not expressly recorded including (but not limited to):
    - The degree of compliance with the New Zealand Building Act 1994 or any other relevant codes or standards other than the structural aspects of the structure; and
    - The drawings included in Appendix A are for concept designs and are not final. These are provided only for the purpose of considering options.

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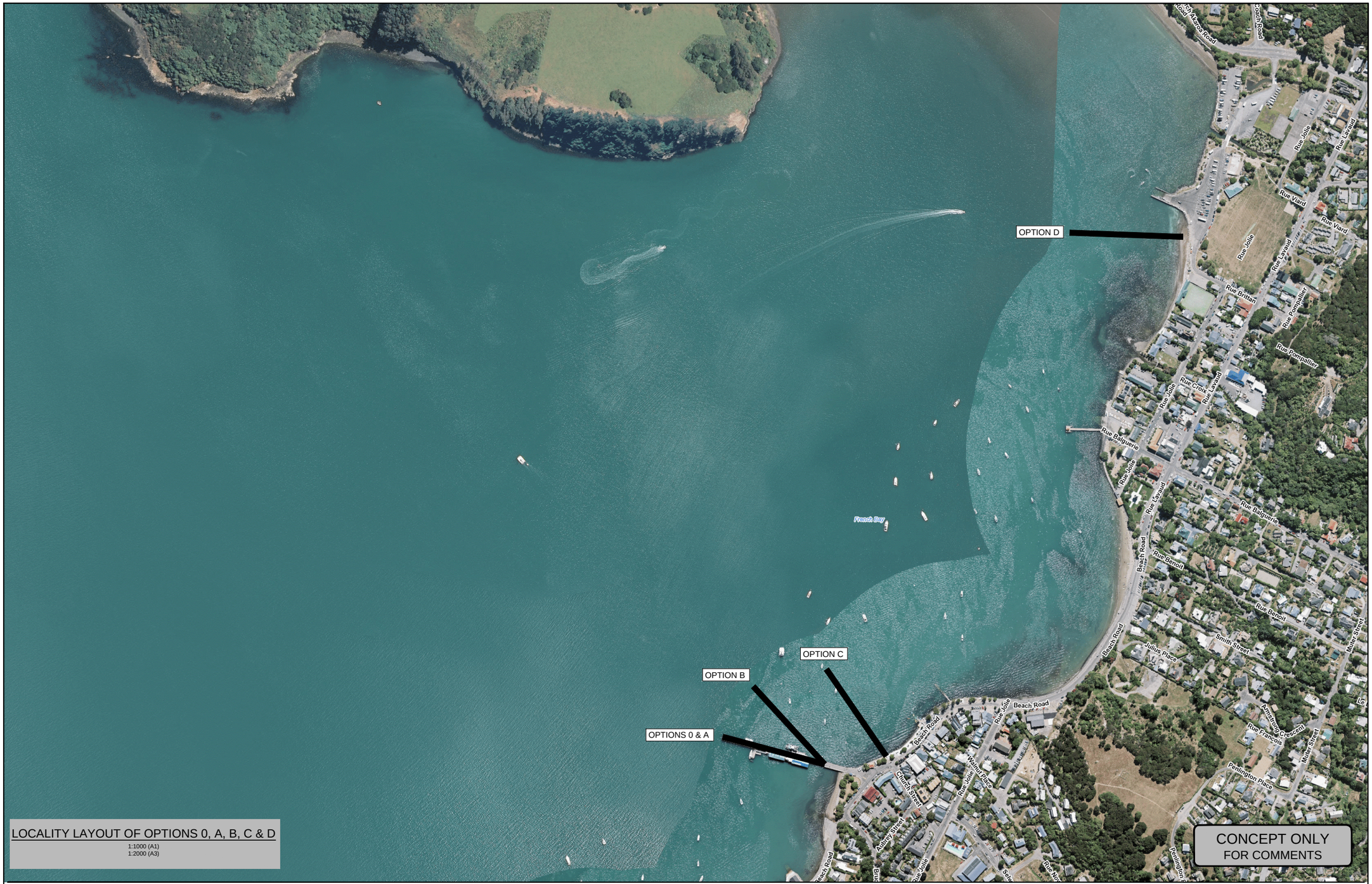
Appendix A - Concept Drawings

Christchurch City Council



Revision	App	Date	
- -	-	-	

Surveyed		
Designed	Tom Arthur	12/19
Drawn	Stephan Chambers	12/19
Reviewed	Tom Arthur	12/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: LOCALITY LAYOUT
OPTIONS 0, A,B,C & D

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
calibreconsulting.co

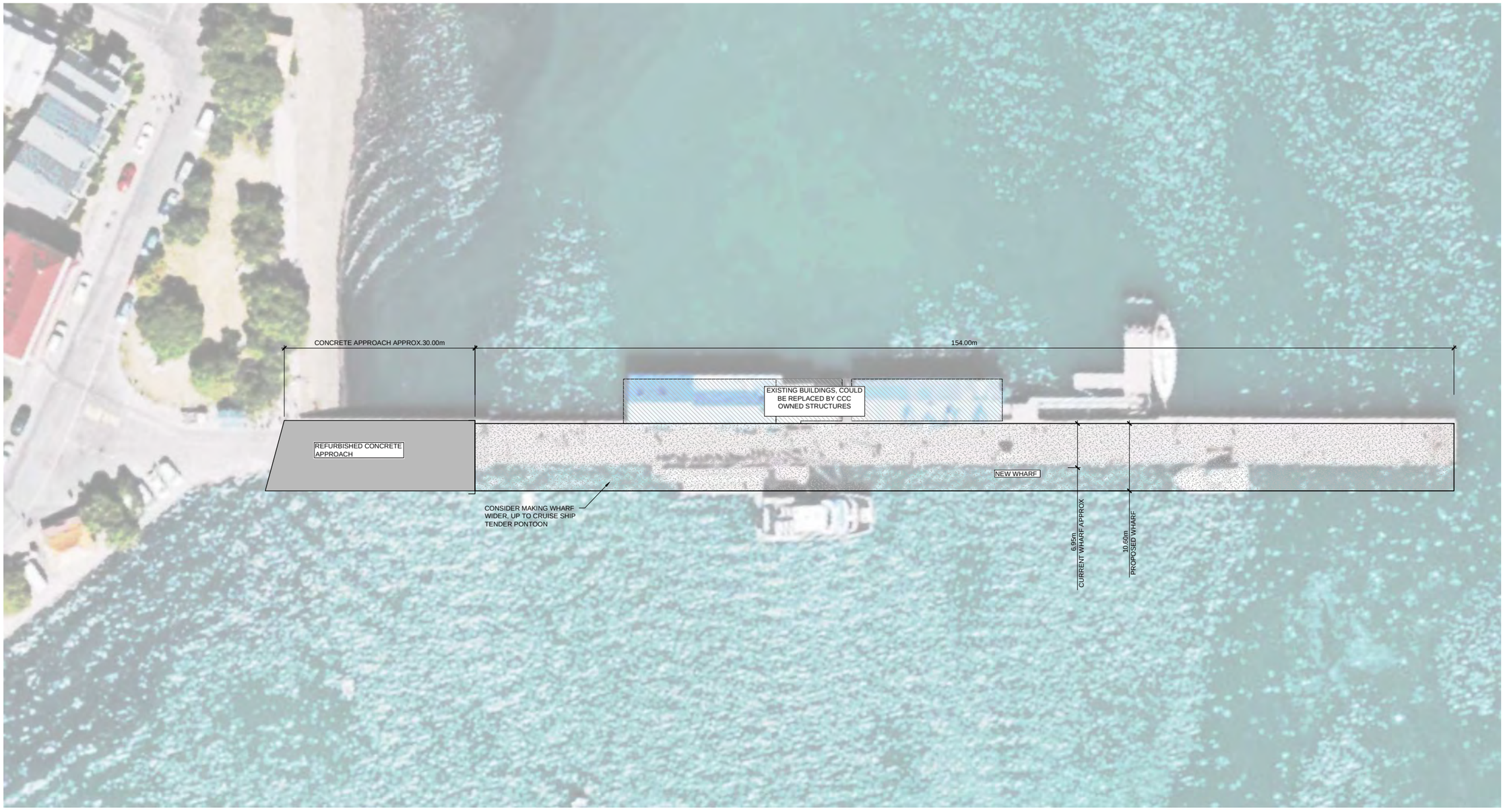
calibre

Scale (A1 Original) 1: (A3) 1:
SCALE AS NOTED

Project No	Sheet	Revision
711779	S050	-

H:\CHC\7117xx\711779 Akaroa Wharf Rebuild\320 Drawings\3_Drawing\711779 - WORKING.dwg, Plotted By Stephan Chambers at 12/12/2019 1:52:20 PM Scale 1:1

Christchurch City Council



OPTION A - CURRENT LOCATION (WHARF WIDENED)

1:200 (A1)
1:400 (A3)

CONCEPT ONLY
FOR COMMENTS

Revision	App	Date
- -	-	-

Surveyed		
Designed	Tom Arthur	11/19
Drawn	Lorena Balili	11/19
Reviewed	Tom Arthur	11/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: OPTION A
NEW WHARF AT
CURRENT LOCATION

Level 1
323 Madras Street
Christchurch 8042
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
711779	S110	-

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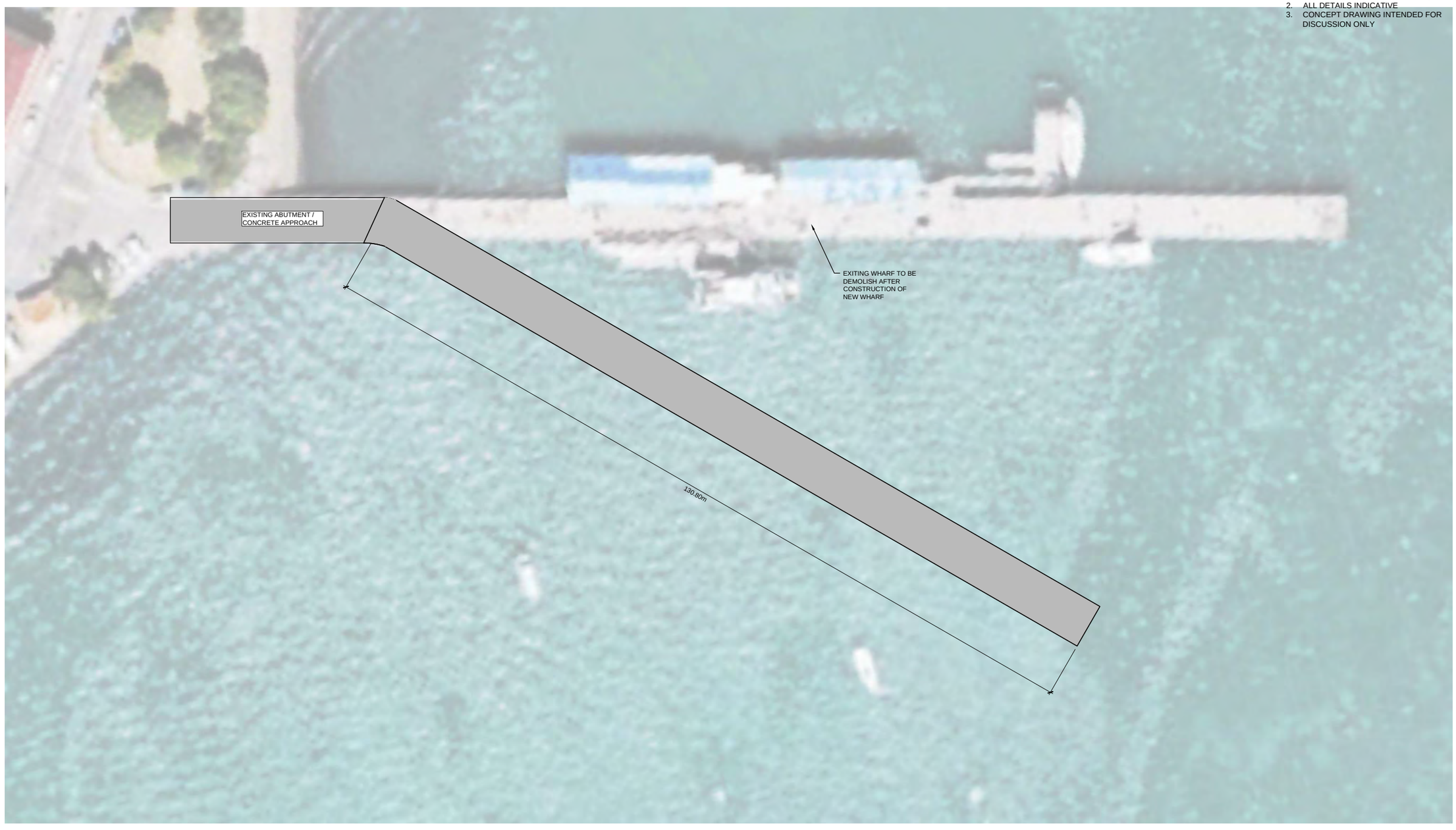
NOTES:

1. CONCEPT BASED ON DISCUSSION AT 2ND PUBLIC CONSULTATION MEETING
2. ALL DETAILS INDICATIVE
3. CONCEPT DRAWING INTENDED FOR DISCUSSION ONLY



OPTION B, NORTH OF CURRENT WHARF FROM CURRENT ABUTMENT

1:150 (A1)
1:300 (A3)

CONCEPT ONLY
FOR COMMENTS

A CONCEPT	TA	09/19	Surveyed		
Revision	App	Date	Designed	Tom Arthur	11/19
			Drawn	Lorena Balili	11/19
			Reviewed	Tom Arthur	11/19
			Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: OPTION B
NEW WHARF TO THE
NORTH OF EXISTING

Level 1
323 Madras Street
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
711779	S120	-

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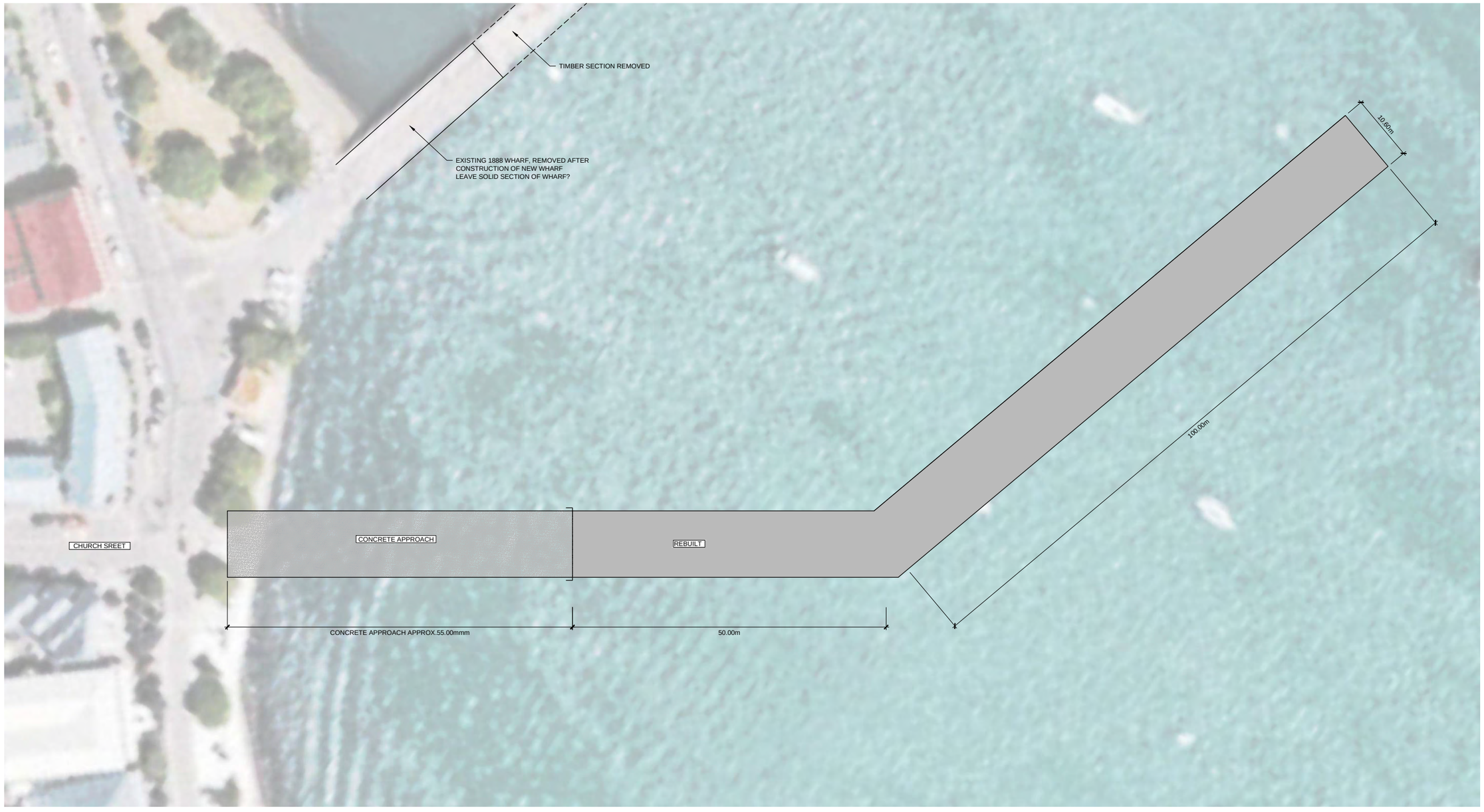
Christchurch City Council



OPTION C - CHURCH STREET

1:300 (A1)
1:600 (A3)

CONCEPT ONLY
FOR COMMENTS

Revision	App	Date
- -	-	-

Surveyed		
Designed	Tom Arthur	11/19
Drawn	Lorena Balili	11/19
Reviewed	Tom Arthur	11/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: OPTION C
NEW WHARF AT
CHURCH STREET

Level 1
323 Madras Street
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
711779	S130	-

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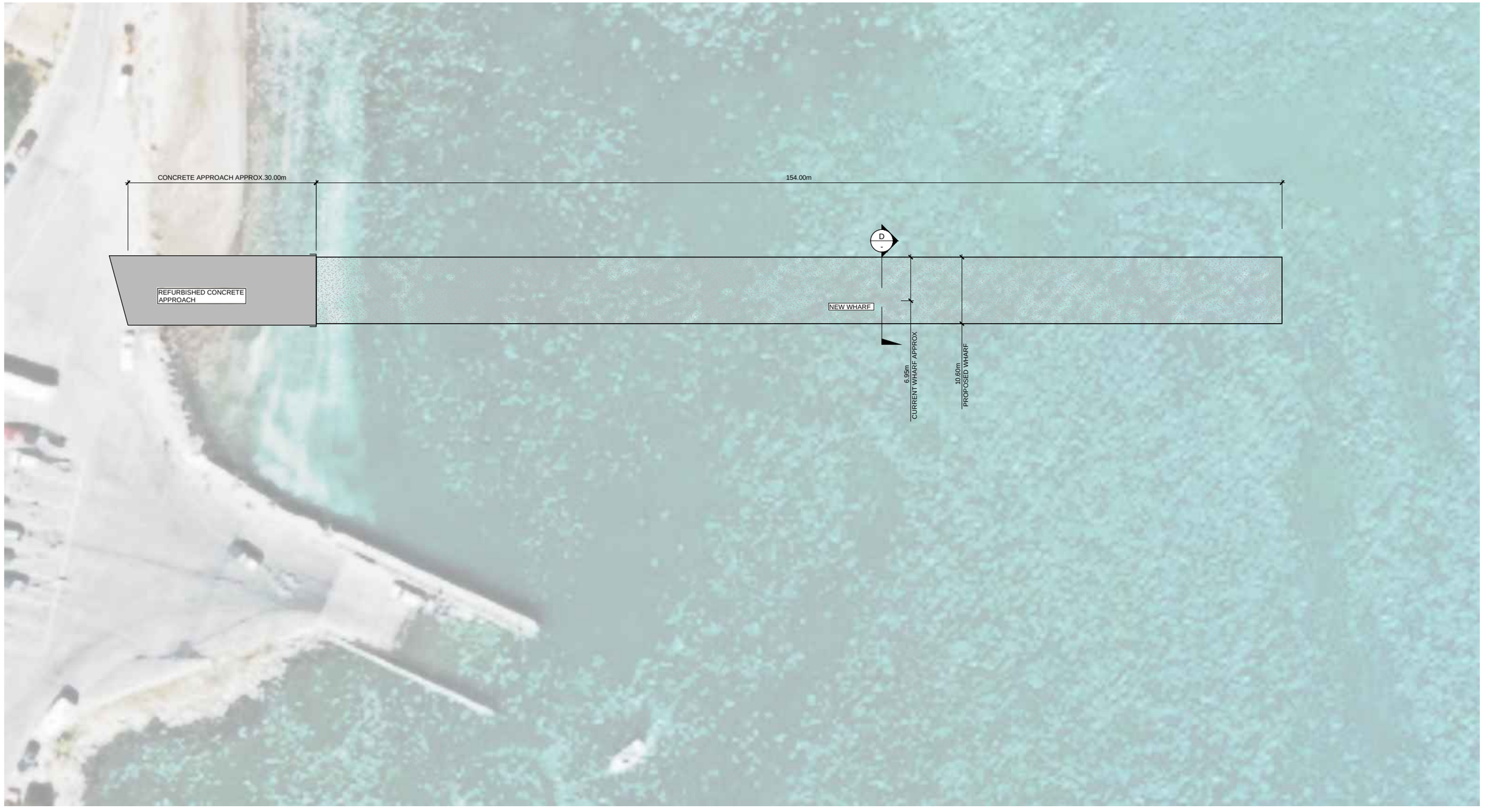
Christchurch City Council



PLAN VIEW DECK OPTION D - CHILDRENS BAY

1:300 (A1)
1:600 (A3)

CONCEPT ONLY
FOR COMMENTS

Revision		App	Date
-	-	-	-

Surveyed		
Designed	Tom Arthur	11/19
Drawn	Lorena Balili	11/19
Reviewed	Tom Arthur	11/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: OPTION D
NEW WHARF AT
CHILDRENS BAY

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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
711779	S140	-

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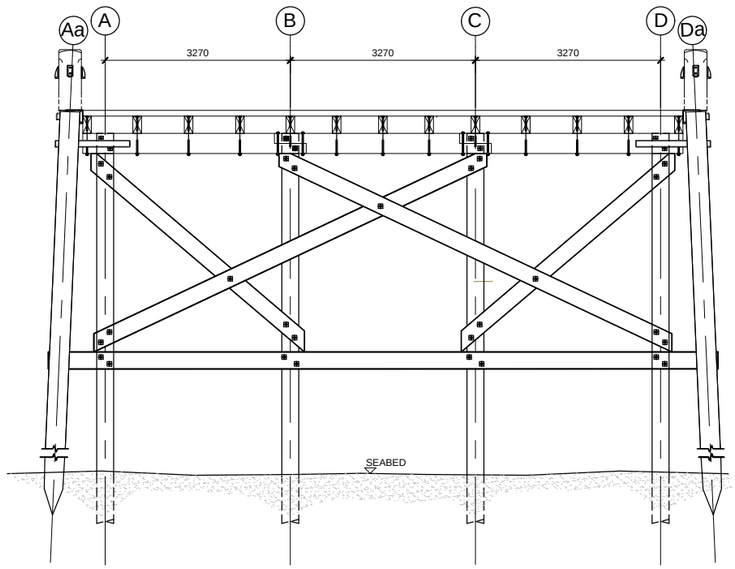
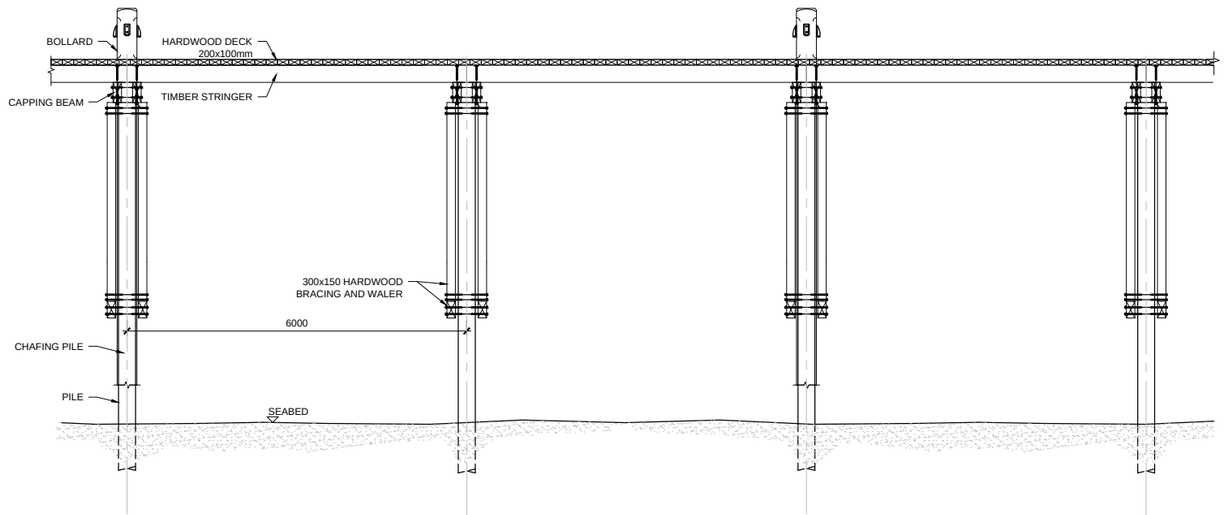


TYPICAL SECTION



TYPICAL ELEVATION

OPTION 1 - NEW WHARF STRUCTURE WITH LIKE-FOR-LIKE HARDWOOD TIMBER (CONCRETE ABUTMENT)

1:50 @ A1
1:100 @ A3

CONCEPT ONLY
FOR COMMENTS

Revision	App	Date
- -	-	-

Surveyed		
Designed	Tom Arthur	11/19
Drawn	Lorena Balili	11/19
Reviewed	Tom Arthur	11/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: OPTION 1 - NEW WHARF LIKE-FOR-LIKE HARDWOOD TIMBER (CONCRETE ABUTMENT)

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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
711779	S230	-

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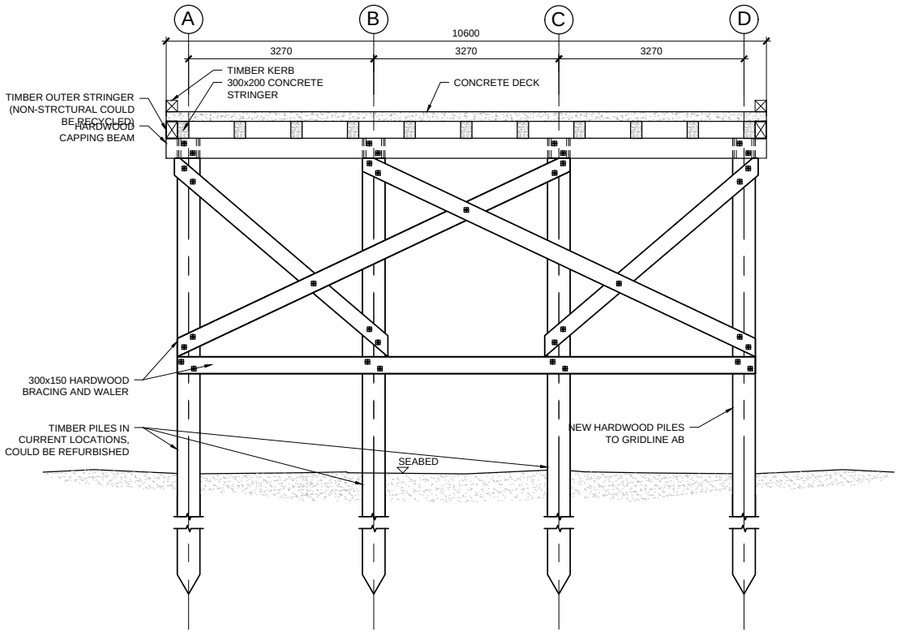

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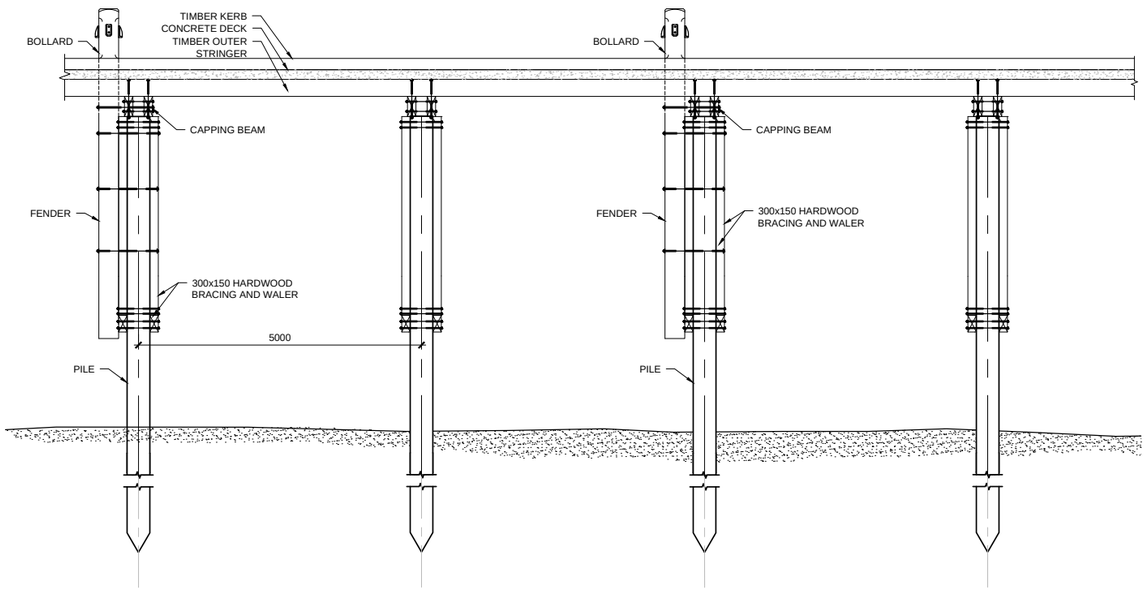

TYPICAL ELEVATION

OPTION 2 - WHARF WITH A MIX OF CONCRETE AND HARDWOOD TIMBER.

1:50 @ A1
1:100 @ A3

CONCEPT ONLY
FOR COMMENTS

Revision	App	Date
- -	-	-

Surveyed		
Designed	Tom Arthur	11/19
Drawn	Lorena Balili	11/19
Reviewed	Tom Arthur	11/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: OPTION 2 - WHARF WITH A MIX OF CONCRETE AND HARDWOOD TIMBER

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Christchurch 8042
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
711779	S240	-

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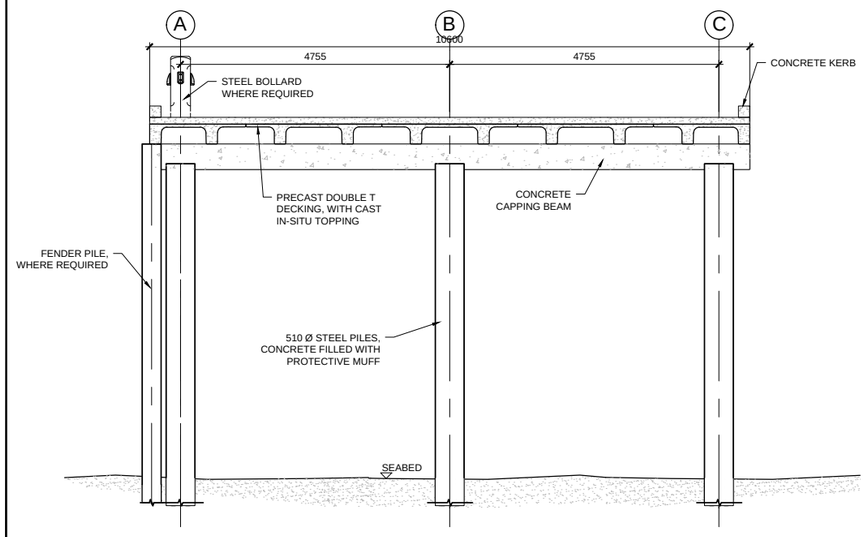
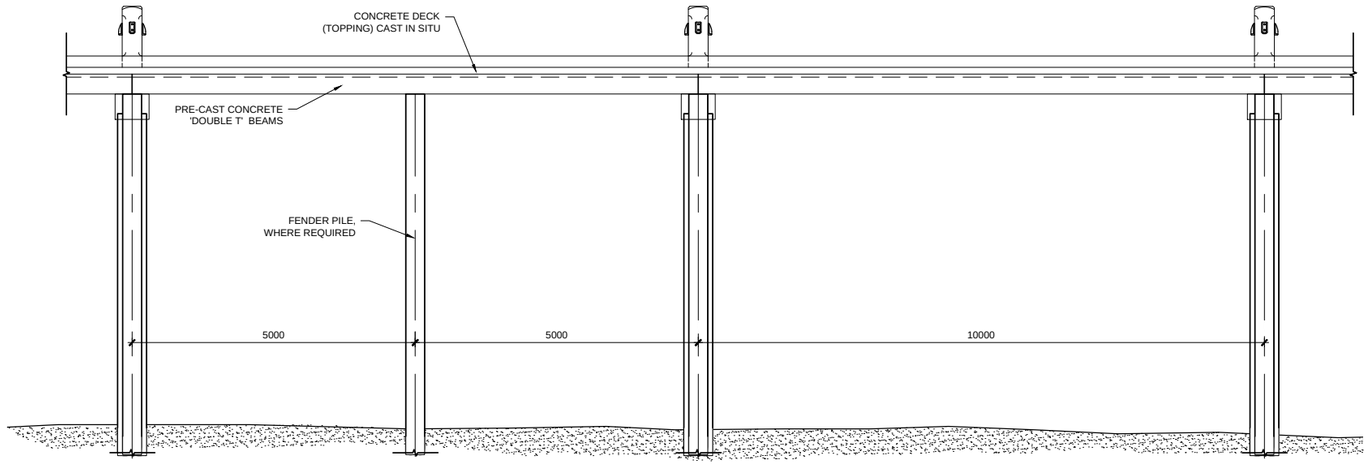


TYPICAL SECTION



TYPICAL ELEVATION

OPTION 3 - MODERN CONCRETE WHARF STRUCTURE

1:50 @ A1
1:100 @ A3

CONCEPT ONLY
FOR COMMENTS

Revision	App	Date
- -	-	-

Surveyed		
Designed	Tom Arthur	11/19
Drawn	Lorena Balili	11/19
Reviewed	Tom Arthur	11/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: OPTION 3 - MODERN CONCRETE WHARF STRUCTURE

Level 1
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Christchurch 8042
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
711779	S250	-

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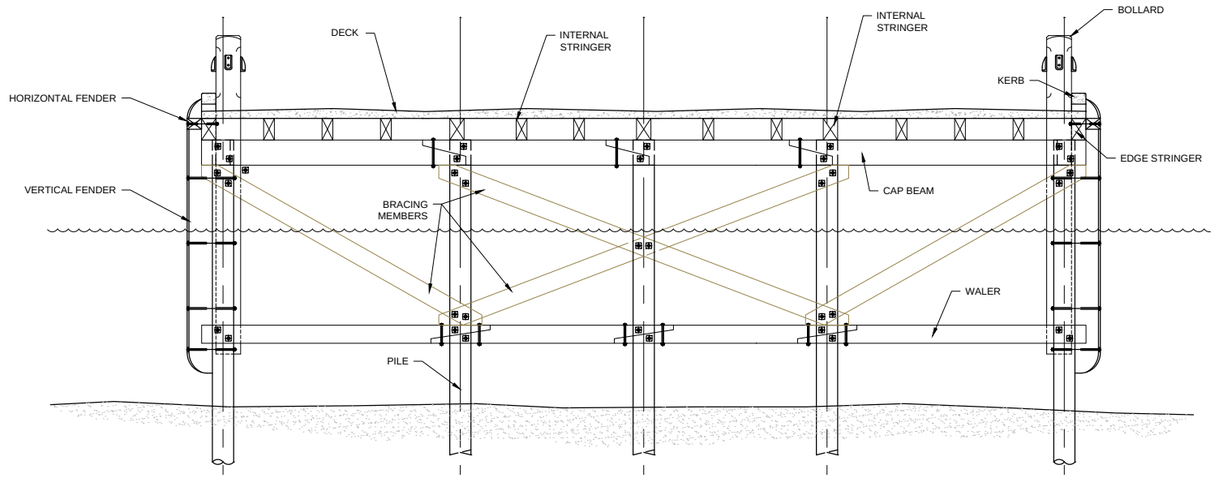
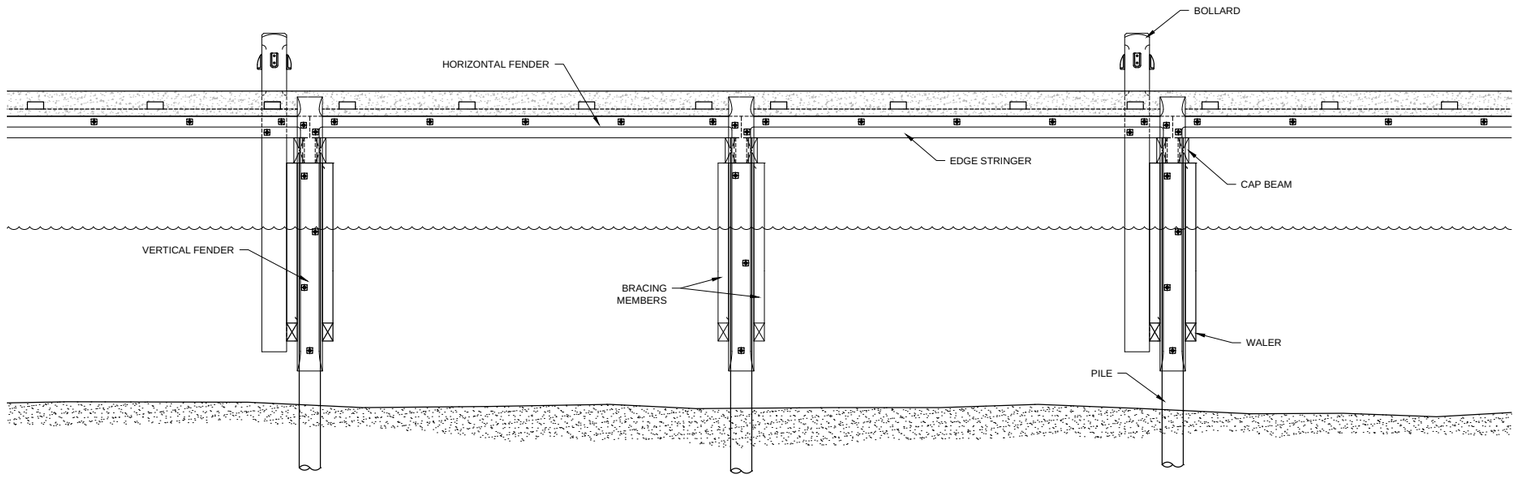
Appendix B - Typical Wharf Components



TYPICAL WHARF SECTION



TYPICAL WHARF ELEVATION

Revision	App	Date

Surveyed		
Designed	-	-
Drawn	-	-
Reviewed	-	-
Approved	-	-

Client: Christchurch City Council

Project Title: Akaroa Wharf Upgrade Options Report

Sheet Title: Typical Wharf Component diagram

Level 13
Kordia House
109-125 Willis Street
Wellington 6011
+64 4 384 2029
calibregroup.com

calibre

Scale (A1 Original): NTS

Project No	Sheet	Revision
711779	-	-

H:\CHCI\7105xx\710552.005 CCC - Akaroa Wharf Rebuild\420 Reports\Typical Wharf Components.dwg, Plotted By Tom Arthur at 10/05/2019 4:14:25 PM Scale 1:0.954

Appendix C - 1887 Construction Drawings

AKAROA JETTY.

(SITE.)

(Scale 3 chains to 1 inch).

PRESENT JETTY

NEW JETTY SITE

R. 863

EXORS of DR. WATKINS

HIGH SCHOOL

MESSRS. GARWOOD

GRANGES HOTEL.

WAGSTAFFS HOTEL

ROAD

AYLMER Rd.

Rd.

ST.

N.Z.

Wm. F. D'Arcy Travis

Governor

Approved subject to the modifications noted on plan marked M. D 1334

Clerk of Executive Council W. D. Willans
Authorised Surveyor
Akaroa Mar: 1887.

M.D. 1333

RECORD SET

RETURN TO H.O. PLAN RECORDS

M. D. 1333

Akaroa Borough Council.

AKAROA JETTY.

W. D. Williams
Akaroa.
April 1866

1.

Approved as Borough subject to the following partly cautionary
1st That more than the first 100 feet of the wharf shall be built
solid? Cobb bede walls for the outer forty feet of the solid
part shall be made not less than 4 ft 6 inches thick and
ends of bede walls to correspond with the reed work of the solid
part shall have a footing of 5 ft 6 inches wide and 18
inches thick
2nd That concrete tie walls shall run about two feet from the
end of the wharf between the walls? & also the concrete
floor below the metalling shall be omitted
3rd Weep holes shall be provided in the walls and the
hand packed stones thereon inside the walls from top
to bottom to act as drains shall be omitted and also
shall the system of drains and pipes shown on
the side of the solid part of the wharf

Clerk of Executive Council
No. 28th 1866

Road formation
Concrete
Stones hand packed to form drains
Filling
Concrete
Low Water
Cross Section

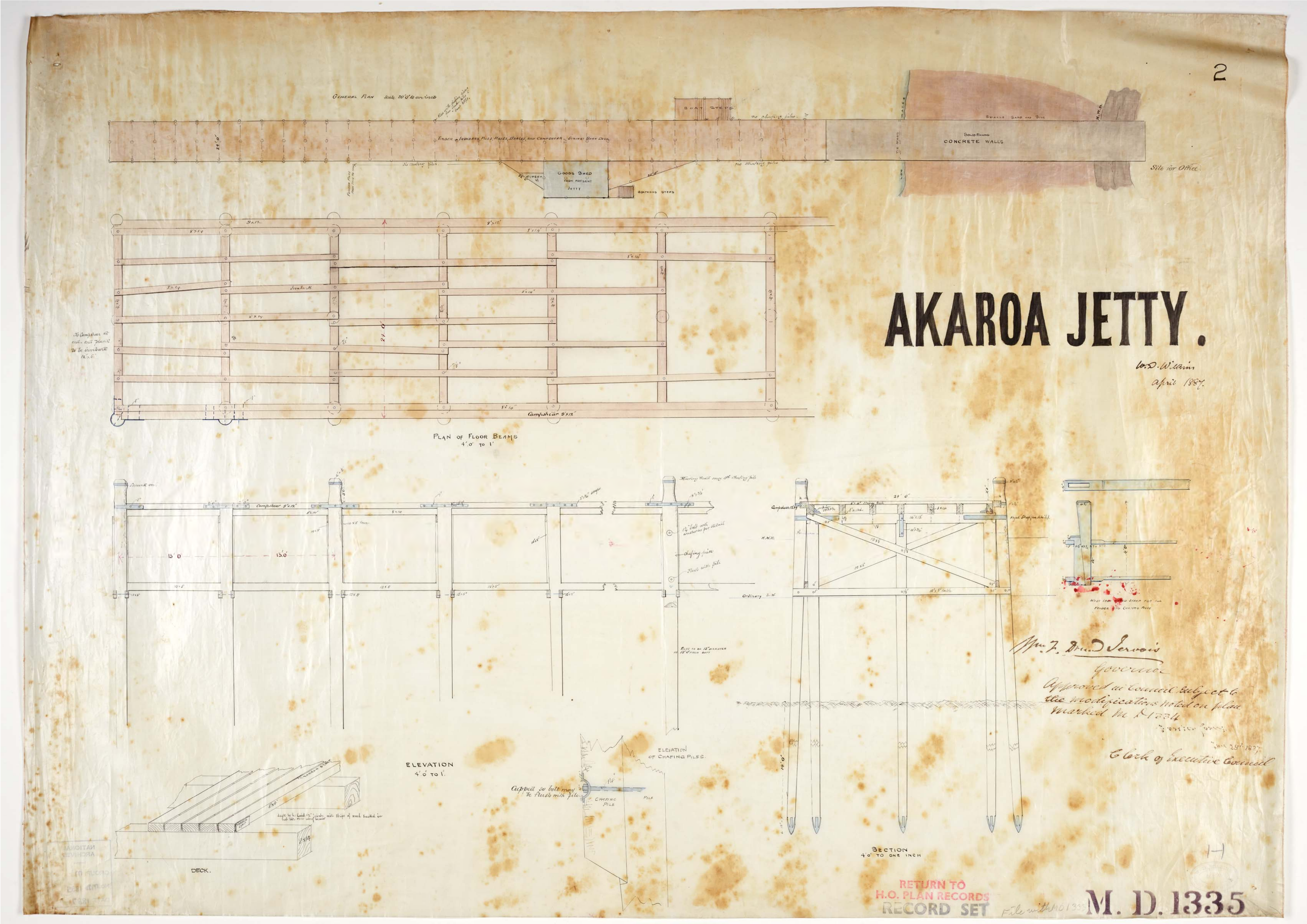
Batter
Hand packed rubble to form drains
Centre line
Concrete floor
Plan of Part of Solid End

Road formation
Concrete
Filling
Foundation line
Longitudinal Section of part of Solid End (on Centre Line)

Junction of Solid with Piered Construction

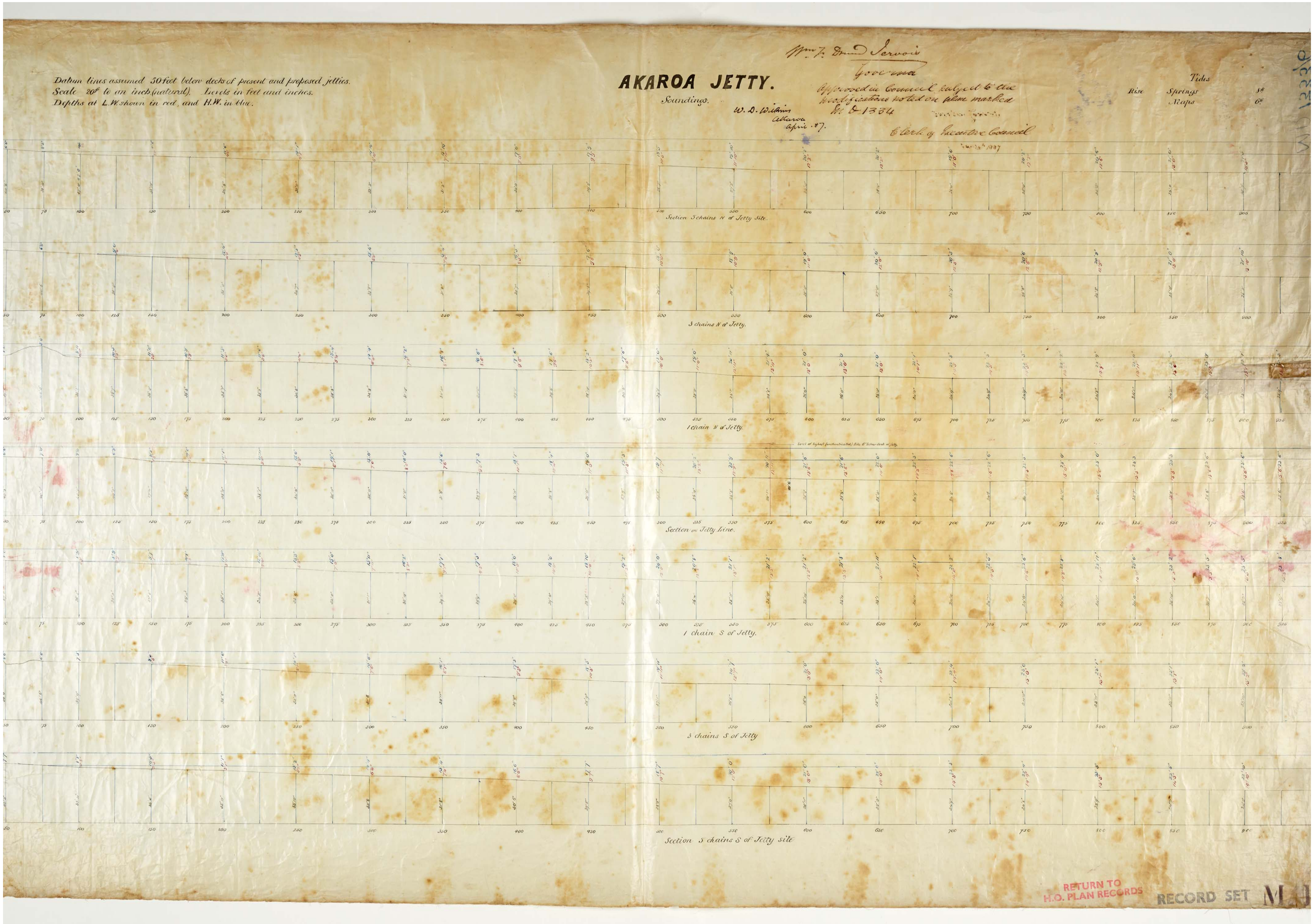
Scale 4.0 to 1 inch.

RETURN TO RECORD SET
H.O. PLAN RECORDS
M. D. 1334



Item 4

Attachment C


Datum lines assumed 50 feet below decks of present and proposed jetties.
Scale 20ft to an inch (natural). Levels in feet and inches.
Depths at L.W. shown in red, and H.W. in blue.
AKAROA JETTY.
Soundings.
W. D. Wilkins
Akaroa
April .87.
Wm F. Drummond Jervois
Governor
Approved in Council subject to the modifications noted on plan marked M D 1334
Clerk of Executive Council
Tides
Rise
Springs 8ft
Neaps 6ft
Section 5 chains N of Jetty Site.
3 chains N of Jetty.
1 chain N of Jetty.
Section on Jetty Line.
1 chain S of Jetty.
3 chains S of Jetty
Section 5 chains S of Jetty site
RETURN TO H.O. PLAN RECORDS
RECORD SET

Appendix D - Current Wharf Configuration

Christchurch City Council

AERIAL VIEW
1:400@A3

CONCEPT ONLY
FOR COMMENTS

Revision	App	Date
- -	-	-

Surveyed
Designed Tom Arthur 10/19
Drawn Lorena Balili 10/19
Reviewed
Approved

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: Aerial view of existing wharf

Level 1
323 Madras Street
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Scale (A1 Original) 1: (A3) 1:
SCALE AS NOTED

Project No	Sheet	Revision
711779	S100	-

H:\CHC\7117xx\711779 Akaroa Wharf Rebuild\320 Drawings\3_Drawing\711779 - WORKING.dwg, Plotted By Lorena Balili at 22/10/2019 11:54:27 am Scale 1:1

Appendix E – Consideration of Public Consultation feedback

CONSIDERATION OF PUBLIC CONSULATION FEEDBACK

The wharf requires significant investment to remain safe for public use in the medium and long term, and CCC have provision for this in their current (2018 – 2028) and proposed (2021 – 2031) long term plan. Demolition of the wharf without replacement has been discounted due to the economic, heritage and social value of the wharf. The Akaroa wharf is an iconic feature for the community and is the focus for community, heritage, recreational and commercial activities in town. Below is a summary of some options that were raised through the public consultation process (Christchurch City Council, 2019). Submissions varied on whether the heritage character of the wharf should be maintained, with feedback also indicating that the function of the wharf was important to the community.

Use of existing (upgraded) infrastructure within Akaroa Harbour

One option that was raised at the workshop was to upgrade other marine infrastructure in Akaroa Harbour, specifically the wharves at French Farm or Wainui (as identified through the consultation process). The rationale behind the use of another existing wharf is to allow for loading and unloading of the cruise ship tenders and dropping passengers at buses to be taken directly to Christchurch. This option would have the benefit of significantly reducing the cruise ship traffic on Akaroa Wharf and within the Akaroa township.

To upgrade multiple wharves, the budget would need to be increased or a smaller, simpler wharf be built in Akaroa. The road networks around French Farm and Wainui would also need upgrading to ensure the safe travel of the additional traffic.

There is uncertainty around the medium – long term cruise ship traffic, more research is needed to determine whether there is sufficient demand to justify the investment.

Construct a breakwater south of wharf

One submission discussed the possibility of incorporating a breakwater to the south of the wharf. This would provide shelter from the prevailing wind, making it easier and safer to berth alongside the existing wharf. This submission suggested retaining and repairing the existing wharf, which is not recommended due to the current condition of the wharf. The current wharf would still require an almost full replacement of its members at a minimum to maintain its current amenity.

The cost implications of constructing a new breakwater and a full repair of the current wharf make this option challenging. Another factor to consider when investigating the breakwater is the impact on ship navigation within the Harbour, whilst it is not expected to present a safety hazard it would mean a less direct route from the wharf to the outer Harbour.

The effects of this option on the marine life around the wharf and the accretion/erosion of sediment would need to be further investigated. The breakwater would also add time to journeys into and out of the harbour and impact the view from the town.

One element of this submission that could be carried forward into the new wharf design (though in a modified form) would be the inclusion of baffle breakwaters under the wharf. This may help reduce the wave action for vessels berthing on the north side of the wharf, providing a safer berthing as per the motivation of the breakwater.

The seawall could reduce the loading on the wharf from berthed vessels, however it is likely the wharf could be strengthened for less than the cost of the seawall.

Marina

Several submitters raised the possibility of a marina to be supported by the wharf for mooring of local and visiting yachts.

A marina has not been considered for this project due to the additional cost and it is recognised that this opportunity could be explored in the future by a commercial operator.

CONTACT US

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PO Box 13875, Christchurch 8141
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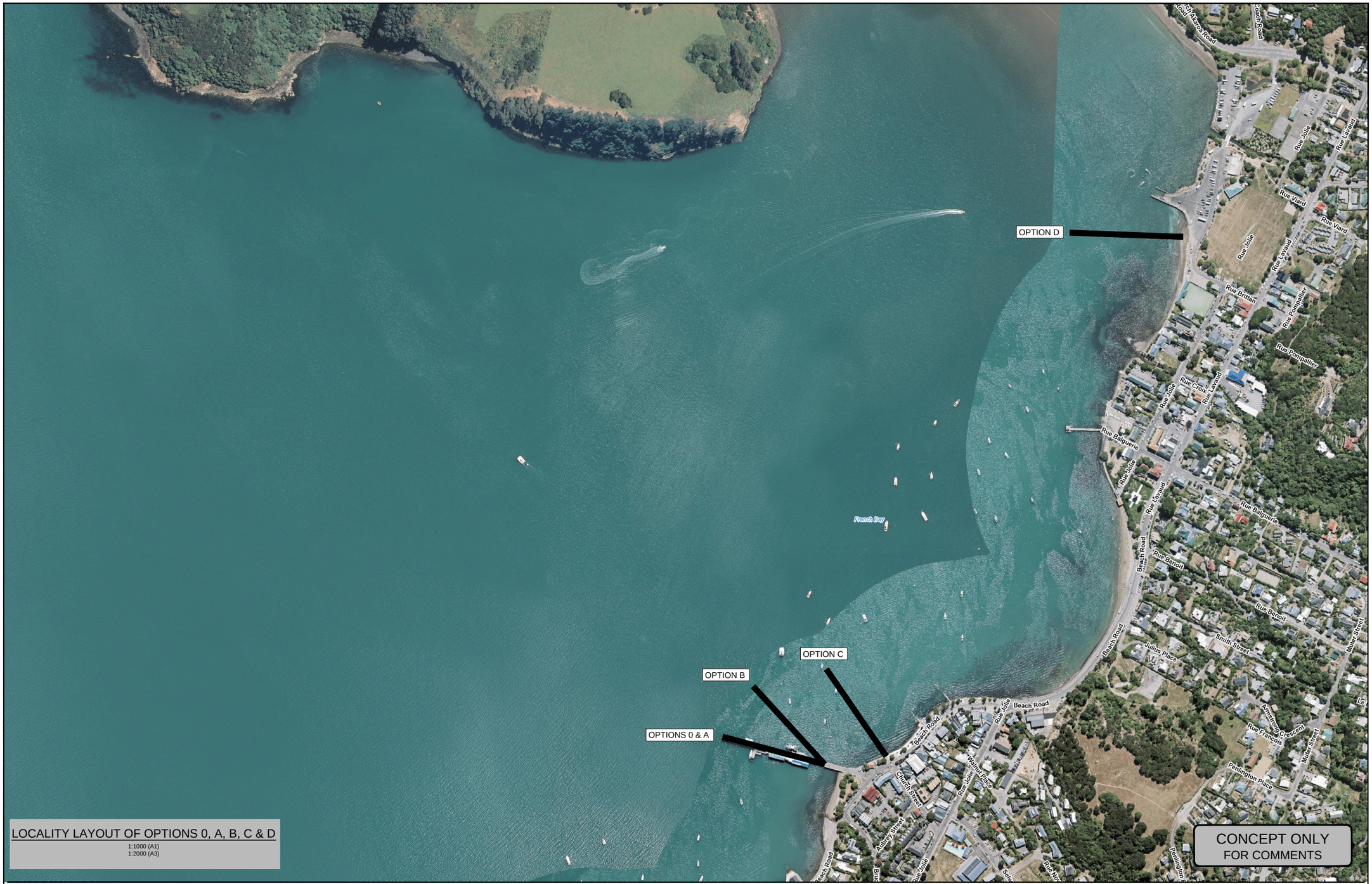
WWW.CALIBREGROUP.COM

Christchurch City Council



LOCALITY LAYOUT OF OPTIONS 0, A, B, C & D
1:1000 (A1)
1:2000 (A3)

CONCEPT ONLY
FOR COMMENTS

Revision	App	Date
- -	-	-

Surveyed		
Designed	Tom Arthur	12/19
Drawn	Stephan Chambers	12/19
Reviewed	Tom Arthur	12/19
Approved		

Client: Christchurch City Council

Project Title: Akaroa Wharf
Preliminary Rebuild Concept

Sheet Title: LOCALITY LAYOUT
OPTIONS 0, A,B,C & D

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
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calibre

Scale (A1 Original) 1: (A3) 1:
SCALE AS NOTED

Project No	Sheet	Revision
711779	S050	-

H:\CHC\7117xx\711779 Akaroa Wharf Rebuild\320 Drawings\3_Drawing\711779 - WORKING.dwg, Plotted By Stephan Chambers at 12/12/2019 1:52:20 PM Scale 1:1

Akaroa Wharf Multi-Criteria Analysis Report

Prepared for Christchurch City Council
Prepared by Beca Limited

Revised November 2021

Creative people together transforming our world

Contents

Revision History

Revision N°	Prepared By	Description	Date
0.1	**Mollie Weston**	Draft Report	16/03/2020
1.0	**Mollie Weston**	Final Report	18/03/2020
1.1	**Noelle Evans**	Updated report based on WTPi Akaroa Wharf Concept Options Estimate Report, Rev 2, dated 23 April 2020.	25/05/2020
2.0	**Noelle Evans**	Updated report and analysis based on change to MCA heritage assessment and scores. Workshop held 23 June 2020.	01/07/2020
3.0	**Noelle Evans**	Updated report for April 2021 consultation following comments received from Akaroa Wharf Project Manger, Kristine Bouw.	20/04/2021
4.0	**Noelle Evans**	Updated report following new information received from Akaroa Wharf Project Manger, Kristine Bouw.	30/11/2021

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Mollie Weston**		18/03/2020
Reviewed by	**Noelle Evans**		30/11/2021
Approved by	**Greg Offer**		30/11/2021
on behalf of	Beca Limited		

Executive Summary

Introduction

Christchurch City Council (CCC or Council) engaged Beca to lead a Multi-Criteria Analysis (MCA) to guide decision-making regarding suitable location and high-level structural design options for the Akaroa Wharf renewal project. This report describes the options, engagement with stakeholders, the MCA assessment process and outcomes.

This version of the report, Version 4.0, reports changes in advice about the risks associated with retaining the existing wharf abutment for certain options.

Calibre have carried out further condition assessment relating to the abutment and have highlighted the risks and challenges associated with retaining this as part of the wharf redevelopment for either Option A or B. This is in contrast to the April 2021 assessement, that indicated that the abutment for Option A would likely need to be demolished but for Option B could be retained.

A new bathymetric survey was obtained, incorporated into Version 3.0 of this report, which identified that the potential wharf for Option C, at Church Street, would have to be extended substantially further than previously considered and extensive dredging would potentially be required. This information would likely influence the outcome of the MCA, however was not considered in the original MCA. As the MCA has not been re-run to date the recommendation has not changed.

The preliminary location options assessed are:

- **Baseline Option, Option 0** - Restore existing wharf in its current location, no change to structural form.
- **Option A** - Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width. The original abutment would be completely removed, and a new abutment constructed fit for purpose.
- **Option B** - Construct a new wharf along the north side of the existing wharf. The original abutment would be completely removed, and a new abutment constructed fit for purpose.
- **Option C** - Construct a new wharf off Church Street and on the site of the original town wharf. The original abutment would be retained.
- **Option D** - Construct a new wharf from Akaroa Recreation Field/ Childrens Bay. The original abutment would be retained.

The preliminary structural options assessed are:

- **Baseline Option, Option 0** - Restore existing wharf in its current location, no change to structural form.
- **Option 1** - New wharf structure with like-for-like hardwood timber (excluding abutment).
- **Option 2** - New wharf structure with a mix of concrete and hardwood timber (excluding abutment). Visible members would be hardwood.
- **Option 3** – New wharf structure made from concrete (excluding abutment).

Background

It's important to note as part of the options to construct a new wharf above, it is Council's intention to demolish the existing wharf due to the existing condition of the wharf and as outlined in the Calibre report; *Akaroa Wharf Renewal: Preliminary Rebuild Options, May 2019.*

The most recent inspections were completed in August 2018 and again in July 2021 at which time Calibre assessed the condition of the wharf to be *moderate to poor*. The wharf is over 130 years old and a large amount of the original material has been replaced, but this is now also deteriorating. CCC completed repairs on the existing wharf in 2019/2020 which included the replacement of stringer beams and pile bracing as well as updates to a number of piles.These repairs will provide the necessary improvements to allow the wharf to operate for 3 to 5 years, however in the longer term the wharf is considered uneconomical to repair.

The Akaroa Wharf MCA

The MCA criteria were developed in collaboration with the project team, based on the Waka Kotahi NZ Transport Agency (NZTA) MCA criteria framework, including the Council project leads, Council Heritage and Urban Design, ECan, Planz Consultants, Calibre Group, WT Partnership Infrastructure (WTPi) and refined through the MCA assessment process consistent with NZTA processes.

The NZTA guidelines for MCA scoring were used to score each option, against the chosen criteria and a weighting assigned to each criterion. The assessment and scoring were carried out with the above parties, over two workshops, including Akaroa Community Board members and incorporating inputs from Ōnuku Rūnanga.

The weightings assigned to the criteria were developed in collaboration with CCC project leads. The weightings are ranked ‘Very Low’, ‘Low’, ‘Medium’, ‘High’ and ‘Very High’, and are apportioned a value from a nil weighting (i.e. not assessed) to 100, consistent with NZTA processes.

The combination of the weighting and scoring enabled comparison between the options and provided the overall preference for each of the key considerations; both for the location and structural options evaluated.

To improve the robustness of the weighting process, a sensitivity assessment was completed, which involved adjusting a single weighting value by ±10% and ±20% of the pre-assigned value. Ultimately the sensitivity assessment showed very little variance from the original weighted values, which indicates the weighting values assigned are suitable in this context.

MCA Analysis

The MCA assessment identified Options A and B are equally preferred for the preliminary location, and Option C is still an option worth consideration.The MCA also identified Options 1 and 2 are equally preferred for the preliminary structural scenarios.

The sensitivity assessment illustrated no change in the order of priority. The difference in MCA scores between Options A and B for location, and Options 1 and 2 for structural material, are within the margin of uncertainty as seen in the original weighted scores and in the sensitivity assessment. In conclusion, there is no clear delineation between Options A and B, and Options 1 and 2 in the MCA assessment.

Whilst Option C is an outlier, it scored reasonably high in the MCA assessment and close to that of Options A and B, so it is recommended this option is further considered in the next phase of the work. Since the MCA was undertaken and analysed in July 2020, a new bathymetric survey has been obtained which has identified that the potential wharf for Option C, at Church Street, would have to be extended substantially further than previously considered and extensive dredging would potentially be required. This new information would likely influence the outcome of the MCA, however as the MCA has not been re-run to date, the recommendation has not changed.

[redacted]

Summary

The MCA assessment is based on the worst case scenario, where the original abutment has to be completely removed for Options A and B.

This version of the report, Version 4.0, reports changes in advice about the risks associated with retaining the existing wharf abutment for certain options. Calibre have carried out further condition assessment relating to the abutment and have highlighted the risks and challenges associated with retaining this as part of the wharf redevelopment for either Option A or B, refer to Appendix E Calibre advice. This is in contrast to the April 2021 assessement, that indicated that the abutment for Option A would likely need to be demolished but for Option B could be retained.

Additionally, a new bathymetric survey was obtained for Option C, incorporated into Version 3.0 of this report, identifying that for a wharf at Church Street, Option C, would have to be extended substantially further than previously considered and extensive dredging would potentially be required.

The new information that has come to light would likely influence the outcome of the MCA if it were to be re-run, however this information was not considered in the original MCA. As the MCA has not been re-run to date the recommendation has not changed.

It will be critical to investigate the preferred options further, undertake further design and consultation, develop cost estimates to identify and incorporate cost risks for each of the shortlisted options, for Council to determine the preferred location and preferred structural material for the Akaroa Wharf Renewal project.

In summary, we recommend Options A, B and C are taken forward as the preferred preliminary location scenarios, and Option 1 and 2 are taken forward as the preferred preliminary structural scenarios.

Disclaimer

Beca has prepared the MCA based on reports prepared by third parties acting on behalf of Council. Beca has not been contrated by Council to provide advice or assessment of these reports, and therefore has not undertaken such analysis.

1 Introduction

1.1 Background

This report documents an assessment process that was conducted in order to evaluate the shortlisted options for the Akaroa Wharf Rebuild Project.

Four preliminary location options and three preliminary structural options, as well as a baseline option, have been conceptualised for the assessment.

The project scope requires that the options are evaluated using a Multi Criteria Analysis (MCA) framework – a framework belonging to the Multi Criteria Decision Making (MCDM) group of frameworks. MCDM is the umbrella term for "the study of methods and procedures by which concerns about multiple conflicting criteria can be formally incorporated into the management planning process.

1.2 Why use MCA?

MCA is suitable when an intuitive approach may not be appropriate, for example because the decision-maker(s) feel the decision is too large and complex to handle intuitively, because it involves several conflicting objectives, or involves multiple stakeholders with diverse views. This process also assists with openness and transparency, so decision makers and the wider community can better understand how options are considered and then developed for consultation and final approval.

It is important to remember MCA is a tool and that people make decisions. The MCA process assists people in making decisions and also gives the wider community understanding of what information was considered in the decision making process. That assistance can take many different forms including; providing structure to discussions, separating fact from judgement, creating shared understanding and gaining a sense of purpose and agreement for the way forward.

1.3 The Assessment Process

All option assessments require a clear documented process in order to understand how the decision was made. The key test of an option evaluation process is that other experts in the field should be able to repeat the process and come to the same decision.

The process is:

1. Establish the decision context – the purpose of the MCA, identify the decision maker(s) and other key players, design the assessment system.
2. Identify the options to be assessed to achieve the objectives.
3. Identify the "criteria".
4. Scoring – describe the consequences of the options, score the options based on the criteria, check the consistency of the scores on each criteria.
5. Weighing – assign weights and scores to each option to reflect their relative importance to the decision.
6. Combine the weights and scores for an overall value.
7. Examine the results.
8. Sensitivity assessment.

2 Project Background

2.1 Prior Work

The Christchurch City Council (CCC) is in the early stages of planning the Akaroa Wharf Rebuild Project.

It is Council's intention to demolish the existing wharf due to the existing condition of the wharf as outlined in the Calibre report *Akaroa Wharf Renewal: Preliminary Rebuild Options, May 2019*. The most recent inspection was completed in August 2018 at which time Calibre assessed the condition of the wharf to be *moderate to poor*. The wharf is over 130 years old and a large amount of the original material has been replaced, but this is now also deteriorating. Council completed repairs on the existing wharf in 2019/2020 which included the replacement of stringer beams and pile bracing as well as updates to a number of piles.These repairs will provide the necessary improvements to allow the wharf to operate for 3 to 5 years, however in the longer term the wharf is considered uneconomical to repair.

The options study and report; '*Akaroa Wharf Renewal: Preliminary Rebuild Options*', issued by Calibre May 2019, outlined the initial preliminary location and construction material options as a starting point for the project.

The Calibre report was used as part of the initial public consultation process between 28 May and 26 June 2019 which included two drop in sessions in Akaroa. In response to the consultation, 95 submissions were received from individuals and groups. The 'Akaroa Wharf Consultation Feedback Memo', dated 21 June 2019, provides a summary on the public feedback from these initial sessions. Refer to https://www.ccc.govt.nz/assets/Documents/Consultation/2019/8-August/Akaroa-Wharf-Submissions.pdf

Further to the initial preliminary designs, a Draft Conservation Plan for the Akaroa Main Wharf was prepared by Origin, issued May 2019. The Draft Conservation Plan provides an outline of the significant heritage and cultural significance of the historic Akaroa Main Wharf to the town and the wider district. Jacobs prepared the 'Akaroa Wharf Coastal Hazards Review', issued September 2019 and Planz Consultants have provided advice on the consenting plans and policies related to the main Akaroa Wharf, including 'The Akaroa Wharf Renewal: Planning Considerations for Proposed Rebuild Options' memo issued November 2019.

[redacted] The participants rated the location and preliminary structural options against the MCA criteria based on the information available at the time, to guide the decision-making and MCA assessment for the Akaroa Wharf renewal project.

2.2 The MCA Participants and Engagement Process

The Council has undertaken stakeholder and community engagement throughout the period of options development, from May 2019 to June 2019, prior to undertaking the MCA assessment of the Akaroa Wharf renewal project.

As part of the first step of the MCA process, a workshop was held to set the MCA criteria on 02 December 2019. Two MCA workshops were held, the first as an assessment of the options against the criteria held on 09 December 2019. The second was to finalise the assessment, held on the 19 December 2019.

Separate meetings were held with Debbie Tikao and Rik Tainui, representing Ōnuku Rūnanga, Planz Consultants, CCC Historic values team members and Calibre Group in January and February of 2020 to finalise the scores and commentary on specific Heritage and Cultural MCA criteria.

Planz Consultants provided indicative scores associated with the 'Preliminary Structural Options' across a range of statuary and management plans, refer to the MCA Workshop – Materiality Assessment Statutory and Management Plans Memo.

WTPi provided a Carbon Emissions Estimate for Akaroa Wharf, dated 12 February 2020, providing a comparative analysis of utilising timber or steel and concrete which have been incorporated into the scoring of the final MCA.

A summary of the key meetings and workshops summarised below.

Date	Meeting & Objective	Meeting Time	Attendees	Role	Organisation
02 December 2019	**MCA Criteria Setting workshop,** agreeing the criteria relevant to the project, based on the NZTA guidelines	1.5hr	Kristine Bouw Sylvia Docherty Paul Rogers Boyd Barber Tom Arthur William Southby Matt Bonis Livi Whyte Ian Fox Luke Donnelly Fiona Wykes Noelle Evans Scott Van Leishout	Project lead Project coordinator Project advisor Urban Designer Structural Engineer Structural Engineer Consultant Planner Consultant Planner Harbourmaster Director, QS Heritage Advisor MCA facilitator MCA facilitator support	CCC CCC CCC CCC Calibre Calibre Planz Planz ECan WTPi CCC Beca Beca
09 December 2019	**MCA Workshop 1** assessing the different location options against agreed project criteria	3hrs	Jamie Stewart Nigel Harrison Tori Peden Kristine Bouw Sylvia Docherty Paul Rogers Boyd Barber Tom Arthur William Southby Matt Bonis Livi Whyte Ian Fox Luke Donnelly Fiona Wykes Noelle Evans Scott Van Leishout	Community Board Member Community Board Member Community Board Member Project lead Project coordinator Project advisor Urban Designer Structural Engineer Structural Engineer Consultant Planner Consultant Planner Harbourmaster Director, QS Heritage Advisor MCA facilitator MCA facilitator support	CCC CCC CCC CCC CCC CCC CCC Calibre Calibre Planz Planz ECan WTPi CCC Beca Beca
19 December 2019	**MCA Workshop 2** finalising the assessment of the different location	2.25hrs + 2.25hrs	Jamie Stewart Nigel Harrison Kristine Bouw Sylvia Docherty	Community Board Member Community Board Member Project lead Project coordinator	CCC CCC CCC CCC

Date	Meeting & Objective	Meeting Time	Attendees	Role	Organisation
	and material options against agreed project criteria		Paul Rogers Boyd Barber Tom Arthur William Southby Matt Bonis Livi Whyte Ian Fox Luke Donnelly Amanda Ohms Noelle Evans Scott Van Leishout	Project advisor Urban Designer Structural Engineer Structural Engineer Consultant Planner Consultant Planner Harbourmaster Director, QS Heritage Advisor MCA facilitator MCA facilitator support	CCC CCC Calibre Calibre Planz Planz ECan WTPi CCC Beca Beca
14 January 2020	**Meeting** to discuss Akaroa Wharf Renewal project and providing input into the MCA assessment, particularly in respect of the cultural and heritage criteria	1hr	Rik Tainui Debbie Tikao Kristine Bouw Sylvia Docherty Noelle Evans	Representative of Ōnuku Rūnanga Representative of Ōnuku Rūnanga Project lead Project coordinator MCA facilitator	Ōnuku Rūnanga CCC CCC Beca
10 February 2020	**Meeting** to further discuss the cultural criteria and assessment	1hr	Debbie Tikao Kristine Bouw Sylvia Docherty Noelle Evans	Representative of Ōnuku Rūnanga Project lead Project coordinator MCA facilitator	Ōnuku Rūnanga CCC CCC Beca
28 February 2020	**Meeting** to further discuss, review and confirm the cultural and heritage scores and assessment	0.75hr	Debbie Tikao Kristine Bouw Sylvia Docherty Fiona Wykes Amanda Ohms Matt Bonis Noelle Evans	Representative of Ōnuku Rūnanga Project lead Project coordinator Heritage Advisor Heritage Advisor Consultant Planner MCA facilitator	Ōnuku Rūnanga CCC CCC CCC CCC Planz Beca
18 March 2020	**Phone call** to confirm final cultural narrative scores		Debbie Tikao Noelle Evans	Representative of Ōnuku Rūnanga MCA facilitator	Ōnuku Rūnanga Beca
27 May 2020	**Meeting** to discuss the change of the existing abutment and impact on MCA assessment*	1hr	Kristine Bouw Tom Arthur Fiona Wykes Amanda Ohs Noelle Evans	Project lead Structural Engineer Heritage Advisor Heritage Advisor MCA facilitator	CCC Calibre CCC CCC CCC

Date	Meeting & Objective	Meeting Time	Attendees	Role	Organisation
* The original MCA assessment was based on the abutment being retained for all options. Through further investigations, it was identified that the abutment was in poor condition and that it was highly unlikely that it could be retained and integrated into the new wharf for locations Options A and B. As the MCA heritage criteria had been evaluated based on the original abutment being retained for Options A and B, it was concluded that the heritage criteria be re-evaluated, based on the worst case scenario i.e. the original abutment would be demolished and a new abutment would be constructed fit for purpose.					
23 June 2020	**Workshop** to review and confirm the heritage scores and assessment based on the abutment being completely removed, and a new abutment would be constructed fit for purpose.	1hr	Kristine Bouw Matt Bonis Fiona Wykes Amanda Ohs Noelle Evans	Project lead Consultant Planner Heritage Advisor Heritage Advisor MCA facilitator	CCC Planz CCC CCC Beca

3 Project Objectives

The objectives of the Akaroa Wharf renewal project, proposed by CCC, are as follows:

- Meet the current and future needs of the community, visitors and commercial operators.
- Develop a functional marine asset to serve the community for the next 100 years.
- Recognise the cultural and heritage significance of the wharf (circa 1887) in the context of the heritage setting of Akaroa, the wider cultural landscape and Mana Whenua identity and values.
- Meet universal accessibility requirements.
- Provide for wharf services – fuel, power, water and waste.
- Consider operational and maintenance costs.

4 Decision Context

The purpose of the MCA is to develop a robust tool to evaluate the preliminary location, and the preliminary structural options listed for the project.

The options that were developed and put forward for the MCA process comprised of the original options from the consultation engineer and options developed as a result of community feedback.

Ultimately, following stakeholder engagement, the Council will be required to make a decision about a preferred wharf location and wharf design. In making this decision the Council will be guided by the requirements of the Local Government Act 2002 (the LGA).

Under section 14.1 of the LGA:

(c) when making a decision, a local authority should take account of—

(i) the diversity of the community, and the community's interests, within its district or region; and

(ii) the interests of future as well as current communities; and

(iii) the likely impact of any decision on each aspect of well-being referred to in section 10:

The well-beings referred to are the social, economic, environmental, and cultural well-being of communities. Section 14.1 of the LGA goes on to say:

(h) in taking a sustainable development approach, a local authority should take into account—

(i) the social, economic, and cultural well-being of people and communities; and

(ii) the need to maintain and enhance the quality of the environment; and

(iii) the reasonably foreseeable needs of future generations.

Under Section 77 of the LGA:

(1) A local authority must, in the course of the decision-making process,—

(a) seek to identify all reasonably practicable options for the achievement of the objective of a decision; and

(b) assess the options in terms of their advantages and disadvantages; and

(c) if any of the options identified under paragraph (a) involves a significant decision in relation to land or a body of water, take into account the relationship of Māori and their culture and traditions with their ancestral land, water, sites, waahi tapu, valued flora and fauna, and other taonga.

Other parties impacted by the project are:

- Commercial operators/building owners located on the Akaroa Wharf.
- Commercial users of the wharf, such as fishermen, cruise ship operators and tourism operators.
- Akaroa business community, such as store owners in the township.
- Land owners affected by related change.
- Wider Akaroa Community who will be affected by proposed works.
- Local Rūnanga/ Maori Iwi.

The key stakeholders are anyone who can make a useful and significant contribution to the MCA. Key stakeholders are chosen to represent all the important perspectives on the subject of the analysis. The key stakeholders are those who were in attendance at the MCA workshops, as detailed in section 2.

Based on the results of the MCA process, the preferred option(s) will be selected and developed for consultation with key stakeholders and the wider community. A final option will then be developed using consultation feedback, which will be taken to the Council through a hearings panel to make a recommendation to Council for a final decision.

5 Options Assessed

The preliminary location options assessed are:

- **Option 0** - Restore existing wharf in its current location, no change to structural form.
- **Option A** - Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width. The original abutment would likely be completely removed, and a new abutment constructed fit for purpose.
- **Option B** - Construct a new wharf along the north side of the existing wharf, using the existing abutment. The original abutment would be completely removed, and a new abutment constructed fit for purpose.
- **Option C** - Construct a new wharf off Church Street and on the site of the original town wharf. The original abutment would be retained.
- **Option D** - Construct a new wharf from Akaroa Recreation Field/ Childrens Bay. The original abutment would be retained.

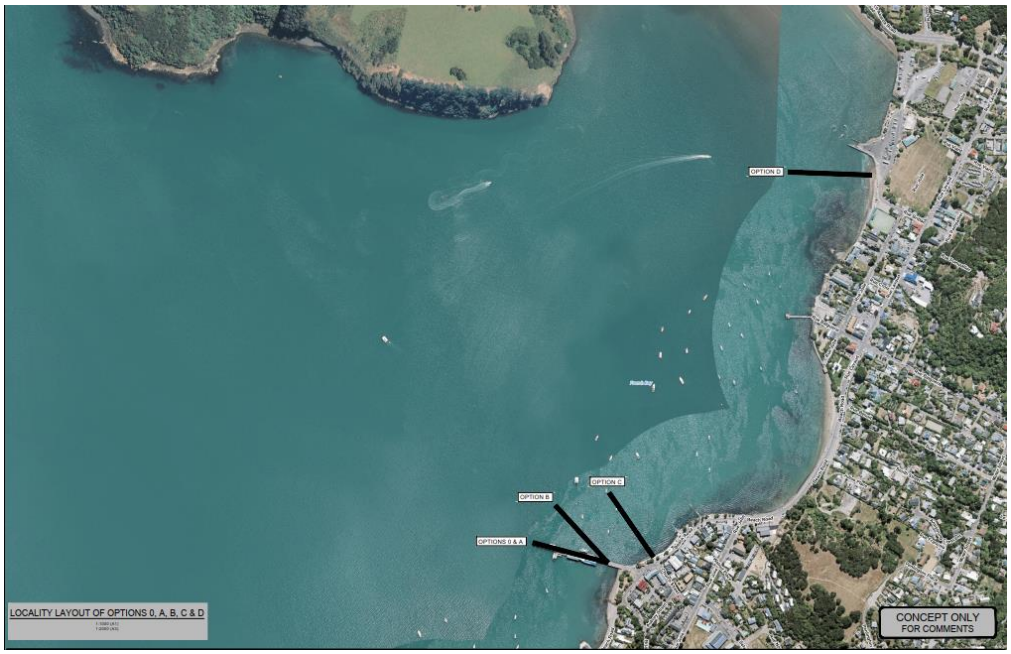


Figure 1: Plan demonstrating location Options A to D

The preliminary structural options assessed are:

- **Option 0** - Restore existing wharf in its current location, no change to structural form.
- **Option 1** - Full restoration of the existing wharf with like-for-like hardwood timber.
- **Option 2** - Full replacement with a mix of concrete and hardwood timber (visible members would be hardwood).
- **Option 3** – Full replacement with modern concrete.

6 Criteria

6.1 Background

The purpose of identifying criteria is to develop the means by which the options will be tested and compared. Each criterion must be measurable, that is, it must be possible to assess, at least in a qualitative sense, how well a particular option is expected to perform in relation to the criterion. This means for each criteria, answering the question:

"Is it possible in practice to measure or judge how well an option performs on these criteria?"

6.2 Criteria Requirements

Developing criteria requires consideration of:

- Do the criteria capture all key aspects of the objectives that are the point of the MCA?
- Over what timeframe are the criteria assessed?
- It must be possible in practice to measure or judge how well an option performs on the criteria
- The ability to distinguish between a good choice and a bad one
- Independent criteria – can you assign performance scores for the options on one criterion without knowing what the options preference scores are on any other criteria?
- Avoid using two or more criteria that essentially measure the same attribute as this would amount to double counting
- Have we included all the criteria necessary to compare the options performance?

In essence developing criteria is asking "what do we care about" and being able to "describe the consequence (what does it look like)".

6.3 Criteria Developed

The MCA criteria were developed at the MCA Criteria Setting workshop, held 02 December 2019, based on the NZTA Multi Criteria Analysis (MCA) framework guidelines, refer to Appendix A: Akaroa Wharf Renewal MCA Criteria Framework.

The criteria are categorised into the following three key areas:

1. Project Objectives
2. Implementability Objectives – including; feasibility, affordability, public/stakeholders.
3. Assessment of Effects – including; safety, community, economy, cultural, natural environment, built environment.

The following list is the criteria that those at the workshops consider as key for the Akaroa Wharf Renewal project.

1. **Project Objectives**

    - Meet the current and future needs of community, visitors and commercial operators (i.e. functionality; scale and structure)
    - Develop a functional marine asset to serve the community for the next 100 years
    - Opportunity to recognise the cultural and heritage significance of the wharf (circa 1887) in the context of the heritage setting of Akaroa, the wider cultural landscape and Mana Whenua identity and values

- Meet universal accessibility requirements (i.e. making the wharf accessible to all people of all ages, size and mobility). Both location and accessibility considered.
- Provide for wharf services – fuel, power, water and waste (commercial use)
- Consider operational and maintenance costs

2. **Implementability Objectives**

Technical

- Procurement of suitable contractors
- Wharf construction timeframe (strictly period of time taken)
- Constructability (including structural effects, in consideration of proximity to other structures)
- Construction risks - building materials (including procurement)
- Construction set down area (considering marine effects, protected trees etc.)
- Level of amenity during construction; wharf users
- Level of amenity during construction; proximate sensitive users

Consentability

- Christchurch District Plan requirements
- Canterbury Regional Coastal Plan requirements
- Canterbury Regional Policy Statement
- New Zealand Coastal Policy Statement
- Akaroa Guide Tourism
- Tourism strategy
- Meets change in sea level and king tide requirements
- Privately held property i.e. privately owned wharf buildings (incl. piles)
- Archaeological approval

Financial & operational maintenance

- Construction cost (build programme)
- Whole of life cost (including maintenance cost over asset lifetime (100 years)
- Maintainability (i.e. accessibility)

Public/stakeholders

- Community support
- Key stakeholder support (wharf operators)

3. **Assessment of Effects Objectives**

Safety in construction methodology

- Health and Safety - Construction workers
- Health and Safety - Wharf users (businesses and public; local community and tourists)
- Temporary traffic management, road closures etc. (community, businesses, tourists)

Social

- Recreational and social activities (recreational fishing, boating, walking, local amenity asset)
- Ability to cater for different user groups
- Ability to cater for future community demand
- Enabling public access to all parts of the wharf at all times, and doesn't compromise access to the beach / water.
- Tourist congestion effect
- Impact on connectivity / public open space
- Operational effect (use of larger boats taking refuge)

Economy

- Commercial impact on commercial operators of the wharf
- Commercial impact on the businesses adjacent to existing wharf
- Flexibility to cater for future demand (i.e. cruise ship, tourist & business growth)

Cultural values

- Local Rūnanga/ Maori Iwi cultural values
- Food resources/mahinga kai effect (fishing spots etc.)
- Other local community cultural values

Heritage

- Retain heritage values of existing wharf and Akaroa waterfront
- Alignment with Heritage Strategy, local rūnanga values, and ICOMOS Charter
- Alignment with Akaroa Heritage Area and Akaroa Historic Area (CCC and HNZPT respectively)
- Heritage and cultural values of adjoining Reserve, buildings and foreshore are maintained

Natural Environment

- Noise and vibration effects (including noise effects on marine mammals i.e. dolphins)
- Air quality effects
- Ecological effects
- Coastal impacts
- Visual / landscape effect on natural environment

System Integration

- Ability to provide infrastructure
- Effect on vehicle movements and active transport to the wharf and along the costal edge
- Tourist congestion effect
- Urban design and landscape effect

Environment

- Environmental impact over lifetime
- Environmental responsibility and ethics (i.e. sourcing timber, carbon miles, local supply)

7 Analysis

The MCA technique used is a numerical analysis in two stages; scoring then weighting.

7.1 Scoring

The expected consequence of each option is assigned a numerical score on a strength of preference scale for each option for each criterion. In this way more preferred options score higher on the scale, and less preferred options score lower. The scoring of criteria for this MCA has been based on NZTA guidelines, with a range from -3 to 3. With -3 having a significantly detrimental impact, while 3 having a significantly positive effect on project outcome. Refer to Appendix B, for an outline of the MCA Workshop Package briefing.

Effects criteria	Scoring (score after mitigation)
Significant adverse effect	-3
Moderate / major adverse effect	-2
Minor adverse effect	-1
Neutral / no change	0
Minor positive effect	1
Moderate / major positive effect	2
Significant positive effect	3

The scoring process was complete during the MCA assessment workshops. Discussion, questions and answers, facilitated through the workshops, enabled the attendees to work through the issues and agree a score for each option under each criterion by consensus, reducing the individual bias and making the process transparent. The summary of these discussions and scoring assessment is documented in Appendix C – Final MCA Worksheet.

7.2 Weighting

MCA decision preferences are expressed through criteria weights. In doing so the importance of each criteria relative to other criteria is expressed. Weighting of each criterion reflects their relative importance to the decision. The process of deriving weights is fundamental to the effectiveness of an MCA.

The weightings used in this MCA are based on a 'Rating' technique where a 'very low', 'low', 'medium', 'high' or 'very high' ranking is given. To assign a value to these rankings, a range from 0 to 100 has been used, consistent with NZTA processes. The CCC project leads assigned initial, 'high', 'medium' or 'low' weightings, to each criterion and requested Beca to review and assign weightings as an independent advisor.

The following are the suggested weightings for Weighting Options:

- Very Low = nil weighting (not assessed)
- Low = 25
- Medium = 50
- High = 75
- Very High = 100

The purpose of providing two more weighting options was to allow for greater distinction between options. A specific criterion is able to be assigned a greater or lesser weighting that may have otherwise been given a weighting not as representative with only three options.

The below table summarises the weightings assigned to each of the criteria, and rational for the weightings. In some instances the criteria may only apply to either the preliminary location options, or the preliminary structural options. Weightings are not assigned in these instances.

MCA Topics		MCA Criteria	Preliminary Location Weightings (Options 0, A-D)		Preliminary Structural Weightings (Options 0, 1-3)		Basis for criteria
			Ranking	% Weighting	Ranking	% Weighting	
Project Objectives							
Akaroa Wharf Renewal Project Objectives		**Meet the current and future needs of community, visitors and commercial operators (**i.e. functionality; scale and structure)	Very High	3%	N/A	0%	Input form key stakeholders is required to drive and asses the functionality.
		Develop a functional marine asset to serve the community for the next 100 years	Very High	3%	N/A	0%	Need robust and resilient asset, to meet long service life as the cost of replacement in the future will be very high.
		Opportunity to recognise the cultural and heritage significance of the wharf (circa 1887) in the context of the heritage setting of Akaroa, the wider cultural landscape and Mana Whenua identity and values	Medium	1%	N/A	0%	Structure is located in coastal marine area, with high cultural values. Heritage features need to be retained and recognised where possible.
		Meet universal accessibility requirements (i.e. making the wharf accessible to all people of all ages, size and mobility) Both location and accessibility considered	Very high	3%	N/A	0%	Avoiding social impacts, through recognising the needs of the wider community
		Provide for wharf services – fuel, power, water and waste (commercial use)	High	2%	N/A	0%	Wharf serves a commercial purpose, and there are service needs which are must haves.
		Consider operational and maintenance costs	High	2%	N/A	0%	Needs to be affordable for the community.
Project Objectives Total % Weighting				*13%*		*0%*	
Implementability Objectives							
Feasibility	**Technical**	**Procurement of suitable contractors**	Very High	3%	Very High	4.5%	Specialised work in a marine environment. Need competent and suitably experienced contractors, to manage temporary works effects.
		Wharf construction timeframe (i.e. period of disruption, strictly period of time taken to construct)	Medium	1%	Medium	2.3%	Minimising the impact on local businesses and other wharf users.

		Constructability (including structural effects, in consideration of proximity to other structures)	Medium	1%	Medium	2.3%	Managing the risks of construction and proximity to other structures. Recognising constructability is a driver of the next phase of design.
		Construction risks - building materials (including procurement)	N/A	0%	Very High	4.5%	Managing risks regarding procurement of certain materials e.g. quality, reliability of hardwood versus concrete and steel
		Construction set down area (considering marine effects, protected trees etc.)	High	2%	High	3.4%	Level of amenity on coastal edge, outside the coastal marine area during construction.
		Level of amenity during construction; wharf users	Medium	1%	N/A	0%	Impact of level of amenity during construction a new wharf
		Level of amenity during construction; proximate sensitive users	Low	0.6%	N/A	0%	Impact of disruption due to traffic movements in the local Akaroa township, due to constrained access.
	Consentability	**Christchurch District Plan requirements**	Very High	3%	Very High	4.5%	Ability to consent
		Canterbury Regional Coastal Plan requirements (Based on current Coastal Plan)	Very High	3%	Very High	4.5%	Ability to consent
		Canterbury Regional Policy Statement (Recreational and Social Outcomes)	Very High	3%	Very High	4.5%	Ability to consent
		New Zealand Coastal Policy Statement	Very High	3%	Very High	4.5%	Ability to consent
		Akaroa Guide Tourism (i.e. character and form)	Medium	1%	Medium	2.3%	Contribution of the wharf character to attracting tourists to the Akaroa township
		Tourism strategy (Targeting greater tourism growth, in Akaroa and regionally)	Medium	1%	Medium	2.3%	Capacity limited by factors outside the scope of this project, i.e. SH75
		Meets change in sea level and king tide requirements	Very High	3%	N/A	0%	Ability to meet the design standards for sea level rise and king tides
		Privately held property i.e. privately owned wharf buildings (incl. piles)	Medium	1%	N/A	0%	Impact of new wharf imposed costs on private businesses
		Archaeological approval	High	2%	N/A	0%	Impact on heritage values
	Safety and design consideration	*This category is not assessed as there is no difference between the options presented.*	N/A	0%	N/A	0%	*This category is not assessed as there is no difference between the Preliminary Location Options or Preliminary Structural Options*
Affordability	**Financial**	**Construction cost** (build programme)	High	2%	High	3.4%	Affordability to the community

	Operational/ Maintenance	**Whole of life cost** (including maintenance cost over asset lifetime (100 years) Note: locally sourced timbers for Governors bay will approx. 40 yr. life expectancy	High	2%	High	3.4%	Affordability to the community
		Maintainability (i.e. accessibility)	High	2%	N/A	0%	Affordability to the community
Public/ Stakeholders		**Community support**	N/A	0%	N/A	0%	Not evaluated. Public consultation is ongoing. Further consultation is planned, following this MCA assessment.
		Key stakeholder support (wharf operators)	High	2%	High	3.4%	Impact on wharf operator needs and preferences i.e.size, aesthetic and proximity to town centre.
Implementability Objectives Total % Weighting				*37%*		*50%*	
Assessment of Effects							
Safety	**Safety in construction methodology**	**Health and Safety - Construction workers**	Very High	3%	Very High	4.5%	Management of health and safety risks between each location and familiarity with material options during period of construction.
		Health and Safety - Wharf users (businesses and public; local community and tourists)	Very High	3%	N/A	0%	Management of health and safety risks between each location option during period of construction.
		Temporary traffic management, road closures etc. (community, businesses, tourists)	High	2%	High	3.4%	Management of health and safety risks on the wider community, during period of construction, including transport of materials to site.
Community	**Social**	**Recreational and social activities** (recreational fishing, boating, walking, local amenity asset)	Medium	1%	N/A	0%	Ability to provide recreational access to all user groups, influenced by location.
		Ability to cater for different user group (functional) requirements (current)	Medium	1%	N/A	0%	Ability to provide functional access to all user groups, influenced by location, i.e. tourism business customers.
		Ability to cater for future community demand	Very High	3%	N/A	0%	Ability to meet increased demand over lifetime.
		Enabling public access to all parts of the wharf at all times, and doesn't compromise access to the beach / water	High	2%	N/A	0%	Impact on recreational users in the coastal marine area/ beach front.
		Tourist congestion effect	High	2%	N/A	0%	Impact on tourist experience and local community
		Impact on connectivity / public open space (local amenity)	Medium	1%	N/A	0%	Impact on existing recreational spaces within the township
		Operational effect (for use of larger boats taking refuge)	Medium	1%	Medium	2.3%	Impact on potential to accommodate larger boats which take refuge, influenced by location and materiality

	Human Health	*This category is not assessed as there is no difference between the options presented.*	N/A	0%	N/A	0%	*This category is not assessed as there is no difference between the Preliminary Location Options or Preliminary Structural Options*
Economy		**Commercial impact on commercial operators of the wharf** (i.e. cruise ship tenders, fishing vessels, sightseeing cruises, interchange of baggage, stores and commercial harvest)	High	2%	High	3.4%	Economic wellbeing of wharf based businesses and community
		Commercial impact on the businesses adjacent to existing wharf (foreshore)	Medium	1%	Medium	2.3%	Economic wellbeing of landside businesses and community
		Flexibility to cater for future demand (i.e. cruise ship, tourist & business growth)	High	2%	High	3.4%	Ability to adapt to a wide range of user requirements
Cultural	**Cultural values**	**Local Runanga/ Maori Iwi cultural values** (large significance in beach access)	High	2%	High	3.4%	Impact on cultural wellbeing
		Food resources/mahinga kai effect (fishing spots etc.)	High	2%	N/A	0%	Impact on cultural wellbeing
		Other local community cultural values	Low	0.6%	N/A	0%	Impact on cultural wellbeing
	Heritage	**Retain heritage values of existing wharf and Akaroa waterfront** i.e. ability to revitalise the existing wharf, with a high level of authenticity and integrity of the existing wharf - alignment with Conservation Plan/ minimising impact and retaining maximum value. Considering individual heritage values - Historical/Social, Cultural/Spiritual, Architectural/Aesthetic, Technological/Craftsmanship, Contextual, Archaeological.	High	2%	High	3.4%	Impact on social and cultural wellbeing
		Retain any original fabric of the existing wharf, minimizing impact/maximising value (including existing concrete abutment, which is to be retained in-situ)	High	2%	High	3.4%	Impact on social and cultural wellbeing
		Alignment with Heritage Strategy, local rūnanga values, and ICOMOS Charter (Ensuring heritage is physical accessibility and providing an understanding of places through storytelling. ICOMOS relates to maintaining materials) (The ICOMOS New Zealand Charter, The Pumanawa o ICOMOS o Aotearoa Hei Tiaki I Nga Taonga Whenua	High	2%	High	3.4%	Impact on social and cultural wellbeing

		Heke Iho o Nehe is a set of guidelines on cultural heritage conservation, produced by ICOMOS New Zealand)					
		Alignment with Akaroa Heritage Area and Akaroa Historic Area (CCC and HNZPT respectively) (Heritage New Zealand Pouhere Taonga (HNZPT) is a Crown entity with a membership of around 20,000 people that advocates for the protection of ancestral sites and heritage buildings in New Zealand.)	High	2%	N/A	0%	Impact on social and cultural wellbeing
		Heritage and cultural values of adjoining Reserve, buildings and foreshore are maintained	High	2%	N/A	0%	Impact on social and cultural wellbeing
Natural Environment		**Noise and vibration effects** (including noise effects on marine mammals i.e. dolphins)	High	2%	High	3.4%	Impact on social and/ or environmental wellbeing
		Air quality effects	N/A	0%	N/A	0%	*This category is not assessed as there is no difference between the Preliminary Location Options or Preliminary Structural Options*
		Ecological effects (considering disturbance to biodiversity/ecosystems, disturbance/displacement of marine habitats, spawning areas etc., including excavation/dredging effects (during and post construction), spillage or materials into the CMA)	Medium	1%	Medium	2.3%	Impact on environmental wellbeing
		Coastal impact (i.e. impact of tidal flows on the seawall and coastal edge)	Medium	1%	Medium	2.3%	Impact on environmental wellbeing
		Visual / landscape effect on natural environment (assumption of view of land from the water)	Low	0.6%	Medium	2.3%	Impact on environmental wellbeing
Built Environment	**System Integration**	**Ability to provide infrastructure** (i.e. electricity, water, waste water. Fuel etc.)	High	2%	N/A	0%	Impact on operation, with linkages to social and economic wellbeing
		Effect on active transport to the wharf and along the costal edge (pedestrian/cycle/mobility devices)	Medium	1%	N/A	0%	Impact on operation, with linkages to social and economic wellbeing

		Tourist congestion effect (of people on wharf)	Medium	1%	N/A	0%	Impact on operation, with linkages to social and economic wellbeing
		Tourist congestion effect (Tourist buses)	Medium	1%	N/A	0%	Impact on operation, with linkages to social and economic wellbeing
		Urban design and landscape effect (i.e. effect of wharf on streetscape setting (existing street trees, furniture, paths) and on nearby landside buildings and urban form)	Low	0.6%	N/A	0%	Managing wider landscape impacts and linkages to social wellbeing
	Environment	**Environmental impact over lifetime** (i.e. Carbon footprint)	N/A	0%	High	3.4%	Managing environmental impact and sustainability
		Environmental responsibility and ethics (i.e. sourcing timber, carbon miles, local supply)	N/A	0%	High	3.4%	Managing environmental impact and sustainability
Assessment of Effects Total % Weighting				*50%*		*50%*	
Total % Weighting				*100%*		*100%*	

7.3 Results

In the MCA workshops, a score was assigned against each criterion under these key areas for each of; the baseline option (Option O), all four preliminary location options (Options A through D), and the three preliminary structural options (Options1, 2 and 3). The weighting of each criterion is then multiplied by the equivalent score for each option. Finally, the weighted score was summed to provide an overall score for each option.

The result of the MCA assessment is summarised in the table below, showing the weighted scores for each option.

Weighted Scores:

Preliminary Location Options				
Option 0	**Option A**	**Option B**	**Option C**	**Option D**
-2425	2350	1900	1550	-3475

Preliminary Structural Options			
Option 0	**Option 1**	**Option 2**	**Option 3**
-375	1025	775	-1000

The weighted MCA scores identify that Option A and B are the preferred preliminary location options, whilst Option C still scores relatively high. Options 1 and 2 are the preferred structural options.

7.4 Sensitivity Assessment

Uncertainty is inherent in the MCA process because the decision makers preferences, expressed as weights, are subjective values. Sensitivity assessment explores the robustness of the results and how sensitive they are in changes to the model. It systematically varies the weights and/or data to see how they affect the results. If a minor variation in one criterion significantly influences the result, that parameter should be subject to further scrutiny.

The sensitivity assessment completed in this MCA involved adjusting a single weighting by +10% and -10% of the pre-assigned value, and +20% and -20% of the pre-assigned values. Refer to Appendix D Sensitivity Assessment Scenarios for a summary table of the scenarios tested, to understand the influence on each criterion.

The following tables illustrate the final sensitivity assessment results for each of the Preliminary location options: 0, A, B, C and D and the Preliminary Structural options: 0, 1, 2 and 3.

- Sensitivity Assessment 1: a single weighting adjusted by +10% or -10% of the pre-assigned value
- Sensitivity Assessment 2: a single weighting adjusted by +20% or -20% of the pre-assigned value

Sensitivity Assessment 1 Results, ± 10% single weighting adjustment

Preliminary Location Options					
	Option 0	Option A	Option B	Option C	Option D
Original	-2425	2350	1900	1550	-3475
VH -10%	-2285	2210	1800	1460	-3385
H +10%	-2505	2440	1970	1540	-3715
H -10%	-2345	2260	1830	1560	-3235
M +10%	-2515	2410	1990	1720	-3585
M -10%	-2335	2290	1810	1380	-3365
L +10%	-2415	2340	1870	1500	-3565
L -10%	-2435	2360	1930	1600	-3385
VL +10%	-2425	2350	1900	1550	-3475
Average	*-2409*	*2334*	*1889*	*1540*	*-3465*

Preliminary Structural Options				
	Option 0	Option 1	Option 2	Option 3
Original	-375	1025	775	-1000
VH -10%	-365	1005	735	-990
H +10%	-385	1095	805	-1080
H -10%	-365	955	745	-920
M +10%	-415	1085	805	-1060
M -10%	-335	965	745	-940
L +10%	-375	1025	775	-1000
L -10%	-375	1025	775	-1000
VL +10%	-375	1025	775	-1000
Average	*-374*	*1023*	*771*	*-999*

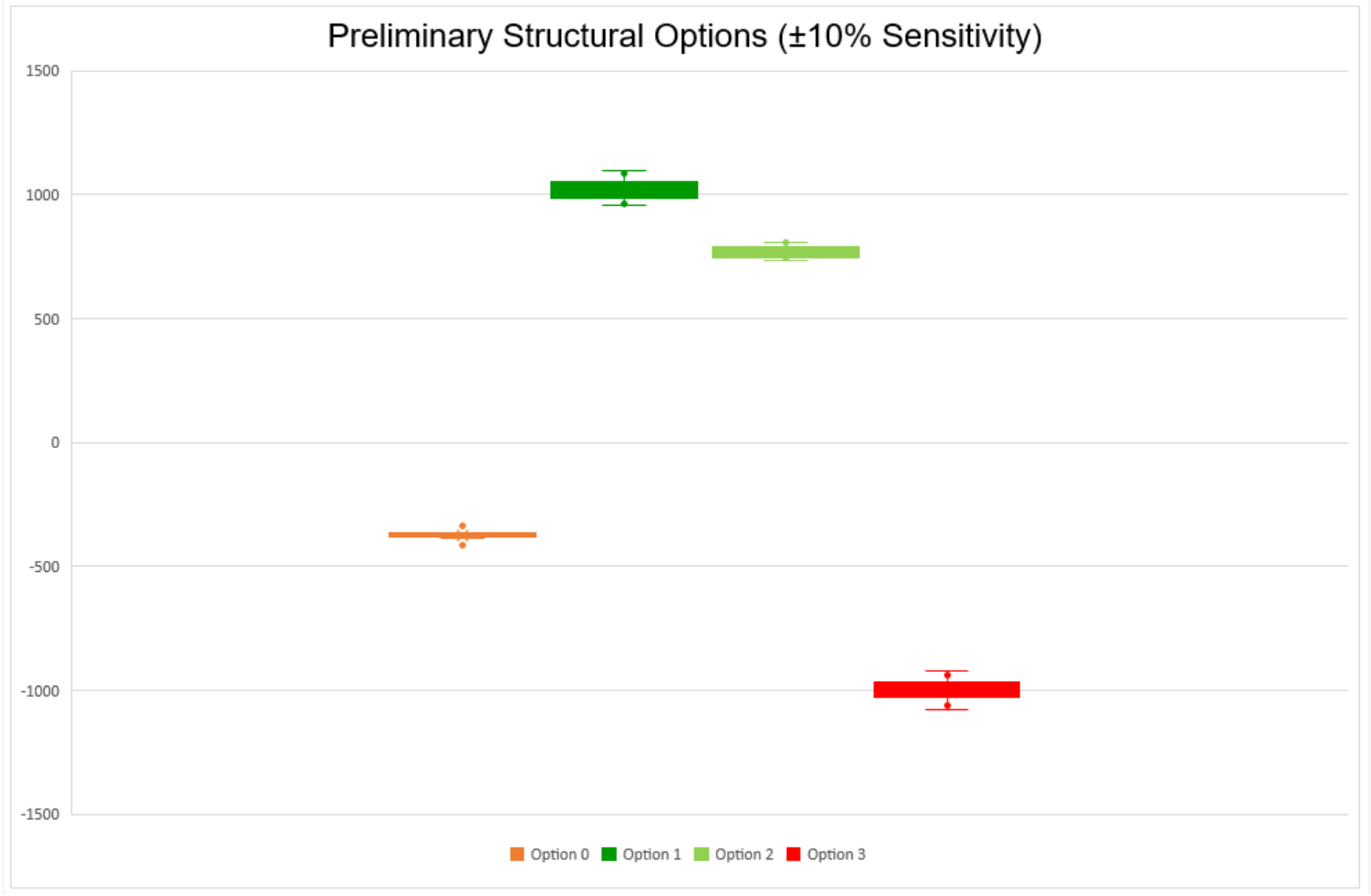
Sensitivity Assessment 2 Results, ± 20% single weighting adjustment

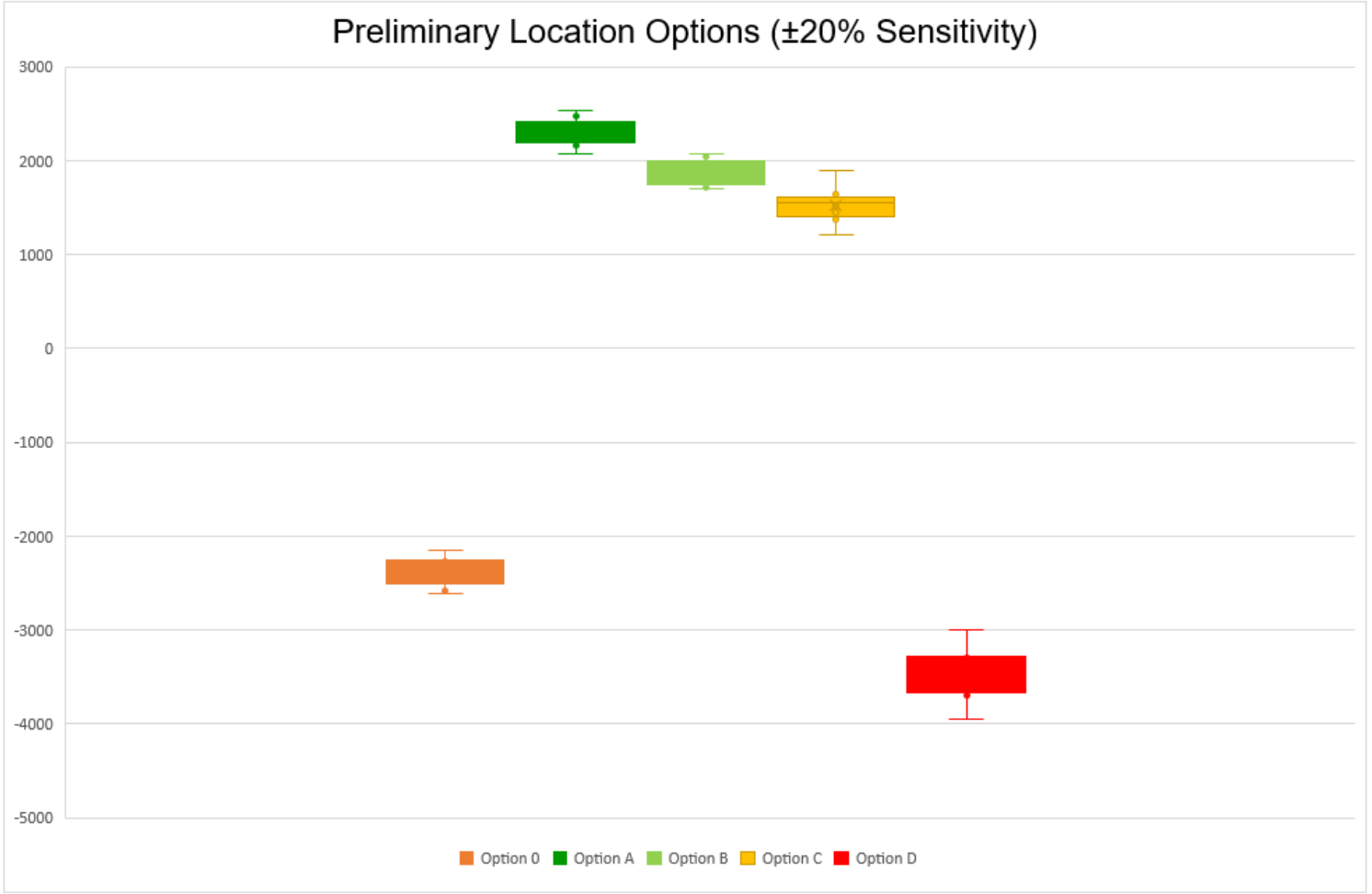
Preliminary Location Options					
	Option 0	Option A	Option B	Option C	Option D
Original	-2425	2350	1900	1550	-3475
VH -20%	-2145	2070	1700	1370	-3295
H +20%	-2585	2530	2040	1530	-3955
H -20%	-2265	2170	1760	1570	-2995
M +20%	-2605	2470	2080	1890	-3695
M -20%	-2245	2230	1720	1210	-3255
L +20%	-2405	2330	1840	1450	-3655
L -20%	-2445	2370	1960	1650	-3295
VL +20%	-2425	2350	1900	1550	-3475
Average	*-2394*	*2319*	*1878*	*1530*	*-3455*

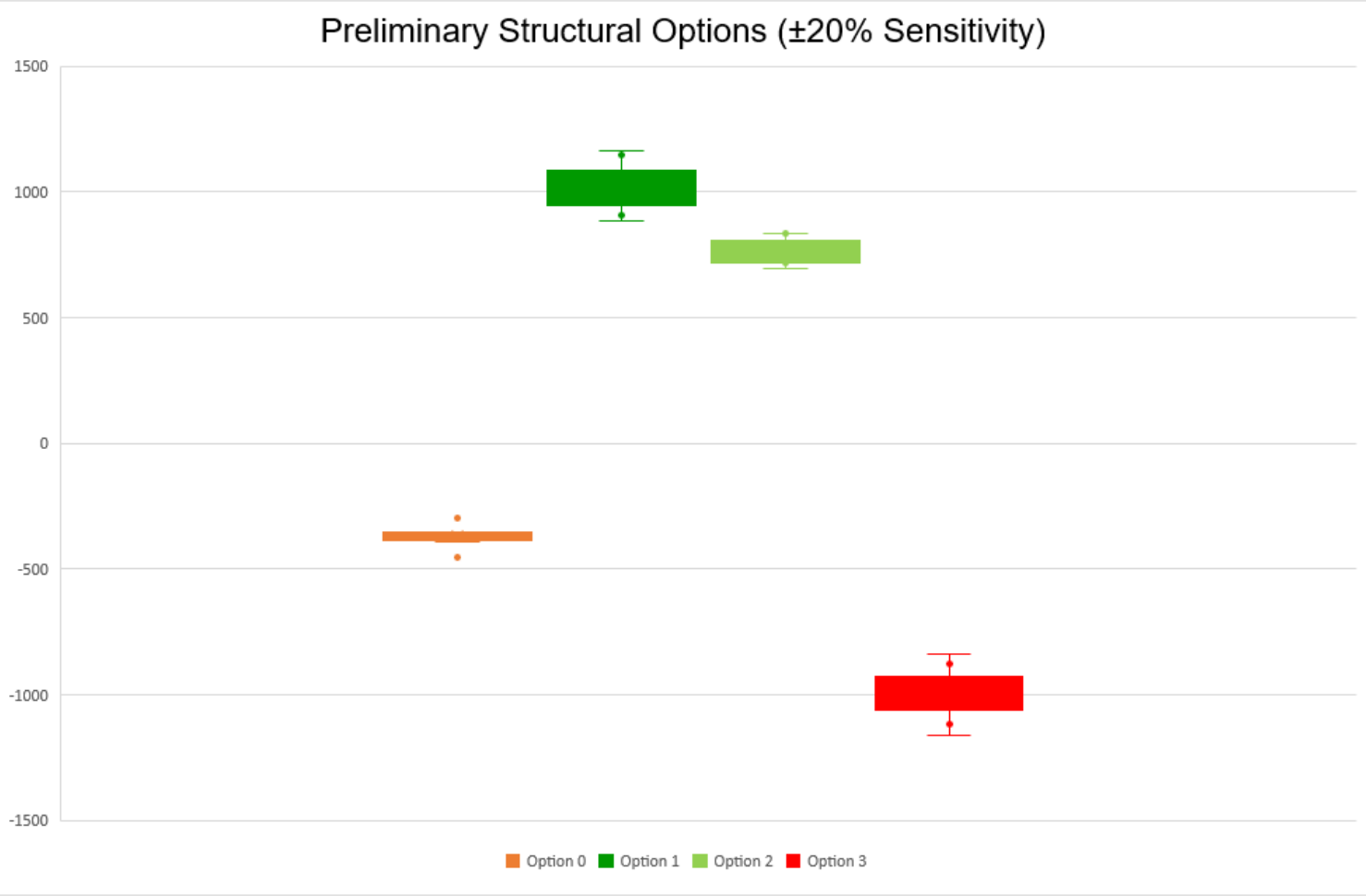
Preliminary Structural Options				
	Option 0	Option 1	Option 2	Option 3
Original	-375	1025	775	-1000
VH -20%	-355	985	695	-980
H +20%	-395	1165	835	-1160
H -20%	-355	885	715	-840
M +20%	-455	1145	835	-1120
M -20%	-295	905	715	-880
M -20%	-375	1025	775	-1000
M -20%	-375	1025	775	-1000
M -20%	-375	1025	775	-1000
Average	*-373*	*1021*	*766*	*-998*

The sensitivity assessment scenarios tested are illustrated in the Sensitivity graphs overleaf.


Preliminary Location Options (±10% Sensitivity)
3000
2000
1000
0
-1000
-2000
-3000
-4000
-5000
Option 0
Option A
Option B
Option C
Option D


Preliminary Structural Options (±10% Sensitivity)
1500
1000
500
0
-500
-1000
-1500
Option 0
Option 1
Option 2
Option 3


Preliminary Location Options (±20% Sensitivity)
3000
2000
1000
0
-1000
-2000
-3000
-4000
-5000
Option 0
Option A
Option B
Option C
Option D


Preliminary Structural Options (±20% Sensitivity)
1500
1000
500
0
-500
-1000
-1500
Option 0
Option 1
Option 2
Option 3

8 Summary

Through the MCA assessment the weighted scores show that Option A has the highest weighted score (2350) of the preliminary location options. Option B has a very similar high weighted score (1900), followed by the next closest score, Option C (1400). Options 0 and D score significantly lower than Option A (-2425 and -3475 respectively). The sensitivity assessment illustrates the order of preference is maintained in all 17 scenarios. The sensitivity assessment also illustrates very little variance from the original weighted values, which emphasises that the weighted values assigned are suitable in this context. On average, Option B scored 19% lower than Option A, and Option C scored 34% lower than Option A. Options 0 and D scored greater than 200% lower than Option A. Based on this assessment Options A and B are well within the margin of uncertainty and therefore confirmed as equally preferred. Whilst Option C is an outlier, it scored reasonably high and close to that of Options A and B, so it is recommended this option also be considered going forward. It is recommended Options 0 and D are not taken forward.

The MCA assessment also identified that Option 1 and Option 2 are the preferred preliminary structural options, with weighted scores of 1025 and 775 respectively. Option 0 and 3 score significantly lower (--375 and -1000 respectively) than Option 1. Again the sensitivity assessment shows the same order of preference is maintained for all 17 scenarios. On average Option 2 scored 25% lower than Option 1, the difference between the MCA scores for Option 1 and 2 is within the margin of uncertainty compared with the range of scores, and across all the sensitivity scenarios. Options 0 and 3 scored greater than 137% lower than Option 1. Based on this assessment, Options 1 and 2 are equally preferred and it is recommended Options 0 and 3 are not taken forward.

[redacted]

[redacted]

Location Options, A, B and C

Of the preferred preliminary location solutions identified through the MCA process, Option B: constructing a new wharf along the north side of the existing wharf, whereby the abutment is completely removed, and a new abutment is constructed fit for purpose, offers notably greater cost savings when compared to Option A: constructing a new wharf in the same location as the existing wharf, where the abutment is completely removed, and a new abutment is constructed fit for purpose.

This version of the report, Version 4.0, reports changes in advice about the risks associated with retaining the existing wharf abutment. Calibre have carried out further condition assessment relating to the abutment. One of the main issues with Option B as identified by engineering advice and discussions with marine contractors includes the risks and uncertainties with building parallel to the existing wharf. While Option B would allow much of the existing wharf to remain open during construction, there will be considerable health and safety, staging and construction management issues with this approach. Another consideration is the ability of the existing abutment to remain intact during construction works which will including piling and drilling works and which will have an unpredictable impact on the abutment and main access to the wharf. Given the age of the abutment it would be difficult to ensure that the structural integrity of the heritage concrete structure could sustain direct adjacent ground works.

In consideration, due to the structural and management complexities which need to be addressed to keep the wharf operational, Option B will be more challenging than Option A..

The cost difference between these two locations is [redacted] over 20% of the overall CAPEX, for both structural material options; Option 1: new wharf structure with like-for-like hardwood timber (excluding abutment) and Option 2: new wharf structure with a mix of concrete

and hardwood timber (excluding abutment), visible members would be hardwood. Although not shown in the above table, location Option B is also favourable for structural material Option 3: new wharf structure made from concrete (excluding abutment), also showing a cost savings of over 20% CAPEX based on the WTPi Akaroa Wharf Concept Options Estimate Report and updated based on the Council LTP Inflation Adjustment, February 2021.

Option C: constructing a new wharf off Church Street, on the site of the original town wharf, where the abutment would be retained but the existing wharf would be demolished, is estimated to be [redacted] about 6.8% on average, in overall CAPEX.

Whilst the price differential between Options A and B is significant, it is important to note that WTPi has included a 20% contingency within the cost estimates, due to the unknown risks relating to the stage of design, storage and handling, which is typical of concept design cost estimates. On this basis, as the cost differential between Options A and B is approximately 20% of the overall CAPEX, and the cost differential between Options A and C is approximately 6.8% of the overall CAPEX, the results are considered within the margin of error. In summary, the cost estimates do not identify a clear cost preference for either Option A, B or C.

Structural Options, 1 and 2

Of the structural material solutions, Option 2: new wharf structure with a mix of concrete and hardwood timber (excluding abutment), visible members would be hardwood, offers a minor cost savings when compared to Option 1: new wharf structure with like-for-like hardwood timber (excluding abutment). The cost difference between the use of these two material scenarios is $240k on average, when making a comparison between the construction of a new wharf in the existing location (Option A) and a new wharf along the north side of the existing wharf (Option B), and $150k, when comparing the construction of a new wharf in the existing location (Option A) and a new wharf off Church Street (Option C), based on the Akaroa Wharf Concept Options Estimate Report.

The cost difference between these scenarios is marginally low, in the region of 1% of the overall CAPEX across the locations. As the difference between the cost estimates for Option 1 and 2 is comfortably within the margin of error, particularly as the cost estimates are based on pre-concept designs, no conclusion can be drawn or cost preference determined between the materiality options, Option 1 and 2.

Conclusion

In summary, the MCA assessment and the concept cost estimates identify that Option A: constructing a new wharf in the same location as the existing wharf, whereby the abutment is completely removed, and a new abutment is constructed fit for purpose, and Option B: constructing a new wharf along the north side of the existing wharf, whereby the abutment is completely removed, and a new abutment is constructed fit for purpose, are equally preferred. Option C: constructing a new wharf off Church St is still an option worth consideration. The other location options score significantly lower, and therefore it is recommended that these are not taken forward.

The MCA assessment and the concept cost estimates also identify that Option 1: new wharf structure with like-for-like hardwood timber (excluding abutment) and Option 2: new wharf structure with a mix of concrete and hardwood timber (excluding abutment), visible members would be hardwood, are similarly preferred.

Whilst the MCA assessment is based on the worst case scenario where the original abutment is completely removed for Options A and B, shortly after the MCA assessment was completed, Council were exploring the possibility of constructing a new abutment north of the original abutment for Option B, i.e. adjacent to the current wharf entrance, between the original abutment and the historical shelter to the North.

This version of the report, Version 4.0, reports changes in advice about the risks associated with retaining the existing wharf abutment for certain options. Calibre have carried out further condition assessment relating to the abutment and have highlighted the risks and challenges associated with retaining this as part of the wharf redevelopment for either Option A or B, refer to Appendix E Calibre advice. This is in contrast to the April 2021 assessement, that indicated that the abutment for Option A would likely need to be demolished but for Option B could be retained.

Additionally, a new bathymetric survey was obtained for Option C, incorporated into Version 3.0 of this report, identifying that a wharf at Church Street (Option C), would have to be extended substantially further than previously considered and extensive dredging would potentially be required.

The new information that has come to light, since the MCA report was issued July 2020, would likely influence the outcome of the MCA if it were to be re-run, however this information was not considered in the original MCA. As the MCA has not been re-run to date the recommendation has not changed.

It will be critical to investigate the preferred options further, undertake further design and consultation, develop cost estimates to identify and incorporate cost risks for each of the shortlisted options, for Council to determine the preferred location and preferred structural material for the Akaroa Wharf Renewal project.

If factors influencing the MCA have changed since the original report in July 2020, then it may be advisable for Council to rerun the MCA to confirm prioritisation based on the most up to date information.

In summary, we recommend Options A, B and C are taken forward as the preferred preliminary location scenarios, and Option 1 and 2 are taken forward as the preferred preliminary structural scenarios.

Disclaimer

Beca has prepared the MCA based on reports prepared by third parties acting on behalf of Council. Beca has not been contrated by Council to provide advice or assessment of these reports, and therefore has not undertaken such analysis.

A

Appendix A – Akaroa Wharf Renewal MCA Criteria Framework

Akaroa Wharf Renewal Multi Criteria Analysis (MCA) – Criteria Framework

Objective

- To develop the Multi Criteria Analysis (MCA) framework "criteria" for Akaroa Wharf renewal, to assess the project delivery options in the MCA workshop.

Draft Criteria Outline

- Criteria determined by legislative and policy drivers / objectives, project specific aims and key issues.
- Scoring of criteria, based on NZTA guidelines, ranges from -3 to 3

Effects criteria	Scoring (score after mitigation)
Significant adverse effect	-3
Moderate / major adverse effect	-2
Minor adverse effect	-1
Neutral / no change	0
Minor positive effect	1
Moderate / major positive effect	2
Significant positive effect	3

BCR criteria	Scoring (score after mitigation)
BCR < 1.0	-3
1.0 ≤ BCR < 1.5	0
1.5 ≤ BCR	3

- Importance factor to be applied to each criteria.
- Criteria apply to the delivery of the Akaroa Wharf Renewal project

Draft Criteria

1 Investment Objectives

Objectives	Performance against investment objective
List each of the investment objectives in summary, together with a target where appropriate. Where appropriate, give details of how the objective is likely to be refined moving into the indicative business case to ensure it meets SMART principles. Akaroa Wharf Renewal Project Brief Objectives: • To investigate need for and purpose of renewed wharf in consultation with the community • To prepare costed concept plan for consultation • To prepare developed design • To acquire consents • To tender the project • To renew wharf Suggested Project Objectives i.e. desired outcomes Council want to achieve through the renewal of the Akaroa wharf • Funding objectives? • Benefit Cost Ratio? • Timing? i.e. works completed by a particular date?	For each investment objective describe to what extent each delivery option is expected to meet the objective.

• Disruption? • Provide public connection to the harbour?	
Rationale for selection or rejection of alternative:	State whether the option is being selected for consideration or being rejected. Describe why an option is favoured over the other alternatives or why the any option is being rejected for further consideration.

2 Implementability Objectives

Objective		Performance against investment objective
1. Feasibility	Technical	From a technical standpoint, how straightforward will it be to implement the option? Are any novel / untried / leading edge technologies involved? Might there be any risks involved in developing or implementing the option or significant associated hazards which may pose a health and safety risk in the design, build and final product? Might there be notable property risks to delivery? Might the option affect other infrastructure providers and in what way? What consenting risks might there be which could affect delivery or cost risk? Are there any factors which might adversely affect the ability to operate or maintain the option over its projected life without major additional costs? How feasible is the Constructability method? Are there resources available for the option? Does the option meet consent requirements? Does the option meet the change in sea level requirements? How disruptive is the delivery option?
	Consentability	
	Safety and Design	
2. Affordability	Financial	What are the funding risks of the alternative? Could the alternative be funded under traditional methods or would more novel approaches seem likely? Would there be potential cash flow risks which affect the desired delivery programme? Are their possible ongoing operating cost risks? If operating subsidies are required, how might these be funded? Does the option meet funding requirements? What impact does the option have on the cost of delivery? Does the option maximise the community benefit? What impact does the option have on operation or maintainability? i.e. is it accessible?
	Operational/ Maintenance	

3. Public/Stakeholders	Has the alternative been made public? If so, how acceptable is the alternative? Are there real or anticipated objections from particular sections of the community or from particular stakeholders? What impact does the option have on the public, local residents and businesses and wharf operators? i.e. accessibility and wharf location What is the impact on time/ programme?

3 Assessment of Effects Objectives

Objective		Weighting	Performance against investment objective
1. Safety **1.1** Safety in construction delivery methodology **1.2** Safety of public users			Explain you assessment. How will the option enhance safety for different types of wharf users? Will it involve gainers and losers in terms of safety? Are there impacts on personal safety / security? What will be the impact on fatal and serious? What H&S impact does the delivery option have on the construction workers? What are the risks?
2. Community	**Social** **1.1** Residential amenity **1.2** Business amenity **1.3** Visual amenity **1.4** Severance / Connectivity **1.5** Urban Form **1.6** Community facilities		Could the option affect accessibility for the public, including access to jobs, communities, shops, services and other facilities? Could the delivery option negatively impact on community fatigue? Could the delivery option negatively impact on businesses? i.e. length of construction programme, restricted waterfront access to businesses due to congestion or construction hoarding
	Human Health		Could the option result in significant risk to human health related to noise, air quality or contaminated land? *Is there any difference between the design or location options? If not, suggest this either be removed from the MCA criteria and reported separately, or included in the criteria but given a low weighting. Note, this would likely be scored equally for all options.*

3. System Integration		Are there any system effects on infrastructure? Does the option impact on the Urban and Landscape design? How does the delivery option impact on local infrastructure? Will the wharf become more congested during the period of construction, especially in the summer months with increase in tourists?
4. Economy		How does the option impact economic growth? How well does the delivery option impact the development potential of adjacent land / attract new jobs / help existing businesses? i.e. length of delivery programme How does the option impact: Community growth? Tourist growth? Cruise ship growth? Fishing vessel effects? Retail opportunity? Location benefit (marketing)?
5. Cultural **5.1** Cultural values **5.2** Heritage		Could the option impact on cultural and iwi values? How does the option impact on the existing wharf (historical value)? Will the option meet the architectural and aesthetic values?
6. Natural Environment **6.1** Noise and vibration **6.2** Air quality **6.3** Ecological		To what extent does the option impact on the natural environment? *Is there any difference between the design or location options?*
7. Built Environment		To what extent does the option impact on the environment? How does the option impact on the built environment once construction has been completed? How does the option impact on the built environment during construction?

B

Appendix B – MCA Workshop Package – Agenda, Objective and Scoring Guideline, Draft Worksheet, Attendees List

Agenda

Akaroa Wharf Renewal Project MCA Workshop Agenda

To be held 09 December 2019 at 1:30pm to 4:00pm

At the BNZ Centre, 120 Hereford Street, Christchurch Central City, Christchurch 8011

Invitees:	Noelle Evans (Beca) – Chair	Boyd Barber (CCC)
	Scott van Lieshout (Beca)	Fiona Wykes (CCC)
	Paul Rogers (CCC)	Richard Herdman (CCC)
	Kristine Bouw (CCC)	Tom Arthur (Calibre Group)
	Paul Devlin (CCC)	Matt Bonis (Planz Consultants)
	Kay Holder (CCC)	Ian Fox (ECan)
		Luke Donnelly (WT Partnership)

Apologies Sylvia Docherty (CCC)

Item		Action
1	Welcome and Introductions	KB
2	Project Recap	KB
3	Akaroa Wharf Renewal Options	
	Option Overview and Key Points	NE
4	Option Evaluation	
	MCA Criteria Overview	NE
	Akaroa Option MCA Evaluation	All
	MCA Criteria Importance factor weightings	NE
5	Summary and Next Steps	NE / KB

Akaroa Wharf Renewal Multi Criteria Analysis (MCA)
Objective and Scoring Guideline

Objective

The main Akaroa Wharf has reached the end of its functional and economic life.

The purpose of the Multi Criteria Analysis (MCA) workshop is to provide a robust method to score and rank the Akaroa Wharf Renewal options according to a range of "criteria", enabling a preferred option to be generated.

The Multi Criteria Analysis (MCA) "criteria" is determined by legislative and policy drivers / objectives, project specific aims and key issues. The MCA criteria established for this workshop has been developed in collaboration with the project team, including key members from Council project team, Planz Consultants, Calibre Group, ECan, Council Heritage and Urban Design.

Scoring Guideline

- Scoring of criteria, based on NZTA guidelines, ranges from -3 to 3

Effects criteria	Scoring
Significant adverse effect	-3
Moderate / major adverse effect	-2
Minor adverse effect	-1
Neutral / no change	0
Minor positive effect	1
Moderate / major positive effect	2
Significant positive effect	3

Benefit Cost Ratio (BCR) criteria	Scoring
BCR < 1.0	-3
1.0 ≤ BCR < 1.5	0
1.5 ≤ BCR	3

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS

MCA Criteria enabling a preferred wharf option		Baseline Option	Preliminary Location Options			
MCA Topics	**MCA Criteria**	**Option 0** Restore existing wharf in its current location, no change to structural form.	**Option A** Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width.	**Option B** Construct a new wharf along the north side of the existing wharf, and using the existing abutment	**Option C** Construct a new wharf off Church Street and on the site of the original town wharf	**Option D** Construct a new wharf from Akaroa Recreation Field/ Childrens Bay
Project Description	To renew the Akaroa Wharf when it reaches the end of its useful life. OPUS recommendations is that the wharf has another 5-10 years life remaining. Demand and use is to be investigated to ensure fit for purpose design.					
Akaroa Wharf Renewal Project Objectives	**Meet the current and future needs of community, visitors and commercial operators**					
	Develop a functional marine asset to serve the community for the next 100 years					
	Recognise the cultural and heritage significance of the wharf (circa 1887) in the context of the heritage setting of Akaroa					
	Meet universal accessibility requirements					
	Provide for wharf services – fuel and waste					
	Consider operational and maintenance costs					
Implementability						
Feasibility – Technical	**Procurement of suitable contractors**					
	Wharf construction timeframe					
	Constructability (including structural effects, in consideration of proximity to other structures)					
	Construction risks - building materials (including procurement)					
	Construction set down area (considering marine effects, protected trees etc.)					
	Level of amenity during construction (disruption effect)					
Feasibility – Consentability	**Christchurch District Plan requirements**					
	Canterbury Regional Coastal Plan requirements					
	Canterbury Regional Policy Statement					
	New Zealand Coastal Policy Statement					
	Akaroa Guide Tourism					
	Tourism strategy					
	CMA consenting requirements (i.e. structures and occupation within the CMA, disturbance and modification and ongoing maintenance requirements)					
	Meets change in sea level and king tide requirements					
	Privately held property i.e. privately owned wharf buildings (incl. piles)					
	Archaeological approval					
Feasibility – Safety and design consideration		Are there any significant associated hazards which may pose a H&S risk in the design, build and final product? (not captured under Safety in Construction Methodology bel				
Affordability – Financial	**Construction cost** (build programme)					
Affordability – Operational/ Maintenance	**Whole of life cost** (including maintenance cost over asset lifetime (100 years))					
	Operation ease / Maintainability (i.e. accessibility)					
Public/ Stakeholders	**Community approval**					
	Key Stakeholder approval (wharf operators)					
	Alignment with feedback sought through public consultation					
Assessment of Effects						
Safety – Safety in construction methodology	**Health and Safety - Construction workers**					
	Health and Safety - Wharf users (businesses and public; local community and tourists)					
	Temporary traffic management, road closures etc. (community, businesses, tourists)					
Community – Social	**Recreational and social activities** (recreational fishing, boating, walking, local amenity asset)					
	Ability to cater for different usergroup (functional) requirements (current)					
	Ability to cater for future community demand					
	Accessbility					
	Impact on connectivity / public open space (local amenity)					
	Operational effect (for use of larger boats taking refuge)					
Community – Human Health		Could any of the options result in significant risk to human health, related to noise, air quality or contaminated land (separate from Natural Environment below)? If there is no impact or difference between the above options, suggest this category be removed from the MCA criteria.				
Economy	**Commercial impact on commercial operators of the wharf** (i.e. cruise ship tenders, fishing vessels, sightseeing cruises, interchange of baggage, stores and commercial harvest)					
	Commercial impact on the businesses adjacent to existing wharf					
	Flexibility to cater for future demand (i.e. cruise ship, tourist & business growth)					

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS

MCA Criteria enabling a preferred wharf option			Baseline Option	Preliminary Location Options			
MCA Topics		**MCA Criteria**	**Option 0** Restore existing wharf in its current location, no change to structural form.	**Option A** Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width.	**Option B** Construct a new wharf along the north side of the existing wharf, and using the existing abutment	**Option C** Construct a new wharf off Church Street and on the site of the original town wharf	**Option D** Construct a new wharf from Akaroa Recreation Field/ Childrens Bay
Cultural	Cultural values	**Local Runanga/ Maori Iwi cultural values**	Placeholder - to be developed with Ōnuku Rūnanga in early 2020				
		Food resources/mahinga kai effect (fishing spots etc.)					
		Other local community cultural values					
	Heritage	**Retain heritage values of existing wharf and Akaroa waterfront** i.e. ability to revitalise the existing wharf, with a high level of authenticity and integrity of the existing wharf - alignment with Conservation Plan/ minimising impact and retaining maximum value. Considering individual heritage values - Historical/Social, Cultural/Spiritual, Architacturel/Aesthetic, Technological/Craftsmanship, Contextual, Archaeological.					
		Retain any original fabric of the existing wharf, minimizing impact/maximising value (including existing concrete abutment, which is to be retained in-situ)					
		Alignment with Heritage Strategy, local rūnanga values, and ICOMOS Charter (The ICOMOS New Zealand Charter, Te Pumanawa o ICOMOS o Aotearoa Hei Tiaki I Nga Taonga Whenua Heke Iho o Nehe is a set of guidelines on cultural heritage conservation, produced by ICOMOS New Zealand)					
		Alignment with Akaroa Heritage Area and Akaroa Historic Area (CCC and HNZPT respectively) (Heritage New Zealand Pouhere Taonga (HNZPT) is a Crown entity with a membership of around 20,000 people that advocates for the protection of ancestral sites and heritage buildings in New Zealand.)					
		Heritage values of adjoining Reserve, buildings and foreshore are maintained					
		Enabling public access to all parts of the wharf at all times					
Natural Environment		**Noise and vibration effects** (including noise effects on marine mammals i.e. dolphins)					
		Air quality effects					
		Ecological effects (considering disturbance to biodiversity/ecosystems, disturbance/displacement of marine habitats, spawning areas etc., including excavation/dredging effects (during and post construction), spillage or materials into the CMA)					
		Coastal impacts (i.e. cruise ship effects on Akaroa harbour)	(N.A. - applicable to location options)				
		Visual / landscape effect on natural environment					
Built Environment	System Integration	**Local infrastructure effect**					
		Tourist congestion effect		(N.A. - applicable to preliminary structural options)			
		Urban design and landscape effect (i.e. on adjacent heritage buildings and businesses) Does Akaroa have a character area/ guidance?					
	Environment	**Environmental value** (carbon footprint)					
		Environmental impact (i.e. Use of construction materials)					

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS

MCA Criteria enabling a preferred wharf option			Preliminary Structural Options		
			Option 1: Full restoration of the existing wharf with like-for-like hardwood timber.	Option 2: Full replacement with a mix of concrete and hardwood timber (visible members would be hardwood).	Option 3: Full replacement with modern concrete.
MCA Topics		**MCA Criteria**			
Project Description		To renew the Akaroa Wharf when it reaches the end of its useful life. OPUS recomm			
Akaroa Wharf Renewal Project Objectives		**Meet the current and future needs of community, visitors and commercial operators**			
		Develop a functional marine asset to serve the community for the next 100 years			
		Recognise the cultural and heritage significance of the wharf (circa 1887) in the context of the heritage setting of Akaroa			
		Meet universal accessibility requirements			
		Provide for wharf services – fuel and waste			
		Consider operational and maintenance costs			
Implementability					
Feasibility	Technical	**Procurement of suitable contractors**			
		Wharf construction timeframe			
		Constructability (including structural effects, in consideration of proximity to other structures)			
		Construction risks - building materials (including procurement)			
		Construction set down area (considering marine effects, protected trees etc.)			
		Level of amenity during construction (disruption effect)			
	Consentability	**Christchurch District Plan requirements**			
		Canterbury Regional Coastal Plan requirements			
		Canterbury Regional Policy Statement			
		New Zealand Coastal Policy Statement			
		Akaroa Guide Tourism			
		Tourism strategy			
		CMA consenting requirements (i.e. structures and occupation within the CMA, disturbance and modification and ongoing maintenance requirements)			
		Meets change in sea level and king tide requirements			
		Privately held property i.e. privately owned wharf buildings (incl. piles)			
		Archaeological approval			
	Safety and design consideration				
Affordability	Financial	**Construction cost** (build programme)			
	Operational/ Maintenance	**Whole of life cost** (including maintenance cost over asset lifetime (100 years))			
		Operation ease / Maintainability (i.e. accessibility)			
Public/ Stakeholders		**Community approval**			
		Key Stakeholder approval (wharf operators)			
		Alignment with feedback sought through public consultation			
Assessment of Effects					
Safety	Safety in construction methodology	**Health and Safety - Construction workers**			
		Health and Safety - Wharf users (businesses and public; local community and tourists)			
		Temporary traffic management, road closures etc. (community, businesses, tourists)			
Community	Social	**Recreational and social activities** (recreational fishing, boating, walking, local amenity asset)			
		Ability to cater for different usergroup (functional) requirements (current)			
		Ability to cater for future community demand			
		Accessbility			
		Impact on connectivity / public open space (local amenity)			
		Operational effect (for use of larger boats taking refuge)			
	Human Health				
Economy		**Commercial impact on commercial operators of the wharf** (i.e. cruise ship tenders, fishing vessels, sightseeing cruises, interchange of baggage, stores and commercial harvest)			
		Commercial impact on the businesses adjacent to existing wharf			
		Flexibility to cater for future demand (i.e. cruise ship, tourist & business growth)			

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS					
MCA Criteria enabling a preferred wharf option			Preliminary Structural Options		
MCA Topics		**MCA Criteria**	**Option 1:** Full restoration of the existing wharf with like-for-like hardwood timber.	**Option 2:** Full replacement with a mix of concrete and hardwood timber (visible members would be hardwood).	**Option 3:** Full replacement with modern concrete.
Cultural	Cultural values	~~**Local Runanga/ Maori Iwi cultural values**~~			
		Food resources/mahinga kai effect (fishing spots etc.)			
		Other local community cultural values			
	Heritage	**Retain heritage values of existing wharf and Akaroa waterfront** i.e. ability to revitalise the existing wharf, with a high level of authenticity and integrity of the existing wharf - alignment with Conservation Plan/ minimising impact and retaining maximum value. Considering individual heritage values - Historical/Social, Cultural/Spiritual, Architacturel/Aesthetic, Technological/Craftsmanship, Contextual, Archaeological.			
		Retain any original fabric of the existing wharf, minimizing impact/maximising value (including existing concrete abutment, which is to be retained in-situ)			
		Alignment with Heritage Strategy, local rūnanga values, and ICOMOS Charter (The ICOMOS New Zealand Charter, Te Pumanawa o ICOMOS o Aotearoa Hei Tiaki I Nga Taonga Whenua Heke Iho o Nehe is a set of guidelines on cultural heritage conservation, produced by ICOMOS New Zealand)			
		Alignment with Akaroa Heritage Area and Akaroa Historic Area (CCC and HNZPT respectively) (Heritage New Zealand Pouhere Taonga (HNZPT) is a Crown entity with a membership of around 20,000 people that advocates for the protection of ancestral sites and heritage buildings in New Zealand.)			
		Heritage values of adjoining Reserve, buildings and foreshore are maintained			
		Enabling public access to all parts of the wharf at all times			
Natural Environment		**Noise and vibration effects** (including noise effects on marine mammals i.e. dolphins)			
		Air quality effects			
		Ecological effects (considering disturbance to biodiversity/ecosystems, disturbance/displacement of marine habitats, spawning areas etc., including excavation/dredging effects (during and post construction), spillage or materials into the CMA)			
		Coastal impacts (i.e. cruise ship effects on Akaroa harbour)	(N.A. - applicable to location options)		
		Visual / landscape effect on natural environment			
Built Environment	System Integration	**Local infrastructure effect**			
		Tourist congestion effect			
		Urban design and landscape effect (i.e. on adjacent heritage buildings and businesses) Does Akaroa have a character area/ guidance?			
	Environment	**Environmental value** (carbon footprint)			
		Environmental impact (i.e. Use of construction materials)			

Akaroa Wharf Replacement – Multi Criteria Analysis Workshop

Monday 9th December

Rapaki Room, BNZ Business Partners Centre, Cashel Street, Christchurch 8011 link to map

Attendees

	Name	Organisation	Role	Email
1	Noelle Evans	Beca	Workshop Facilitator	Noelle.Evans@beca.com
2	Paul Devlin	Christchurch City Council	Project Sponsor	Paul.Devlin@ccc.govt.nz
3	Kay Holder	Christchurch City Council	Project Sponsor	Kay.Holder@ccc.govt.nz
4	Kristine Bouw	Christchurch City Council	Project Manager	Kristine.Bouw@ccc.govt.nz
5	Paul Rogers	Christchurch City Council	Project Advisor	paul.rogers@spireconsulting.co.nz
6	Tom Arthur	Calibre	Structural Engineer	Tom.Arthur@calibregroup.com
7	William Southby	Calibre	Structural Engineer	William.Southby@calibregroup.com
8	Boyd Barber	Christchurch City Council	Urban Design	Boyd.Barber@ccc.govt.nz
9	Matt Bonis	Planz	Planning/Consent	matt@planzconsultants.co.nz
10	Livi Whyte	Planz	Planning/Consent	livi@planzconsultants.co.nz
11	Ian Fox	3Can	Harbourmaster	Ian.Fox@ecan.govt.nz
12	Luke Donnelly	WT Partnership	Director, QS	luke.donnelly@wtpartnership.co.nz
13	Fiona Wykes	Christchurch City Council	Heritage	Fiona.Wykes@ccc.govt.nz
14	Richard Herdman	Christchurch City Council	Heritage	Richard.Herdman@ccc.govt.nz
15	Jamie Stewart	Christchurch City Council	Community Board member	Jamie.Stewart@ccc.govt.nz
16	Nigel Harrison	Christchurch City Council	Community Board member	Nigel.Harrison@ccc.govt.nz
17	Tori Peden	Christchurch City Council	Community Board Chair	Tori.Peden@ccc.govt.nz
18	Scott Van Leishout	Beca	Workshop Facilitator Support	Scott.vanLieshout@beca.com

C

Appendix C – Final MCA Worksheet

Christchurch City Council

Item 4

Attachment E

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS

MCA Criteria enabling a preferred wharf option				Baseline Option	Preliminary Location Options			
MCA Topics	MCA Criteria		Weighting %	Option 0 Restore existing wharf in its current location, no change to structural form.	Option A Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width. Abutment completely removed, and new abutment constructed fit for purpose.	Option B Construct a new wharf along the north side of the existing wharf, using the existing abutment. Existing wharf will be demolished. Abutment completely removed, and new abutment constructed fit for purpose.	Option C Construct a new wharf off Church Street and on the site of the original town wharf. Existing wharf will be demolished. Abutment would be retained.	Option D Construct a new wharf from Akaroa Recreation Field/ Children's Bay. Existing wharf will be demolished. Abutment would be retained.
Project Description	To renew the Akaroa Wharf when it reaches the end of its useful life. OPUS recommendations is that the wharf has another 5-10 years life remaining. Demand and use is to be investigated to ensure fit for purpose design.							
Project Objectives								
Akaroa Wharf Renewal Project Objectives	**Meet the current and future needs of community, visitors and commercial operators** (i.e. functionality; scale and structure)	VH	100.00	-3	3	3	3	3
		Comments		It is anticipated that in 20 to 30 years the wharf will not adequately meet the user functionality requirements, due to the current platform level, structural form, rising sea levels and degradation.	A new wharf will be designed to the latest design standards, taking into consideration the changing sea level, and to meet the current and future functional requirements.	A new wharf will be designed to the latest design standards, taking into consideration the changing sea level, and to meet the current and future functional requirements.	A new wharf will be designed to the latest design standards, taking into consideration the changing sea level, and to meet the current and future functional requirements.	A new wharf will be designed to the latest design standards, taking into consideration the changing sea level, and to meet the current and future functional requirements.
	Develop a functional marine asset to serve the community for the next 100 years	VH	100.00	-2	3	3	3	-1
		Comments		The existing wharf is currently reaching maximum capacity at peak tourist (cruise boat visitor) times. It is close to the end of its design life, and the expectation is that it will not last another 100 years.	A new wharf will be designed for a life span of 100 years.	A new wharf will be designed for a life span of 100 years.	A new wharf will be designed for a life span of 100 years.	A new wharf will be designed for a life span of 100 years, however dredging will be required over the lifetime of the wharf at this location. Dredging shifts the activity centre, and is prone to sea level rise. The wharf will be less resilient
	Opportunity to recognise the cultural and heritage significance of the wharf (circa 1887) in the context of the heritage setting of Akaroa, the wider cultural landscape and Mana Whenua identity and values	M	50.00	2	1	1	0	-1
		Comments		A substantial amount of new timber will be required to restore the original wharf. As the original species cannot be sourced, the timber will be replaced with timber that closely resembles the original. It will look similar, and meet other heritage criteria, but the materiality heritage will be lost.	The look and feel of the wharf will be retained, by maintaining the wharf in the same location and alignment. Heritage relating to the original materials will be lost.	The look and feel of the wharf will be retained, by maintaining the wharf in a similar position and alignment. Heritage relating to the original materials will be lost.	The heritage relationship would be lost, as the new site is not on or adjacent to the original site.	The heritage relationship would be lost, as the new site is not on or adjacent to the original site. Would have the largest negative impact.
	Meet universal accessibility requirements (i.e. making the wharf accessible to all people of all ages, size and mobility) Both location and accessibility considered	VH	100.00	-2	3	3	3	-1
		Comments		The existing wharf is narrow, and extremely congested at peak tourist (cruise boat visitor) times. The timber deck surface is uneven, a number of boards are a tripping hazard.	A new wharf will be designed to meet universal accessibility requirements.	A new wharf will be designed to meet universal accessibility requirements.	A new wharf will be designed to meet universal accessibility requirements.	A new wharf will be designed to meet universal accessibility requirements. This location is more remote/ not as well connected to the town centre compared to the other location options.
	Provide for wharf services – fuel, power, water and waste (commercial use)	H	75.00	-1	3	3	3	3
		Comments		Currently failing with some ferries. High cost to rectify / ma	A new structure will allow for new service connections, to meet current wharf requirements and with built-in flexibility	A new structure will allow for new service connections, to meet current wharf requirements	A new structure will allow for new service connections, to meet current wharf requirements	A new structure will allow for new service connections, to meet current wharf
	Consider operational and maintenance costs	H	75.00	-3	3	3	3	-3
		Comments		Exponential cost associated with maintaining the existing wharf for the next 100 years. It is close to the end of its design life and it is anticipated that in 20 to 30 years the wharf will not adequately meet the user functionality requirements, due to the current platform level, structural form, rising sea levels and degradation.	A new wharf will be designed for a life span of 100 years. General maintenance will be expected.	A new wharf will be designed for a life span of 100 years. General maintenance will be expected.	A new wharf will be designed for a life span of 100 years. General maintenance will be expected.	A new wharf will be designed for a life span of 100 years. Ongoing dredging throughout the wharf lifespan will cause significant maintenance costs.
Project Objectives Score	NZTA Base Score & Weighting			-900	1400	1400	1350	50
Implementability Objectives								
Technical	**Procurement of suitable contractors**	VH	100.00	0	1	1	1	1
		Comments		Less businesses available with capability to build traditional wharfs.	Scarcity of wharf construction contractors available in New Zealand market.	Scarcity of wharf construction contractors available in New Zealand market.	Scarcity of wharf construction contractors available in New Zealand market.	Scarcity of wharf construction contractors available in New Zealand market.
	Wharf construction timeframe (i.e. period of disruption, strictly period of time taken to construct)	M	50.00	-1	0	0	1	1
		Comments		Large disruption expected, over a substantial period of time due to the complexity of restoring the existing wharf.	Large disruption expected, over a substantial period of time due to the complexity of constructing atop of the existing wharf. Not anticipated to be as complex as restoring the existing wharf.	Large disruption expected, over a substantial period of time due to the complexity of constructing North and alongside the existing wharf. Not anticipated to be as complex as restoring the existing wharf. Expect duration would be similar to constructing atop of the existing wharf.	No connection to existing wharf. Less complexity/ staging involved. Shorter construction period anticipated. Existing wharf would be kept operational until new wharf is available.	No connection to existing wharf. Less complexity/ staging involved. Shorter construction period anticipated. Dredging would not have a major impact on timeframe. Existing wharf would be kept operational until new wharf is available.
	Constructability (including structural effects, in consideration of proximity to other structures)	M	50.00	-2	-2	-1	1	-1
		Comments		Major challenges in structure and management, to keep wharf operational during construction.	Major challenges in structure and management, to keep wharf operational during construction.	Less challenging than building atop of existing wharf, however will still have construction management challenges around abutment, small proximity for construction.	Note there will be seawall and landside buildings challenges.	Anticipate challenges relating to the finger jetty structure.
	Construction risks - building materials (including procurement)							
		Comments			This category is not assessed as there is no difference between the above options, in assessing Construction risks with respect to building materials.			

Christchurch City Council

Item 4

Attachment E

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MCA Topics		MCA Criteria		Weighting %	Option 0 Restore existing wharf in its current location, no change to structural form.	Option A Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width. Abutment completely removed, and new abutment constructed fit for purpose.	Option B Construct a new wharf along the north side of the existing wharf, using the existing abutment. Existing wharf will be demolished. Abutment completely removed, and new abutment constructed fit for purpose.	Option C Construct a new wharf off Church Street and on the site of the original town wharf. Existing wharf will be demolished. Abutment would be retained.	Option D Construct a new wharf from Akaroa Recreation Field/ Children's Bay. Existing wharf will be demolished. Abutment would be retained.
Feasibility		**Construction set down area** (considering marine effects, protected trees etc.)	H	75.00	-2	-2	-2	-2	-1
			Comments		Challenging, as potential nearby set down areas are protected Heritage sites.	Challenging, as potential nearby set down areas are protected Heritage sites.	Challenging, as potential nearby set down areas are protected Heritage sites.	Challenging due to heritage and proximity.	Easiest of all options, with larger, more open spaces.
		Level of amenity during construction; wharf users	M	50.00	-3	-3	-1	3	3
			Comments		Construction will constrain functionality of existing wharf. Temporary walkway structure is likely to be required to maintain access to outer end of wharf during construction	Construction will constrain functionality of existing wharf. Temporary walkway structure is likely to be required to maintain access to outer end of wharf during construction	Construction will constrain wharf access and functionality of existing wharf, especially around the abutment. This will be felt to a lesser extent when compared to constructing atop of the existing wharf.	As the new wharf will not be close to commercial operators, the existing wharf will remain fully operational during construction, providing full amenities.	As the new wharf will not be close to commercial operators, the existing wharf will remain fully operational during construction, providing full amenities. May need to move existing moorings at the site of the new wharf.
		Level of amenity during construction; proximate sensitive users	L	25.00	-1	-2	-2	-3	-2
					Some disruption will be felt.	A greater level of disruption will be felt, due to constructing a higher platform atop of the existing wharf.	A greater level of disruption will be felt, as access to the existing wharf will be restricted	Challenging as the area is will be highly congested, and therefore will cause the largest amount of disruption of the options presented.	Impacts recreational boat launch. There is limited access at high tide.
	Consentability	**Christchurch District Plan requirements**	VH	100.00	1	1	0	-1	-3
			Comments		Hazards challenging to manage. Great from a heritage perspective.	Hazards challenging to manage. Great from a heritage perspective.	Proximity issues.	Urban design issues.	A lot of challenges with location.
		Canterbury Regional Coastal Plan requirements (Based on current Coastal Plan)	VH	100.00	0	1	-1	-1	-3
			Comments		The coastal plan will be unaffected, as no changes or modifications required to coastal environment.		Dredging required.	A new structure in the CMA, and associated dredging.	More significant impact on costal environment. Ongoing requirement for dredging.
		Canterbury Regional Policy Statement (Recreational and Social Outcomes)	VH	100.00	2	2	0	-1	-2
			Comments		Balances recreational and social.	Balances recreational and social.		Minor modification of natural heritage environment	Significant change in natural heritage environme
		New Zealand Coastal Policy Statement	VH	100.00	0	0	0	-1	-2
			Comments		No change in Akaroa coastline.	No change in Akaroa coastline.	Minor change in Akaroa coastline.	New infrastructure on coastline.	New infrastructure on coastline, and ongoing effects of dredging.
		Akaroa Guide Tourism (i.e. character and form)	M	50.00	0	2	2	2	-2
			Comments		Doesn't allow for future growth for the community. Noting that this could be both positive or negative impact, dependent on community aspirations.	Allowance for growth within the township setting.	Allowance for growth within the township setting.	Allowance for growth within the township setting.	This new location would have a negative affect on local form and growth of the township
		Tourism strategy (Targeting greater tourism growth, in Akaroa and regionally)	M	50.00	0	0	0	0	0
			Comments		All options allow for inbound tourist and business growth. The main road into Akaroa, SH75, is considered the single most major choke point restricting growth for the local region.	All options allow for inbound tourist and business growth. The main road into Akaroa, SH75, is considered the single most major choke point restricting growth for the local region.	All options allow for inbound tourist and business growth. The main road into Akaroa, SH75, is considered the single most major choke point restricting growth for the local region.	All options allow for inbound tourist and business growth. The main road into Akaroa, SH75, is considered the single most major choke point restricting growth for the local region.	All options allow for inbound tourist and business growth. The main road into Akaroa, SH75, is considered the single most major choke point restricting growth for the local region.
		Meets change in sea level and king tide requirements	VH	100.00	-3	2	2	2	-1
			Comments		The existing wharf platform will fail to meet the required design standards for sea level rise and king tides.	A new wharf will be designed to suit level of risk, per council regulations.	A new wharf will be designed to suit level of risk, per council regulations.	A new wharf will be designed to suit level of risk, per council regulations.	A new wharf will be designed to suit level of risk, per council regulations however the location has known resilience issues, and is more prone to king tides and landside flooding.
		Privately held property i.e. privately owned wharf buildings (incl. piles)	M	50.00	0	-3	-3	-3	-3
			Comments		No effect on dwellings/ buildings or license holders, atop of existing wharf.	Privately owned premises are reliant on Council owned piles. It is implied that it will stay the same. The perception is that the privately owned businesses and license holders may assume they can relocate in the same place after the new wharf is constructed.	Consideration needed for privately owned premises.	Consideration needed for privately owned premises.	Consideration needed for privately owned premises.
		Archaeological approval	H	75.00	-2	-2	-2	-2	-3
			Comments		Replacing virtually all materials.	No original materials will remain. Opportunity to repurpose existing materials in new construction, for visual effect.	No original materials will remain. Opportunity to repurpose existing materials in new construction, for visual effect.	No original materials will remain. Opportunity to repurpose existing materials in new construction, for visual effect.	No original materials will remain. Opportunity to repurpose existing materials in new construction, for visual effect.
	Safety and design consideration	*This category is not assessed as there is no difference between the options presented.*				This category is not assessed as there is no difference between the above options, in assessing Safety and Design considerations, in the design, build and final product. Safety in Construction Methodology is considered below.			

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Attachment E Item 4

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS

MCA Criteria enabling a preferred wharf option					Baseline Option	Preliminary Location Options			
MCA Topics		MCA Criteria	Weighting %	Ranking %	Option 0 Restore existing wharf in its current location, no change to structural form.	Option A Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width. Abutment completely removed, and new abutment constructed fit for purpose.	Option B Construct a new wharf along the north side of the existing wharf, using the existing abutment. Existing wharf will be demolished. Abutment completely removed, and new abutment constructed fit for purpose.	Option C Construct a new wharf off Church Street and on the site of the original town wharf. Existing wharf will be demolished. Abutment would be retained.	Option D Construct a new wharf from Akaroa Recreation Field/ Children's Bay. Existing wharf will be demolished. Abutment would be retained.
Affordability	Financial	**Construction cost** (build programme)	H	75.00	-2	-1	0	1	1
			Comments		Challenge managing interface between construction and public users, will drive up cost. Increased legal risks.	Challenge managing interface between construction and public users, will drive up cost. Increased legal risks.	Need to manage interface at entry point / the abutment.	Completely removed from existing wharf, less complex to manage.	Completely removed from existing wharf, less complex to manage.
	Operational/ Maintenance	**Whole of life cost** (including maintenance cost over asset lifetime (100 years) Note: locally sourced timbers for Governors bay will approx. 40 yr. life expectancy	H	75.00	-1	1	1	1	-1
			Comments		The existing wharf is close to the end of its design life, and the expectation is that it will not last another 100 years. Due to the current degradation of the structural form, platform level and sea level rise, it would be very costly to maintain over another 100 years at would need to be extensively rebuilt.	A new wharf will be designed for a life span of 100 years. General maintenance will be expected. Whole of life cost for new build would be less costly than restoring the existing wharf near it's end of life.	A new wharf will be designed for a life span of 100 years. General maintenance will be expected. Whole of life cost for new build would be less costly than restoring the existing wharf near it's end of life.	A new wharf will be designed for a life span of 100 years. General maintenance will be expected. Whole of life cost for new build would be less costly than restoring the existing wharf near it's end of life.	A new wharf will be designed for a life span of 100 years. General maintenance will be expected. The requirement of ongoing dredging significantly increases maintenance costs.
		Maintainability (i.e. accessibility)	H	75.00	-2	-1	0	0	0
			Comments		Due to the current platform level and sea level rise, access will be more and more difficult.	Access will have some limitations, due to being located above the existing wharf and reuse of existing piles.	Clear delineation from existing wharf and piles.	Clear delineation from existing wharf and piles.	Clear delineation from existing wharf and piles.
Public/ Stakeholders		**Community support**							
					Based on community feedback and Council led public consultation, this option is regarded favourably by the community. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**	Based on community feedback and Council led public consultation, this option is regarded favourably by the community. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**	Based on community feedback and Council led public consultation, this option is regarded favourably by the community, but majority of opinion is in support of maintaining the wharf in the same location as the existing wharf. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**	Based on community feedback and Council led public consultation, this option is not regarded as a good option by the community. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**	Based on community feedback and Council led public consultation, this option is the least favourable option by the community. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**
		Key stakeholder support (wharf operators)	H	75.00	-1	3	3	3	-1
			Comments		Based on community feedback, wharf operators are insistent on better recreational access and a wharf designed to meet business/ operator needs.	Based on community feedback, wharf operators are insistent on better recreational access and a wharf designed to meet business/ operator needs.	Based on community feedback, wharf operators are insistent on better recreational access and a wharf designed to meet business/ operator needs.	Based on community feedback, wharf operators are insistent on better recreational access and a wharf designed to meet business/ operator needs.	Based on feedback from the wharf operators, this option would take operations too far away from the town centre.
Implementability Objectives Score		**NZTA Base Score & Weighting**			-1075	200	0	100	-1525
Assessment of Effects									
Safety	Safety in construction methodology	**Health and Safety - Construction workers**	VH	100.00	-1	-1	-1	0	0
			Comments		Considered higher comparative risk for construction workers. Safety risks arise due to proximity to public wharf users, especially at peak tourist times. Risks associated in working with old materials, additional complexity, staging required on existing wharf and resulting in a longer construction period.	Considered higher comparative risk for construction workers. Safety risks arise due to proximity to public wharf users, especially at peak tourist times, additional complexity, staging required and longer construction period due to building atop of existing wharf.	Considered higher comparative risk for construction workers. Safety risks arise due to proximity to public wharf users, especially at peak tourist times, additional complexity, staging required and longer construction period due to restricted access on southern side causing congestion with public users.	Typical risks associated with construction. Ease of separate site, removed from existing wharf, providing a large uninterrupted site and shorter construction timeframe.	Typical risks associated with construction. Ease of separate site, removed from existing wharf, providing a large uninterrupted site and shorter construction timeframe.
		Health and Safety - Wharf users (businesses and public; local community and tourists)	VH	100.00	-3	-3	-2	-1	-1
			Comments		Large amount of congestion causing increase in hazards for public wharf users, especially at peak tourist (cruise ship) times.	Large amount of congestion causing increase in hazards for public wharf users, especially at peak tourist (cruise ship) times.	Brief period of congestion at abutment which interfaces with existing wharf.	Negative impact on public wharf users and local businesses.	Negative impact on slipway and recreational users.
		Temporary traffic management, road closures etc. (community, businesses, tourists)	H	75.00	-1	-1	-2	-3	-3
			Comments		Minor negative effects due to complexity of site and potential for congestion. Assuming materials and plant will be barged in from seaside.	Minor negative effects due to complexity of site and potential for congestion. Assuming materials and plant will be barged in from seaside.	Moderate negative effects due to complexity of site and potential for congestion. Assuming materials and plant will be barged in from seaside.	Signification negative effects as there is no flexibility in space. High potential for congestion at intersection. There will be reduced traffic connectivity with that specific area being congested. Assuming materials and plant will be barged in from seaside.	Signification negative effects as there is no flexibility in space. Negative impact on slipway and recreational users, access is limited at high tide. Assuming materials and plant will be barged in from seaside.
		Recreational and social activities (recreational fishing, boating, walking, local amenity asset)	M	50.00	-2	3	3	3	1
			Comments		Constrained final form, does not allow for future growth.	Opportunity to provide for all recreational and social activities.	Opportunity to provide for all recreational and social activities.	Opportunity to provide for all recreational and social activities.	Opportunity to provide for all recreational and social activities. Location removed from Akaroa township.
		Ability to cater for different user group (functional) requirements (current)	M	50.00	-1	2	2	2	1
			Comments		Doesn't cater for all user groups.	Ability to cater for all user groups wharf functional requirements, subject to budget.	Ability to cater for all user groups wharf functional requirements, subject to budget.	Ability to cater for all user groups wharf functional requirements, subject to budget.	Ability to cater for all user groups wharf functional requirements, subject to budget. Location/proximity to town centre and waterside access is challenging.

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Attachment E Item 4

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS

MCA Criteria enabling a preferred wharf option					Baseline Option	Preliminary Location Options			
MCA Topics		**MCA Criteria**	Weighting %	Weighting	**Option 0** **Restore existing wharf in its current location, no change to structural form.**	**Option A** **Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width. Abutment completely removed, and new abutment constructed fit for purpose.**	**Option B** **Construct a new wharf along the north side of the existing wharf, using the existing abutment. Existing wharf will be demolished. Abutment completely removed, and new abutment constructed fit for purpose.**	**Option C** **Construct a new wharf off Church Street and on the site of the original town wharf. Existing wharf will be demolished. Abutment would be retained.**	**Option D** **Construct a new wharf from Akaroa Recreation Field/ Children's Bay. Existing wharf will be demolished. Abutment would be retained.**
Community	Social	**Ability to cater for future community demand**	VH	100.00	-3	2	2	2	1
			Comments		Existing wharf has reached maximum capacity, unable to meet future demand.	A new wharf will be designed to cater for future community demand.	A new wharf will be designed to cater for future community demand.	A new wharf will be designed to cater for future community demand.	A new wharf will be designed to cater for future community demand. Extent of affects from dredging are unknown, i.e. impact on marine life, local eco system, resilience to flooding. Less desirable impact than alternative new wharf locations.
		Enabling public access to all parts of the wharf at all times, and doesn't compromise access to the beach / water	H	75.00	-2	2	2	2	2
			Comments		Constrained in it's current form.	Dependent on design.	Dependent on design.	Dependent on design.	Dependent on design.
		Tourist congestion effect	H	75.00	-2	2	2	2	2
			Comments		Existing wharf is currently at capacity at peak tourist (cruise ship) times.	Addressed in design, through use of traffic modelling and forecasting. New wharf will be an improvement, but won't be able to eliminate all concerns. Historic buildings on the waterfront will still cause congestion.	Addressed in design, through use of traffic modelling and forecasting. New wharf will be an improvement, but won't be able to eliminate all concerns. Historic buildings on the waterfront will still cause congestion.	Addressed in design, through use of traffic modelling and forecasting. New wharf will be an improvement, but won't be able to eliminate all concerns. It was noted efficiencies can be achieved in network, through use of a 4-way connection, not a T-intersection.	Addressed in design, through use of traffic modelling and forecasting. New wharf will be an improvement, but won't be able to eliminate all concerns.
		Impact on connectivity / public open space (local amenity)	M	50.00	0	0	0	2	-1
			Comments		No change, as no change in location.	No change, as in the same location as the existing wharf.	No change, as, same connection to land, via abutment. Very similar location	Increase area of open space	Negative impact on recreational ground use, carparking and slipway.
		Operational effect (for use of larger boats taking refuge)	M	50.00	1	3	3	3	1
			Comments		Can be improved, to a lesser extent.	A new wharf will have the ability to cater for larger vessels.	A new wharf will have the ability to cater for larger vessels.	A new wharf will have the ability to cater for larger vessels.	A new wharf will have the ability to cater for larger vessels. Shallow water restricts access, especially for larger vessels.
	Human Health	*This category is not assessed as there is no difference between the options presented.*				This category is not assessed as there is no difference between the above options, in assessing effects on Human Health (i.e. noise, air quality or contaminated land). The effects on Natural Environment are considered below.			
Economy		**Commercial impact on commercial operators of the wharf** (i.e. cruise ship tenders, fishing vessels, sightseeing cruises, interchange of baggage, stores and commercial harvest)	H	75.00	-1	2	2	2	2
			Comments		It is anticipated that in 20 to 30 years the wharf will not adequately meet the user functionality requirements, due to the current platform level, sea level rise and flooding. Deterioration will accelerate over time.	A new wharf will be able to provide for all the functional requirements of the commercial operators.	A new wharf will be able to provide for all the functional requirements of the commercial operators.	A new wharf will be able to provide for all the functional requirements of the commercial operators.	A new wharf will be able to provide for all the functional requirements of the commercial operators.
		Commercial impact on the businesses adjacent to existing wharf (foreshore)	M	50.00	-2	2	2	2	-3
			Comments		It is anticipated that in 20 to 30 years the wharf will not adequately meet the user functionality requirements, due to the current platform level, sea level rise and flooding. Deterioration will accelerate over time. Functionality of wharf is key to tourist industry, needs to be kept viable.	Close proximity to businesses adjacent to existing wharf.	Close proximity to businesses adjacent to existing wharf.	Close proximity to businesses adjacent to existing wharf.	Location relative to the town centre will have a significant negative impact on the businesses adjacent to the existing wharf.
		Flexibility to cater for future demand (i.e. cruise ship, tourist & business growth)	H	75.00	-3	0	0	0	-1
			Comments		It is anticipated that in 20 to 30 years the wharf will not adequately meet the user functionality requirements, due to the current platform level, sea level rise and flooding. Deterioration will accelerate over time. Functionality of wharf is key to tourist industry, needs to be kept viable.	Dealt with in design. This location does not impact on flexibility.	Dealt with in design. This location does not impact on flexibility.	Dealt with in design. This location does not impact on flexibility.	The ongoing requirement for dredging limits flexibility.
	Cultural values	**Local Runanga/ Maori iwi cultural values** (large significance in beach access)	H	75.00	1	3	3	-2	-3
			Comments		No change Acknowledge there is some, but limited opportunity to integrate mana whenua identity and values into restoring the existing wharf. There is greater opportunity to integrate these values into a new wharf.	Provides an opportunity to integrate mana whenua identity and values into the design of the wharf and acknowledge the significance of the foreshore location, and connection to Britomart reserve. The existing location is important. The opportunity to tie the Taiāpure history, identity and values all together would be very powerful. Note, this is not a wahi tapu site, and there is no issue with continuing use and activities of the wharf, such as use of toilets contained on the wharf.	Provides an opportunity to integrate mana whenua identity and values into the design of the wharf, and acknowledge the significance of the connection of the foreshore location to Britomart reserve.	Provides an opportunity to integrate mana whenua identity and values into the design of the wharf. This location does not provide the opportunity to acknowledge the significance of Britomart reserve to Taiāpure.	Provides an opportunity to integrate mana whenua identity and values into the design of the wharf. This location does not provide the opportunity to acknowledge the significance of Britomart reserve to Taiāpure.
		Food resources/mahinga kai effect (fishing spots etc.)	H	75.00	1	0	0	0	-1
			Comments		No change	Considered to have a minor adverse environmental impact on mahinga kai, extent of impact unknown. **Advice to be sought from the Taiāpure Committee**	Considered to have a minor adverse environmental impact on mahinga kai, extent of impact unknown. **Advice to be sought from the Taiāpure Committee**	Considered to have a minor adverse environmental impact on mahinga kai, extent of impact unknown. **Advice to be sought from the Taiāpure Committee**	Significant adverse effect on mahinga kai value, this option is not supported by Ōnuku Rūnanga. **Advice to be sought from the Taiāpure Committee**

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Attachment E Item 4

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS									
MCA Criteria enabling a preferred wharf option					Baseline Option	Preliminary Location Options			
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Cultural		Other local community cultural values	L	25.00	0	1	1	1	-3
			Comments		No change.	Same location as existing wharf, with improvements made to better accommodate users. Same level of amenity for a new wharf, in any location.	Same connection to land, via abutment. Similar location, with improvements made to better accommodate users. Same level of amenity for a new wharf, in any location.	Positive for local businesses. Minor impact on recreational fishing, some moorings would need to be moved for safety/ navigation purposes. Same level of amenity for a new wharf, in any location.	Significant impact on sports field and recreational fishing. Approximately 15-20 consented moorings would need to be moved for safety/ navigation purposes. This would be at no cost to owner. Opportunity to redesign moorings, creating more space for boat access. Same level of amenity for a new wharf, in any location.
	Heritage	Retain heritage values of existing wharf and Akaroa waterfront i.e. ability to revitalise the existing wharf, with a high level of authenticity and integrity of the existing wharf - alignment with Conservation Plan/ minimising impact and retaining maximum value. Considering individual heritage values - Historical/Social, Cultural/Spiritual, Architectural/Aesthetic, Technological/Craftsmanship, Contextual, Archaeological.	H	75.00	3	-1	-2	-2	-3
			Comments		A large extent of the heritage values would be retained through restoring the existing wharf, and there is the ability to achieve a high level of authenticity. This option would provide the closest resemblance to the original wharf.	Due to the condition of the existing abutment and the requirement to meet sea level rise and king tide design requirements, replacement of the original abutment would be required. The integrity of the heritage context and form and placement is degraded to a modest degree.	Due to the condition of the existing abutment and the requirement to meet sea level rise and king tide design requirements, replacement of the original abutment would be required. The integrity of the heritage context and form and placement is degraded to a material degree, due to realignment.	Heritage value would be retained through maintaining the existing abutment. Heritage values would largely be lost, with change in wharf alignment and the new location, noting that it is still in close proximity to the town centre. Narrative in terms of original location is very limited.	Heritage value would be retained through maintaining the existing abutment. Heritage values would largely be lost with change in wharf alignment, new location, and severed connection with the town centre.
		Retain any original fabric of the existing wharf, minimizing impact/maximising value (including existing concrete abutment, which is to be retained in-situ)	H	75.00	3	-2	-2	-1	-1
			Comments		Restoration will be with new materials, however the original materials will be retained and reused or repurposed in the restoration where possible, providing links to the heritage values.	The new wharf will be constructed largely of new materials and will have the form, i.e. look and feel of a new structure. Existing piles may be reused depending on condition. The original abutment would be removed, and a new abutment would be required to meet the higher platform level. Wholesale loss of fabric.	The new wharf will be constructed largely of new materials and will have the form, i.e. look and feel of a new structure. Existing piles may be reused depending on condition. The original abutment would be removed, and a new abutment would be required to meet the higher platform level. Wholesale loss of fabric.	The new wharf will be constructed from new materials and will have the form, i.e. look and feel of a new structure. The original abutment would be retained, with no modifications made.	The new wharf will be constructed from new materials and will have the form, i.e. look and feel of a new structure. The original abutment would be retained, with no modifications made.
		Alignment with Heritage Strategy, local rūnanga values, and ICOMOS Charter (Ensuring heritage is physical accessibility and providing an understanding of places through storytelling. ICOMOS relates to maintaining materials) (The ICOMOS New Zealand Charter, The Pumanawa o ICOMOS o Aotearoa Hei Tiaki i Nga Taonga Whenua Heke iho o Nehe is a set of guidelines on cultural heritage conservation, produced by ICOMOS New Zealand)	H	75.00	0	-2	-3	-2	-3
			Comments		New materials would be used. Considered neutral. Dependent on how matapopare design and ICOMOS are used to restore i.e. contrast, cultural narrative vs retaining existing heritage character based on function over form.	The abutment would need to be replaced, which would negatively impact the authenticity and integrity and therefore reduce the heritage value. New materials would be used, negatively impacting the heritage connection and values. Keeps form and alignment retaining some intangible heritage values and associations. Dependent on how cultural narrative design and ICOMOS are used to rebuild i.e. cultural narrative vs retaining existing heritage character based on function over form.	The abutment would need to be replaced, which would negatively impact the authenticity and integrity and therefore reduce the heritage value. New materials would be used, negatively impacting the heritage connection and values. Complete loose of form and alignment, and the intangible heritage values and associations. Dependent on how cultural narrative design and ICOMOS are used to rebuild i.e. cultural narrative vs retaining existing heritage character based on function over form.	This option provides the ability to maintain abutment, however new materials would be used, the connection to historical wharf would be lost, and the intergenerational connection would be broken having a significant negative impact on the heritage connection and values. Reduced ability to accommodate ICOMOS.	This option provides the ability to maintain abutment, however new materials would be used, the connection to historical wharf would be lost, and the intergenerational connection would be broken having a significant negative impact on the heritage connection and values. Reduced ability to accommodate ICOMOS. Dissociation with the original heritage waterfront location.
		Alignment with Akaroa Heritage Area and Akaroa Historic Area (CCC and HNZPT respectively) (Heritage New Zealand Pouhere Taonga (HNZPT) is a Crown entity with a membership of around 20,000 people that advocates for the protection of ancestral sites and heritage buildings in New Zealand.)	H	75.00	3	1	1	-2	-3
			Comments		It retains the wharf in the existing location and the same heritage values.	As the wharf is positioned in the same location it retains the majority of the heritage values for the wider area. Character remains the same, the difference in location between Options A & B is considered negligible.	As the wharf is positioned in the same location it retains the majority of the heritage values for the wider area. Character remains the same, the difference in location between Options A & B is considered negligible.	Ability to retain the existing abutment with no modification for heritage value. The location of the wharf is considered a focal point, moving the wharf would change the social and commercial function of the waterfront, impacting the community. There are substantial implications in terms of having the structure located in an area currently unmodified - i.e. adjoining landowners will raise issues in terms of loss of connections and impediment in terms of views within waterfront.	Ability to retain the existing abutment with no modification for heritage value. The location of the wharf is considered a focal point, there has never been anything of this scale in the area, no logical context moving the wharf would change the social and commercial function of the waterfront, impacting the community. It removes the substantial heritage item (and space) from its waterfront context and relocates the wharf to an area that has never had those connections.
		Heritage and cultural values of adjoining Reserve, buildings and foreshore are maintained	H	75.00	3	2	1	-1	-3
			Comments		Situation as is/ no change.	Retains the wharf placement and alignment as the focal point in connection with the reserve. The historical context is largely retained. Onuku Runanga preference for this location as it acknowledges the significance of Britomart reserve. Although there is a distinction between Options A & B, where Option B proposes a change in alignment to the existing wharf and associated loss of the existing footprint, it is considered to not have a material impact. There is still the opportunity to capture and tell the story of the Onuku Runanga.	Retains the wharf connection with the reserve, however does not retain the alignment. The historical context is somewhat retained. Onuku Runanga preference for this location as it acknowledges the significance of Britomart reserve. Although there is a distinction between Options A & B, where Option B proposes a change in alignment to the existing wharf and associated loss of the existing footprint, it is considered to not have a material impact. There is still the opportunity to capture and tell the story of the Onuku Runanga.	Loose the focal point of the Britomart reserve, as it was originally designed.	Complete separation of the wharf away from the Britomart reserve. Removing individual element away from the Britomart reserve area, devalues the overall heritage purpose. Value in maintaining them in the same area.

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			Weighting	% Weighting					
Natural Environment		**Noise and vibration effects** (including noise effects on marine mammals i.e. dolphins)	H	75.00	0	-1	-1	-1	-1
			Comments		Reusing existing piles, assuming piles will be adequate below the sea bed. To be determined on inspection.	Potential to reuse existing piles, assuming piles will be adequate bellow the sea bed. To be determined on inspection. Pile driving will have a negative impact. Public perception is that all pile driving impacts on marine life. Driving piles 900mm or greater are known to impact on marine life, i.e. dolphins. Assume minimal large pile driving. Pile driving considered to have a greater affect on people.	Pile driving will have a negative impact. Public perception is that all pile driving impacts on marine life. Driving piles 900mm or greater are known to impact on marine life, i.e. dolphins. Assume minimal large pile driving. Pile driving considered to have a greater affect on people.	Pile driving will have a negative impact. Public perception is that all pile driving impacts on marine life. Driving piles 900mm or greater are known to impact on marine life, i.e. dolphins. Assume minimal large pile driving. Pile driving considered to have a greater affect on people.	Pile driving will have a negative impact. Public perception is that all pile driving impacts on marine life. Driving piles 900mm or greater are known to impact on marine life, i.e. dolphins. Assume minimal large pile driving. Pile driving considered to have a greater affect on people.
		Air quality effects							
			Comments			This category is not assessed as there is no difference between the above options, in assessing Air Quality effects.			
		Ecological effects (considering disturbance to biodiversity/ecosystems, disturbance/displacement of marine habitats, spawning areas etc., including excavation/dredging effects (during and post construction), spillage or materials into the CMA)	M	50.00	0	-1	-1	-1	-3
			Comments		No impact.	Some disturbance caused by construction of new wharf and installing piles, required for wider platform. Potential to reuse existing piles, assuming piles will be adequate below the sea bed. To be determined on inspection. Assumed no dredging required, would need to confirm.	Some disturbance caused by construction of new wharf and installing piles. Assumed no dredging required, would need to confirm.	Some disturbance caused by construction of new wharf and installing piles. Assumed no dredging required, would need to confirm.	Dredging required to prepare area for construction. Ongoing dredging required to maintain access to wharf, causing continual disturbance and negative ecological affects on a presently untouched area. Some disturbance caused by construction of new wharf and installing piles.
		Coastal impact (i.e. impact of tidal flows on the seawall and coastal edge)	M	50.00	0	0	0	-1	-3
			Comments		No change in vessel movement. No impact.	No change in vessel movement. No impact.	No change in vessel movement. No impact.	Change in vessel movements/ route to wharf. Will have some impact, impact unknown. May be lessened by the presence of the existing abutment nearby. Would need further investigation/ expertise advice.	Change in vessel movement, and dredging will have a significant negative impact on the coastal edge in this location.
Built Environment	System Integration	**Visual / landscape effect on natural environment** (assumption of view of land from the water)	L	25.00	0	-1	-2	-3	-3
			Comments		No change.	Minor negative impact on natural landscape, due to the introduction of new infrastructure and new form.	Moderate negative impact on natural landscape due to new form and change in location, to north of existing wharf, however still in close proximity.	The change in location has a significant negative impact on the natural landscape.	The change in location has a significant negative impact on the natural landscape.
		Ability to provide infrastructure (i.e. electricity, water, waste water. Fuel etc.)	H	75.00	-1	0	0	0	-1
			Comments		The existing infrastructure is operating at capacity, services are difficult to renew or extend. Significant maintenance works would be necessary to extend the life of the existing wharf for an additional 100 years.	New wharf would allow for adequate services.	New wharf would allow for adequate services.	New wharf would allow for adequate services.	Location more challenging, due to proximity. New services would be required landside, up to the water edge, in order to provide services to the wharf and it's operators.
		Effect on active transport to the wharf and along the costal edge (pedestrian/cycle/mobility devices)	M	50.00	0	1	1	2	-1
			Comments		No change.	New construction will be more accessible by design, and will naturally be in a better state of condition than the original wharf, making it suitable for all; pedestrians, cyclists and mobility devices.	New construction will be more accessible by design, and will naturally be in a better state of condition than the original wharf, making it suitable for all; pedestrians, cyclists and mobility devices.	New construction will be more accessible by design, and will naturally be in a better state of condition than the original wharf, making it suitable for all; pedestrians, cyclists and mobility devices. Potential to solve traffic flow through existing T-intersection at Church St and improve overall access.	Less accessible for mobility and wheelchair users as further away from town centre.
		Tourist congestion effect (of people on wharf)	M	50.00	0	2	2	2	-2
			Comments		No change to current congestion issues.	The new wharf will be designed to have greater capacity, for peak tourist (cruise ship) times.	The new wharf will be designed to have greater capacity, for peak tourist (cruise ship) times.	The new wharf will be designed to have greater capacity, for peak tourist (cruise ship) times.	Would conflict with boat ramp, and have a significant negative impact on recreational users. Would require cruise ship tourists to be bused back into township. It was noted that a number of the tourists visiting by cruise ship had limited mobility.
		Tourist congestion effect (Tourist buses)	M	50.00	-1	-1	-1	-1	2
			Comments		No change to current congestion issues, relating to cruise ship tourist buses.	No change to current congestion issues, relating to cruise ship tourist buses.	No change to current congestion issues, relating to cruise ship tourist buses. Pick up point would be the same.	No change to current congestion issues, relating to cruise ship tourist buses. Pick up point would be very similar.	New location would remove congestion from the centre of town. More space available for buses near the sports recreational fields.
		Urban design and landscape effect (i.e. effect of wharf on streetscape setting (existing street trees, furniture, paths) and on nearby landside buildings and urban form)	L	25.00	2	1	0	0	-1
			Comments		Some minor impact on urban design and landscape, but mostly no impact.	The change in form and use of new materials would have an impact on urban design of the township, but as it is in the original location it is considered to have a minor landscape effect.	Change in form and new location will alter the urban design of the township. Particularly, if there were a change in wharf alignment.	Change in form and new location will alter the urban design of the township. Particularly, if there were a change in wharf alignment.	Would loose all connection between buildings and the wharf.

Christchurch City Council

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS								
MCA Criteria enabling a preferred wharf option				Baseline Option	Preliminary Location Options			
MCA Topics		MCA Criteria	Weighting %	Option 0 Restore existing wharf in its current location, no change to structural form.	Option A Construct a new wharf in the same location as the existing wharf. Increase in deck height and investigate increase in width. Abutment completely removed, and new abutment constructed fit for purpose.	Option B Construct a new wharf along the north side of the existing wharf, using the existing abutment. Existing wharf will be demolished. Abutment completely removed, and new abutment constructed fit for purpose.	Option C Construct a new wharf off Church Street and on the site of the original town wharf. Existing wharf will be demolished. Abutment would be retained.	Option D Construct a new wharf from Akaroa Recreation Field/ Children's Bay. Existing wharf will be demolished. Abutment would be retained.
	Environment	**Environmental impact over lifetime** (i.e. Carbon footprint)	Comments		This category is not assessed as there is no difference between the above options, in assessing Environmental impact over lifetime (carbon footprint).			
		Environmental responsibility and ethics (i.e. sourcing timber, carbon miles, local)	Comments		This category is not assessed as there is no difference between the above options, in assessing Environmental responsibility and ethics (i.e. sourcing timber, carbon miles, local)			
Assessment of Effects Objectives Score		NZTA Base Score & Weighting		-450	750	500	100	-2000
Weighted Score Base				-2425	2350	1900	1550	-3475

Akaroa Wharf MCA worksheet FINAL 01-07-2020.xlsx
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AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS										
MCA Criteria enabling a preferred wharf option						Preliminary Structural Options			
MCA Topics	MCA Criteria		% Weighting		% Weighting	Option 0 Restore existing wharf in its current location, no change to structural form.	Option 1: New wharf structure with like-for-like hardwood timber (excluding abutment).	Option 2: New wharf structure with a mix of concrete and hardwood timber (excluding abutment). Visible members would be hardwood	Option 3: New wharf structure made from concrete (excluding abutment).
Project Description	To renew the Akaroa Wharf when it reaches the end of its useful life. OPUS recommendations is that the wharf has another 5-10 years life remaining. Demar								
Project Objectives									
Akaroa Wharf Renewal Project Objectives	**Meet the current and future needs of community, visitors and commercial operators** (i.e. functionality; scale and structure)	VH	100.00						
		Comments		Comments		This is assessed under the Preliminary Location Options. The Structural Options (i.e. materiality) are a sub-option, to the Preliminary Location Options.			
	Develop a functional marine asset to serve the community for the next 100 years	VH	100.00						
		Comments		Comments		This is assessed under the Preliminary Location Options. The Structural Options (i.e. materiality) are a sub-option, to the Preliminary Location Options.			
	Opportunity to recognise the cultural and heritage significance of the wharf (circa 1887) in the context of the heritage setting of Akaroa, the wider cultural landscape and Mana Whenua identity and values	M	50.00						
		Comments		Comments		This is assessed under the Preliminary Location Options. The Structural Options (i.e. materiality) are a sub-option, to the Preliminary Location Options.			
	Meet universal accessibility requirements (i.e. making the wharf accessible to all people of all ages, size and mobility) Both location and accessibility considered	VH	100.00						
		Comments		Comments		This is assessed under the Preliminary Location Options. The Structural Options (i.e. materiality) are a sub-option, to the Preliminary Location Options.			
	Provide for wharf services – fuel, power, water and waste (commercial use)	H	75.00						
		Comments		Comments		This is assessed under the Preliminary Location Options. The Structural Options (i.e. materiality) are a sub-option, to the Preliminary Location Options.			
	Consider operational and maintenance costs	H	75.00						
		Comments		Comments		This is assessed under the Preliminary Location Options. The Structural Options (i.e. materiality) are a sub-option, to the Preliminary Location Options.			
Project Objectives Score	NZTA Base Score & Weighting								
Implementability Objectives									
Technical	**Procurement of suitable contractors**	VH	100.00	VH	100.00	0	-1	0	0
		Comments		Comments		Less businesses available with capability to build traditional wharfs.	Fewer contractors available with skills and experience in timber wharf construction.	Easier with more wharfs being constructed from concrete and steel. Contractors are experienced.	Easier with more wharfs being constructed from concrete and steel. Contractors are experienced.
	Wharf construction timeframe (i.e. period of disruption, strictly period of time taken to construct)	M	50.00	M	50.00	-1	0	0	1
		Comments		Comments		Large disruption expected, over a substantial period of time due to the complexity of restoring the existing wharf.	Time to construct the wharf would be similar for all structural material options, excluding procurement of material.	Time to construct the wharf would be similar for all structural material options, excluding procurement of material.	Time to construct the wharf would be similar for all structural material options, excluding procurement of material. There is greater flexibility with concrete to maximise efficiencies, i.e. installing larger piles, minimising the total number of piles required, which would positively impact construction timeframe. Note, this would be at a cost to culture and heritage.
	Constructability (including structural effects, in consideration of proximity to other structures)	M	50.00	M	50.00	-2	0	0	0
		Comments		Comments		Major challenges in structure and management, to keep wharf operational during construction.	Marine work predominantly over water. No difference between structural material options.	Marine work predominantly over water. No difference between structural material options. No additional risk in concrete and steel construction.	Marine work predominantly over water. No difference between structural material options. No additional risk in concrete and steel construction.
	Construction risks - building materials (including procurement)			VH	100.00	-3	-3	-1	1
		Comments		Comments		Sources of hardwood timber is limited and unreliable	There are significant challenges sourcing the long sections of hardwood timber required for the structure. The sources are unreliable, with respect to quality, volume and timeframe. Contractors are quick to promise and late to advise of delays. There are risks associated with storing large timber sections, logs splitting etc. Note, timber is more flexible than concrete/ steel under seismic load.	Smaller sections of timber required for this option. Will still require marine grade timber for stringers and bracing elements. There are challenges sourcing the hardwood timber. Sources are unreliable, with respect to quality, volume and timeframe. Contractors are quick to promise and late to advise of delays. Note, timber is more flexible than concrete/ steel under lateral load.	Material easier to source, and more reliable in comparison. Note, concrete dries out faster. More suitable for a lower platform, less susceptible to cracking. Timber is more flexible than concrete/ steel under seismic load.

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AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS									
MCA Criteria enabling a preferred wharf option						Preliminary Structural Options			
MCA Topics		MCA Criteria	Weighting	% Weighting	Weighting	% Weighting	Option 0 Restore existing wharf in its current location, no change to structural form.	Option 1: New wharf structure with like-for-like hardwood timber (excluding abutment).	Option 2: New wharf structure with a mix of concrete and hardwood timber (excluding abutment). Visible members would be hardwood	Option 3: New wharf structure made from concrete (excluding abutment).
Feasibility		**Construction set down area** (considering marine effects, protected trees etc.)	H	75.00	H	75.00	-2	0	1	1
			Comments		Comments		Challenging, as potential nearby set down areas are protected Heritage sites.	Need storage for large sections of hardwood timber. May need to buy timber 6 months in advance.	Smaller storage requirements, due to smaller sections of timber required for this option.	Trucks will provide concrete as required. Storage required for steel etc.
		Level of amenity during construction; wharf users	M	50.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing the Level of amenity during construction (disruption effect).			
		Level of amenity during construction; proximate sensitive users	L	25.00						
							This category is not assessed as there is no difference between the above options, in assessing the Level of amenity during construction (disruption effect).			
	Consentability	**Christchurch District Plan requirements**	VH	100.00	VH	100.00	1	2	1	-2
			Comments		Comments		Hazards challenging to manage. Great from a heritage perspective.	The relevant provisions of the District Plan (Chapter 9 and 15) require (re)development to maintain or enhance existing character, materiality and heritage aesthetic.	Assuming that utilitarian elements are largely visually shrouded, form and design would be maintained. Changes in heritage fabric results in score of 1.	A concrete wharf will substantially alter the current heritage values and character of the waterfront in Akaroa. These would be inconsistent with provisions seeking compatible form, character and materiality. Could be reduced (-1) with substantial design input (i.e. motifs).
		Canterbury Regional Coastal Plan requirements (Based on current Coastal Plan)	VH	100.00	VH	100.00	0	1	2	-1
			Comments		Comments		The coastal plan will be unaffected, as no changes or modifications required to coastal environment.	Retains heritage fabric and character and hence maintains amenity – would require increased future maintenance or additional protection works to maintain integrity of materials.	This option maximises retaining current amenity values (note character is less of an issue in the Coastal Plan) and ensures integrity of materiality over the longer term without additional protection / replacement works.	This option would contrast with current amenity values and built form character as associated with public access to the coast / waterfront. Integrity of materiality would be provided.
		Canterbury Regional Policy Statement (Recreational and Social Outcomes)	VH	100.00	VH	100.00	2	2	2	1
			Comments		Comments		Balances recreational and social.	Restores and enhances amenity, recreational and (as appropriate) historic heritage values. Enhances public access	Restores and enhances amenity, recreational and (as appropriate) historic heritage values. Enhances public access	Degrades existing amenity and historic heritage values. Materiality would provide longevity in terms of recreational values (and access)
		New Zealand Coastal Policy Statement	VH	100.00	VH	100.00	0	2	1	-1
			Comments		Comments		No change in Akaroa coastline.	Maintains character of the existing built environment, and (more appropriate) management of historic heritage (through like for like materiality). Provides appropriate public access.	Maintains character of the existing built environment, management of historic heritage (but not in a way that utilises consistent fabric). Provides appropriate public access.	Contrasts more severely with provisions relating to the 'natural environment' but not definitive given modified environment. Degrades character of the existing built environment / historic heritage, but maintains public access and long term structural integrity reducing need for further protection works.
		Akaroa Guide Tourism (i.e. character and form)	M	50.00	M	50.00	0	2	1	-2
			Comments		Comments		Doesn't allow for future growth for the community. Noting that this could be both positive or negative impact, dependent on community aspirations.	Heritage fabric, structural form and design would be consistent with Akaroa aesthetic and character.	Visually would be consistent with Akaroa aesthetic and character.	A concrete wharf will likely appear as a more utilitarian structure, which would contrast and degrade the aesthetic and character of Akaroa. Whilst these plan(s) have less statutory weight their localised application and the (community) optics of an inconsistency would be severe.
		Tourism strategy (Targeting greater tourism growth, in Akaroa and regionally)	M	50.00	M	50.00	0	1	1	-2
			Comments		Comments		All options allow for inbound tourist and business growth. The main road into Akaroa, SH75, is considered the single most major choke point restricting growth for the local region.	This option will closely resemble the existing wharf, in form, structure and heritage features and therefore will maintain the values seen as critical for maintained tourism within Akaroa.	This option will closely resemble the existing wharf, in form, structure and heritage features and therefore will maintain the values seen as critical for maintained tourism within Akaroa.	Utilitarian structure would contrast and degrade visual character and potentially visitor experience associated with Akaroa.
		Meets change in sea level and king tide requirements	VH	100.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing Sea level change and king tide requirements. All of the options should address these issues despite the materiality of the structure.			
		Privately held property i.e. privately owned wharf buildings (incl. piles)	M	50.00						
			Comments		Comments		This category is not assessed as there is no a statutory issue. No scoring given			
		Archaeological approval	H	75.00						
			Comments		Comments		This category is not assessed, assuming that the existing wharf will be demolished in accordance with any Archaeological Authority there should be no difference in scoring. Authority may specify specific aspects of fabric (i.e. abutment) that require specific treatment or retention.			
	Safety and design consideration	*This category is not assessed as there is no difference between the options presented.*								
							This category is not assessed as there is no difference between the above options, in assessing Safety and Design considerations, in the design, build and final product. Safety in Construction Methodology is considered below.			

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AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS										
MCA Criteria enabling a preferred wharf option							Preliminary Structural Options			
MCA Topics		MCA Criteria	Weighting	% Weighting	Weighting	% Weighting	Option 0 Restore existing wharf in its current location, no change to structural form.	Option 1: New wharf structure with like-for-like hardwood timber (excluding abutment).	Option 2: New wharf structure with a mix of concrete and hardwood timber (excluding abutment). Visible members would be hardwood	Option 3: New wharf structure made from concrete (excluding abutment).
Affordability	Financial	**Construction cost** (build programme)	H	75.00	H	75.00	-2	-1	-1	0
			Comments		Comments		Challenge managing interface between construction and public users, will drive up cost. Increased legal risks.	Iron bark (historical material) hardwood timber is very expensive. Estimated at $6,000 per unit cost versus $3,500 for other hardwood timbers. Anticipate 12 month minimum procurement period, with high level of uncertainty of availability of this material in large volume. Potential to cause significant delays to programme. Need to seek advice from Heritage NZ on what they consider to be 'like-for-like' and which timbers they would consider.	Extra complexity relating to detailing concrete and timber connections.	Can maximise efficiencies, with use of larger, fewer piles.
	Operational/ Maintenance	**Whole of life cost** (including maintenance cost over asset lifetime (100 years) Note: locally sourced timbers for Governors bay will approx. 40 yr. life expectancy	H	75.00	H	75.00	-1	-1	0	1
			Comments		Comments		The existing wharf is close to the end of its design life, and the expectation is that it will not last another 100 years. Due to the current degradation of the structural form, platform level and sea level rise, it would be very costly to maintain over another 100 years at would need to be extensively rebuilt.	Iron bark (historical material) hardwood timber is very expensive. It doesn't have the same resistance to marine degradation. Need to seek advice from Heritage NZ on what they consider to be 'like-for-like' and which timbers they would consider.	Concrete will be used in areas that make direct sustained contact with marine environment, i.e. piles. Timber used to achieve desired aesthetic look.	Concrete structure will resist marine degradation. Additives used to improve life of steel and concrete in marine environment i.e. galvanised steel.
		Maintainability (i.e. accessibility)	H	75.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing Operation ease/ maintainability (i.e. accessibility). Maintenance costs are considered above, Whole of life cost.			
Public/ Stakeholders		**Community support**								
					Comments		Based on community feedback and Council led public consultation, this option is regarded favourably by the community. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**	Majority are in strong support for similar aesthetic structure. Keeping form and character, retaining some heritage value. To be confirmed at next round of public consultation. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**	Community open to low cost, low maintenance option this provides whist retaining some heritage value. To be confirmed at next round of public consultation. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**	Community open to low cost, low maintenance option. To be confirmed at next round of public consultation. **No score is given, as public consultation is ongoing. Further consultation is planned, following this MCA assessment.**
		Key stakeholder support (wharf operators)	H	75.00	H	75.00	-1	2	2	1
			Comments		Comments		Based on community feedback, wharf operators are insistent on better recreational access and a wharf designed to meet business/ operator needs.	Strong support for similar aesthetic structure. Keeping form and character, retaining some heritage value (as above). To be confirmed at next round of public consultation.	Strong support for similar aesthetic structure. Keeping form and character, retaining some heritage value (as above). To be confirmed at next round of public consultation.	Majority accept quicker to build, and most pragmatic option, although heritage value not retained. To be confirmed at next round of public consultation.
Implementability Objectives Score		**NZTA Base Score & Weighting**					-600	450	750	-125
Assessment of Effects										
Safety	Safety in construction methodology	**Health and Safety - Construction workers**	VH	100.00	VH	100.00	-1	-1	-1	1
			Comments		Comments		Considered higher comparative risk for construction workers. Safety risks arise due to proximity to public wharf users, especially at peak tourist times. Risks associated in working with old materials, additional complexity, staging required on existing wharf and resulting in a longer construction period.	Timber construction is more complex and hazardous, in comparison to concrete and steel. Dive work and more work below deck required. Re-use of existing timber also risky.	Timber construction is more complex and hazardous, in comparison to concrete and steel. Dive work and more work below deck required. Re-use of existing timber also risky.	Contractors more familiar with concrete and steel construction process. General risks associated with constructing a wharf.
		Health and Safety - Wharf users (businesses and public; local community and tourists)	VH	100.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing the Health and Safety of Wharf users (businesses and public; local community and tourists).			
		Temporary traffic management, road closures etc. (community, businesses, tourists)	H	75.00	H	75.00	-1	-1	-1	-1
			Comments		Comments		Minor negative effects due to complexity of site and potential for congestion. Assuming materials and plant will be barged in from seaside.	Similar challenges between options. Assuming plant and materials will be transported over water.	Similar challenges between options. Assuming plant and materials will be transported over water.	Similar challenges between options. Assuming plant and materials will be transported over water. Concrete will be transported via truck, on the road, not considered to cause a significant impact.
		Recreational and social activities (recreational fishing, boating, walking, local amenity asset)	M	50.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing Recreational and social activities (recreational fishing, boating, walking, local amenity asset)			
		Ability to cater for different user group (functional) requirements (current)	M	50.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing ability to cater for different user group (functional) requirements (current)			

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AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS									
MCA Criteria enabling a preferred wharf option						Preliminary Structural Options			
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Community	Social		VH	100.00						
		Ability to cater for future community demand	Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing ability to cater for future community demand.			
		Enabling public access to all parts of the wharf at all times, and doesn't compromise access to the beach / water	H	75.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing the ability to enable public access to all parts of the wharf at all times, and access to the beach / water.			
		Tourist congestion effect	H	75.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing the Tourist congestion effect.			
		Impact on connectivity / public open space (local amenity)	M	50.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing the impact on connectivity / public open space (local amenity).			
		Operational effect (for use of larger boats taking refuge)	M	50.00	M	50.00	1	0	0	1
			Comments		Comments		Can be improved, to a lesser extent.			Easier to accommodate larger boats with a wharf constructed from modern materials.
	Human Health	*This category is not assessed as there is no difference between the options presented.*					This category is not assessed as there is no difference between the above options, in assessing effects on Human Health (i.e. noise, air quality or contaminated land). The effects on Natural Environment are considered below.			
Economy		Commercial impact on commercial operators of the wharf (i.e. cruise ship tenders, fishing vessels, sightseeing cruises, interchange of baggage, stores and commercial harvest)	H	75.00	H	75.00	-1	1	0	-1
			Comments		Comments		It is anticipated that in 20 to 30 years the wharf will not adequately meet the user functionality requirements, due to the current platform level, sea level rise and flooding. Deterioration will accelerate over time.	Timber adds to the character of the wharf. If the construction of the wharf is authentic to the original wharf, it will be more appealing to tourists, and attract tourists to the commercial operators on the wharf.	This option retains some heritage features.	This option would have a negative impact, due to the heritage value of the existing wharf and connection to Akaroa township.
		Commercial impact on the businesses adjacent to existing wharf (foreshore)	M	50.00	M	50.00	-2	1	0	-1
			Comments		Comments		It is anticipated that in 20 to 30 years the wharf will not adequately meet the user functionality requirements, due to the current platform level, sea level rise and flooding. Deterioration will accelerate over time. Functionality of wharf is key to tourist industry, needs to be kept viable.	Timber adds to the character of the wharf. If the construction of the wharf is authentic to the original wharf, it will be more appealing to tourists, and attract tourists to the commercial operators adjacent to the wharf.	This option retains some heritage features.	This option would have a negative impact, due to the heritage value of the existing wharf and connection to Akaroa township.
		Flexibility to cater for future demand (i.e. cruise ship, tourist & business growth)	H	75.00	H	75.00	-3	1	0	0
			Comments		Comments		It is anticipated that in 20 to 30 years the wharf will not adequately meet the user functionality requirements, due to the current platform level, sea level rise and flooding. Deterioration will accelerate over time. Functionality of wharf is key to tourist industry, needs to be kept viable.	Easier to extend wharf with timber materials.	Harder to extend wharf with concrete members.	Harder to extend wharf with concrete members.
	Cultural values	Local Runanga/ Maori iwi cultural values (large significance in beach access)	H	75.00	H	75.00	1	3	2	-3
			Comments		Comments		Preference is for use of natural materials where practicable, and to recycle as much of the existing wharf as possible, to retain character. Acknowledge there is some, but limited opportunity to integrate mana whenua identity and values into restoring the existing wharf. There is greater opportunity to integrate these values into a new wharf.	Preference is for use of natural materials where practicable, and to recycle as much of the existing wharf as possible, to retain character.	Preference is for use of natural materials where practicable, and to recycle as much of the existing wharf as possible, to retain character.	No support for concrete structure.
		Food resources/mahinga kai effect (fishing spots etc.)	H	75.00						
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing the impact on mahinga kai.			

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Attachment E

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Cultural			L	25.00						
			Comments		Comments					
		Other local community cultural values					This category is not assessed as the difference between the above options, on the local community cultural values, is considered to be minor. Note the options are assessed under the criteria: 'Retain heritage values of existing wharf and Akaroa waterfront'.			
	Heritage		H	75.00	H	75.00	3	3	1	-3
			Comments		Comments		A large extent of the heritage values would be retained through restoring the existing wharf. This option would provide the closest resemblance to the original wharf.	Timber aligns with conservation plan policies (best practice), minimising impact and retaining maximum value. Dependent on how design is used to restore i.e. retaining existing heritage character based on function over form.	This option is tolerable. Lacks authenticity. Retaining elements and retention of material reflective of what was there is positive.	No residual heritage fabric. Huge departure from existing wharf.
		Retain heritage values of existing wharf and Akaroa waterfront i.e. ability to revitalise the existing wharf, with a high level of authenticity and integrity of the existing wharf - alignment with Conservation Plan/ minimising impact and retaining maximum value. Considering individual heritage values - Historical/Social, Cultural/Spiritual, Architectural/Aesthetic, Technological/Craftsmanship, Contextual, Archaeological.								
			H	75.00	H	75.00	3	3	1	-3
			Comments		Comments		New materials would be used however there is the ability to achieve a high level of authenticity. This option would provide the closest resemblance to the original wharf.	The new wharf will be constructed largely of new materials and will have the form, i.e. look and feel of a new structure. Opportunity to reuse original fabric of the existing wharf.	This option is tolerable. Lacks authenticity. Retaining elements and retention of material reflective of what was there is positive.	No residual heritage fabric. Huge departure from existing wharf.
		Retain any original fabric of the existing wharf, minimizing impact/maximising value (including existing concrete abutment, which is to be retained in-situ)								
			H	75.00	H	75.00	3	3	1	-3
			Comments		Comments		A large extent of the heritage values would be retained through restoring the existing wharf, and there is the ability to achieve a high level of authenticity. This option would provide the closest resemblance to the original wharf.	Timber aligns with conservation plan policies and ICOMOS charter (best practice). Dependent on how matapopere design and ICOMOS are used to develop design i.e. cultural narrative vs retaining existing heritage character, based on function over form. Greater opportunity to integrate local rūnanga identity and values into a new wharf.	This option is tolerable. Lacks authenticity. Less aligned with conservation plans and ICOMOS. Retaining elements and retention of material reflective of what was there is positive.	No residual heritage fabric. Huge departure from existing wharf.
		Alignment with Heritage Strategy, local rūnanga values, and ICOMOS Charter (Ensuring heritage is physical accessibility and providing an understanding of places through storytelling. ICOMOS relates to maintaining materials) (The ICOMOS New Zealand Charter, The Pumanawa o ICOMOS o Aotearoa Hei Tiaki i Nga Taonga Whenua Heke Iho o Nehe is a set of guidelines on cultural heritage conservation, produced by ICOMOS New Zealand)								
			H	75.00						
			Comments		Comments					
		Alignment with Akaroa Heritage Area and Akaroa Historic Area (CCC and HNZPT respectively) (Heritage New Zealand Pouhere Taonga (HNZPT) is a Crown entity with a membership of around 20,000 people that advocates for the protection of ancestral sites and heritage buildings in New Zealand.)					For the sake of not duplicating or double counting, the impact of materiality is assessed under the criteria: 'Alignment with Heritage Strategy, local rūnanga values, and ICOMOS Charter '.			
			H	75.00						
			Comments		Comments					
		Heritage and cultural values of adjoining Reserve, buildings and foreshore are maintained					For the sake of not duplicating or double counting, the impact of materiality is assessed under the criteria: 'Retain heritage values of existing wharf and Akaroa waterfront'.			

Christchurch City Council

Attachment E Item 4

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS										
MCA Criteria enabling a preferred wharf option							Preliminary Structural Options			
MCA Topics		MCA Criteria	Weighting %	Weighting %	Weighting %	Weighting %	Option 0 Restore existing wharf in its current location, no change to structural form.	Option 1: New wharf structure with like-for-like hardwood timber (excluding abutment).	Option 2: New wharf structure with a mix of concrete and hardwood timber (excluding abutment). Visible members would be hardwood	Option 3: New wharf structure made from concrete (excluding abutment).
Natural Environment	System Integration		H	75.00	H	75.00	0	0	0	1
		Noise and vibration effects (including noise effects on marine mammals i.e. dolphins)	Comments		Comments		Reusing existing piles, assuming piles will be adequate below the sea bed. To be determined on inspection.			Could potentially minimise noise and vibration effects, due to flexibility to minimise size and number with concrete construction. Need confirmation, specialist advice (i.e. Assessment of Effects).
		Air quality effects								
			Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing Air Quality effects.			
			M	50.00	M	50.00	0	0	0	0
		Ecological effects (considering disturbance to biodiversity/ecosystems, disturbance/displacement of marine habitats, spawning areas etc., including excavation/dredging effects (during and post construction), spillage or materials into the CMA)	Comments		Comments		No impact.	Minimal impact.	Minimal impact. No much concrete will be poured in-situ.	Minimal impact. No much concrete will be poured in-situ.
			M	50.00	M	50.00	0	0	0	0
		Coastal impact (i.e. impact of tidal flows on the seawall and coastal edge)	Comments		Comments		No change in vessel movement. No impact.	Due to early stage of conception, number of piles unknown. Unclear on impacts. Would need to confirm through design process.	Due to early stage of conception, number of piles unknown. Unclear on impacts. Would need to confirm through design process.	Due to early stage of conception, number of piles unknown. Unclear on impacts. Would need to confirm through design process.
Built Environment			L	25.00	M	50.00	0	2	1	-3
		Visual / landscape effect on natural environment (assumption of view of land from the water)	Comments		Comments		No change.	This option will most closely resemble the existing wharf, in form, structure and heritage features.	Some character and heritage features will be retained.	Will look very different. Will loose all original form, structure and heritage features..
			H	75.00						
		Ability to provide infrastructure (i.e. electricity, water, waste water. Fuel etc.)	Comments				This category is not assessed as there is no difference between the above options, in assessing ability to provide infrastructure.			
			M	50.00						
		Effect on active transport to the wharf and along the costal edge (pedestrian/cycle/mobility devices)	Comments				This category is not assessed as there is no difference between the above options, in assessing the effect on active transport to the wharf and along the costal edge (pedestrian/cycle/mobility devices)			
			M	50.00						
		Tourist congestion effect (of people on wharf)	Comments				This category is not assessed as there is no difference between the above options, in assessing the tourist congestion effect (of people on wharf)			
			M	50.00						
		Tourist congestion effect (Tourist buses)	Comments		Comments		This category is not assessed as there is no difference between the above options, in assessing the tourist congestion effect (tourist buses)			
			L	25.00						
		Urban design and landscape effect (i.e. effect of wharf on streetscape setting (existing street trees, furniture, paths) and on nearby landside buildings and urban form)	Comments				This category is not assessed as there is no difference between the above options, in assessing the urban design and landscape effect. It will be the same size and scale, the materiality doesn't effect the streetscape. (i.e. effect of wharf on streetscape setting (existing street trees, furniture, paths) and on nearby landside buildings and urban form)			

AKAROA WHARF RENEWAL MULTI CRITERIA ANALYSIS										
MCA Criteria enabling a preferred wharf option							Preliminary Structural Options			
MCA Topics		**MCA Criteria**	**% Weighting**	**% Weighting**	**% Weighting**	**% Weighting**	**Option 0** **Restore existing wharf in its current location, no change to structural form.**	**Option 1:** **New wharf structure with like-for-like hardwood timber (excluding abutment).**	**Option 2:** **New wharf structure with a mix of concrete and hardwood timber (excluding abutment). Visible members would be hardwood**	**Option 3:** **New wharf structure made from concrete (excluding abutment).**
	Environment				H	75.00	3	3	0	-3
		Environmental impact over lifetime (i.e. Carbon footprint)	Comments		Comments		WTP Akaroa Wharf: Carbon Emissions Estimate for CCC, February 2020 report outlines there is a clear benefit of utilising timber over steel and concrete, even when excluding sequestered carbon, and when accounting for shipping of materials from as far afield as South America.	WTP Akaroa Wharf: Carbon Emissions Estimate for CCC, February 2020 report outlines there is a clear benefit of utilising timber over steel and concrete, even when excluding sequestered carbon, and when accounting for shipping of materials from as far afield as South America.	WTP Akaroa Wharf: Carbon Emissions Estimate for CCC, February 2020 report outlines there is a clear benefit of utilising timber over steel and concrete, even when excluding sequestered carbon, and when accounting for shipping of materials from as far afield as South America.	WTP Akaroa Wharf: Carbon Emissions Estimate for CCC, February 2020 report outlines there is a clear benefit of utilising timber over steel and concrete, even when excluding sequestered carbon, and when accounting for shipping of materials from as far afield as South America.
					H	75.00	-3	-3	-1	-1
		Environmental responsibility and ethics (i.e. sourcing timber, carbon miles, local)	Comments		Comments		Long term, it is anticipated that the large sections of hardwood timber, i.e. 400 x 400, will be very difficult to source in 50 years time. Not sustainable. Note, CCC would require contractors to demonstrate the process of sourcing timber is in alignment with Council policy.	Long term, it is anticipated that the large sections of hardwood timber, i.e. 400 x 400, will be very difficult to source in 50 years time. Not sustainable. Note, CCC would require contractors to demonstrate the process of sourcing timber is in alignment with Council policy.	More sustainable options available as smaller volumes and smaller sized hardwood timber required for this option. Note, CCC would require contractors to demonstrate the process of sourcing timber is in alignment with Council policy.	Challenges with sourcing concrete, i.e. China, and Human Rights violations. Other sources available, i.e. South Korea, Australia. Note, CCC would require contractors to demonstrate the process of sourcing timber is in alignment with Council policy.
Assessment of Effects Objectives Score		NZTA Base Score & Weighting					225	575	25	-875
Weighted Score Base							-375	1025	775	-1000

Akaroa Wharf MCA worksheet FINAL 01-07-2020.xlsx
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D

Appendix D – Sensitivity Assessment Scenarios

Sensitivity Assessment 1			Sensitivity Assessment 2		
Sensitivity Assessment Scenarios	Weighting Rank	Weighting Rank Value	**Sensitivity Assessment Scenarios**	Weighting Rank	Weighting Rank Value
Original	VH	100.00	**Original**	VH	100.00
	H	75.00		H	75.00
	M	50.00		M	50.00
	L	25.00		L	25.00
	VL	0.00		VL	0.00
VH -10%	VH	90.00	**VH -20%**	VH	80.00
	H	75.00		H	75.00
	M	50.00		M	50.00
	L	25.00		L	25.00
	VL	0.00		VL	0.00
H +10%	VH	100.00	**H +20%**	VH	100.00
	H	85.00		H	95.00
	M	50.00		M	50.00
	L	25.00		L	25.00
	VL	0.00		VL	0.00
H -10%	VH	100.00	**H -20%**	VH	100.00
	H	65.00		H	55.00
	M	50.00		M	50.00
	L	25.00		L	25.00
	VL	0.00		VL	0.00
M +10%	VH	100.00	**M +20%**	VH	100.00
	H	75.00		H	75.00
	M	60.00		M	70.00
	L	25.00		L	25.00
	VL	0.00		VL	0.00
M -10%	VH	100.00	**M -20%**	VH	100.00
	H	75.00		H	75.00
	M	40.00		M	30.00

	L	25.00		L	25.00
	VL	0.00		VL	0.00
L +10%	VH	100.00	**L +20%**	VH	100.00
	H	75.00		H	75.00
	M	50.00		M	50.00
	L	35.00		L	55.00
	VL	0.00		VL	0.00
L -10%	VH	100.00	**L -20%**	VH	100.00
	H	75.00		H	75.00
	M	50.00		M	50.00
	L	15.00		L	5.00
	VL	0.00		VL	0.00
VL +10%	VH	100.00	**VL +20%**	VH	100.00
	H	75.00		H	75.00
	M	50.00		M	50.00
	L	25.00		L	25.00
	VL	10.00		VL	20.00

E

Appendix E – Calibre Advice on Akaroa Wharf Abutment Retention

Noelle Evans

To: Bouw, Kristine
Cc: Tom Arthur ([redacted]
Subject: RE: Akaroa Wharf Abutment Retention.

From: Bouw, Kristine [redacted]
Sent: Wednesday, 17 November 2021 3:42 pm
To: Noelle Evans [redacted]
Cc: Tom Arthur [redacted]
Subject: FW: Akaroa Wharf Abutment Retention.

From: Tom Arthur <[redacted]
Sent: Wednesday, 17 November 2021 11:13 am
To: Bouw, Kristine <[redacted]
Subject: Akaroa Wharf Abutment Retention.

Hi Kristine,

As discussed, I've summarised some of the risks and challenges associated with retaining the abutment.

- The condition of the abutment is moderate – poor. There is cracking throughout the abutment walls and the condition of the inner structure is unknown.
- The abutment was damaged in the Canterbury earthquake sequence. For the structure to be retained, CCC would need to accept the risk of damage from moderate earthquakes in the future.
- The proposed wharf deck is 500mm higher than the existing abutment, a sloping section would need to be created over the abutment or at the start of the main wharf. Modification of the abutment will be needed in the medium term
- The condition of the existing abutment is such that strengthening / modifying the structure would present programme and cost risk

Happy to elaborate on any of the above should you require.

Regards,

Tom

calibre
calibregroup.com

Tom Arthur
Associate Engineer - Buildings & Structures
[redacted]
Level 13, Kordia House, 109-125 Willis Street, Wellington 6011
View the legal disclaimer.

SIR JOHN KIRWAN FOUNDATION

Enabling Communities to Thrive

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44722	On behalf of the Akaroa Fishermans Association we present our submission to the CCC on the proposed new wharf. Firstly we fully support the reconstruction of the Drummons Wharf as an interim facility to accommodate our needs during the new wharf rebuild (berthage, fuel, loading, crane, etc). We are having on-going discussions with Mr Paul Devlin and Miss Kristine Bouw as to new wharf rebuild (material, width, length, power, fuel, crane, sewage, etc). At this stage we feel a lot to be decided. We are not in favour of the so-called knuckle this would attract people to an area where vehicles, passengers to the carter boats are passing through. It would be a health and safety issue and unnecessary as access to the beach and water front is virtually everywhere in the inner Akaroa Harbour. We would like to be able to speak to the Community Board at the next Akaroa meeting.	J G	Wright	Akaroa	Akaroa Fishermans Association
44721	The new Akaroa Wharf has to have a solid timber decking. Any other material will not fit in with the environment of the hills and the whole atmosphere of the area. As many historical pieces from the old wharf have to be saved and incorporated into the new wharf. At the public display last year an Option 2 was mentioned as a fully concrete deck. This may work at the New Brighton Pier where this view is to the horizon. This will not work in Akaroa for the above reasons and also including its history.	Stephen	Carswell	Akaroa	
44716	Dear Project Team, We write to provide a community business perspective on the wharf redevelopment, in particular the proposed supply of petrol on the wharf for commercial use. We have owned the NPD, Akaroa Motor Garage, in Akaroa for almost 3 years. We are strong supporters of the community and wherever possible like to operate in a way that is mutually beneficial for our community as well as our business. It is simply not possible to achieve one without the other in a community this size. We see this wharf as an exciting opportunity for Akaroa to continue to provide the world class experiences we are known for, while also offering world class infrastructure for a wide range of stakeholders to enjoy. However, we feel the supply of petrol on the wharf is unnecessary; there is a safe and accessible current supply in the town (no market failure), the increased traffic on the wharf that it may attract would present considerable health and safety and environmental risks, and should the use be extended to recreational use	Nina	Wright	Akaroa	Akaroa Motor Garage

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	the impact on the NPD business, and its ability to sustain the current level of service and employment may be compromised. Below I have detailed what we believe to be the three key areas for concern which would not only impact us as a business but the overall enjoyment of the facility for all. *Environmental risk. Does the need justify the risk?* This has to be of very high concern for the Christchurch City Council. The proposal states "Continuing to provide diesel for commercial operators while exploring the possibility of also providing access to petrol for them." The User Requirements document by Envisor states that there are only three commercial operators who require petroleum supply on the wharf. Two of these are seasonal tourism operators and one is a commercial fishing company that does not currently use the wharf. One of the operators has also requested facilities for electric vessels, an indication that any investment in on-wharf petrol supply may be short lived. The cost of installation of a petrol supply in a marine setting is unlikely to be less than $150K (but does depend on a number of factors for which there has not been enough information supplied to assess). It is unclear who would be paying for this, however if it was to be the current diesel supplier, the investment would be questionable in the long term. If it was to be the Christchurch City Council then there would be a huge misalignment between the Christchurch City Council's vision toward carbon zero and it's actions. Aside from the huge cost, the risks of installation in this environment are significant. This is reflected in the consent hurdles required for the construction of the wharf structure, let alone the installation of an additional fuel system whether above or below ground. There has already been a huge amount of consideration for the ecological impacts of the wharf rebuild and proceeding with seemingly unnecessary further disruption in this area sounds irresponsible and again, disproportionate to the need. Given this, I have concerns over how "commercial use" categorisation will be applied and enforced? What is to stop a user from obtaining the required fuel card and using the commercial facilities as a recreational user? Although the intention is for this facility to be commercial only, I doubt this will be enforceable long term and the only way to justify the return on investment would be to allow recreational use. The wharf is already a busy place, do we want to encourage more foot traffic when there are other boat launching and loading facilities available in the town? There are significant Health and safety implications of additional recreational vessels using commercial facilities.				

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	Akaroa's key tourism and cruise seasons coincide with the busiest recreational season in the town. With increased foot traffic comes the increased risk from an Health and Safety perspective. With the wharf already busy with cruise ship passengers, fishing vessels and commercial operators, if recreational use was also facilitated (whether intentionally or otherwise), this would also add to the risks associated with a multi-use area. There are also already considerable challenges with vehicle congestion and parking in the area which would only be exacerbated. Recreational vessels are suitably catered for in other areas of the community infrastructure - launch at the Recreation ground ramp or Dalys wharf, fuel at NPD and Duvauchelle for 91 - and attracting all vessels to the main wharf will cause congestion and negatively impact commercial use of the wharf. Increased berth space will be required which could impact on commercial boating operations. *The impact on the NPD Akaroa Motor Garage business directly.* We are concerned on how the duplication of available impact will impact our business. We could choose to take an approach that assumes only a small portion of recreational users would go out of their way to find a way to use this facility. For us to take this approach would be irresponsible. We currently employ 10 local staff year round. Many of them have families, mortgages and some of them are currently completing apprenticeships. This is a big responsibility and relies on our business model working effectively. Fuel is much like "2 for 1" deal in the supermarket mailer, a loss leader, it is a reason to enter the shop and as a result, a customer might buy a drink and a magazine, book their boat trailer for a warrant and an annual service for their car. If one of the cogs in this wheel is removed, the flow on effect could be considerable. We have no doubt that we would experience a downturn in petrol sales in our business if the duplication in supply of fuel was to go ahead. The commercial users of petrol are currently our customers but as also addressed above, it would be remiss of us to see the "commercial use only" as a genuine mitigating factor in the protection of our business from the impacts of petrol being supplied on the wharf. Fuel is not a high margin business, it relies on volume to be a viable service to provide. Sales of petroleum more than double in turnover over the period of (October - April) and a large portion of this can be attributed to petrol sales to recreational boats. This significant lift supports our business to make the most of a peak period of trade in the high season which this community relies on. This lift helps to ease the drop off in the lower season. Without this there could potentially be challenges to our ability to supply all necessary services for the community at other times of the year. The future of fuel and electric or other fuel alternatives means we as a business are forward planning to ensure we can pivot and provide services for the community into the future as these things change and evolve. In order to do this, it goes without saying, we rely on the income of our business to eventually enable us to invest in infrastructure to future proof for our business and our ability to support and serve our				

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	community. Regardless of the "commercial use only" label put on this by the Christchurch City Council, there will inevitably be recreational use so we must consider the impact of this redevelopment on the wider infrastructure and businesses in the community. *Other businesses perspective* Again, we are able to see the benefits for a small number of commercial businesses that would appreciate a more convenient refuelling option. Although we see the supply of petrol on the wharf as something that would have a negative impact overall, even for commercial use, we can understand some businesses may view this as an advantage. As current suppliers of petrol in a small town, we are willing to proactively work with these commercial operators to find and invest in solutions which can improve on how the current facilities cater for them. This would add economic value to all local businesses rather than bring additional tankers over the Christchurch-Akaroa road more often when there is already a petrol supply on the Peninsula. *In Conclusion* Akaroa needs to remain sustainable in the future, this involves maintaining the viability of critical infrastructure. At this time we are well resourced, but developments and the outside influence of a business who does not contribute to our community in any other capacity is a risk to us retaining viability into the future. We would be disappointed to see the Christchurch City Council take such a minority approach to something when we as a private business are planning towards and investing in a more sustainable future. Something according to the Christchurch City Council is an important goal for them also. We intend to continue to oppose this element of the redevelopment and would appreciate further transparency and conversation around the project and other solutions we can find for the people who require this service that do not involve risking our environment and community infrastructure. Yours Sincerely, Nina Wright and Clint Beatson Owner Operators, NPD Akaroa Motor Garage				
44715	See attached submission	Harry	Stronach		Akaroa Ratepayer & Residents Association Inc

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44714	As a commercial user of akaroa wharf its important to have fuel, a crane, loading unloading area, something much the same as we all ready have, just keep it simple.	jason	wright	akaroa	akaroa fishermans association
44712	Black Cat Cruises were the first to offer daily tourism cruises in Akaroa in 1985 and are known as one of New Zealand's first eco-tourism operators. Black Cat have won a number of awards in recent years, both for business excellence within the tourism industry and their commitment to conservation and the protection of the Hector's Dolphins. Black Cat Cruises have owned and occupied one of the buildings adjacent to the wharf since 1990 and have a high reliance on the Akaroa Wharf for our operations. Pre-Covid, over 45,000 visitors experienced a Black Cat cruise or Swimming with Dolphins in Akaroa each year. Whilst Black Cat Cruises generally support the councils plan for the rebuild of the Akaroa Wharf, we wish to submit the following comments: 1. A rebuild in the current location is the most suitable and logical option. The current wharf is a key feature of the town and moving this would have a significant visual impact. 2. We accept the need for a full demolition and reconstruction of a new structure. There will be a large amount of disruption through this method, especially for businesses located on the wharf itself. We need further discussion about the council's plans to enable our business to run; in particular the firm proposal on loading/unloading passengers during the construction phase. In addition, if we are unable to access our building on the wharf, what options are going to be made available. 3. The current agreement between CCC and the private building owners allows for the current wharf to provide support to the building structures. CCC should ensure through their tendering process that continued support of these buildings is allowed for and maintained without causing damage to the buildings or their supporting structure. 4. We are seeking assurance from the council that any work done to the wharf, in particular the demolition and re-piling works, will not damage the infrastructure under our buildings or the buildings themselves, and that any cost for such damage will be borne by CCC. Recent engineering assessments show the piles and buildings in good condition. 5. When finalising the design, it is important to acknowledge that a wharf is, in the first instance, a functional civil asset. Much like a road or bridge, it must first be designed to meet its functional needs utilising the most modern technology available taking into account the harsh marine environment. In this case, the primary use is for the loading and unloading of vessels (both recreational and commercial, aquaculture/fishing and tourism) and safe access for the public. After this can come the aesthetic integration to ensure it is not an eyesore for the community.	Paul	Milligan	Lyttelton	Black Cat Cruises

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	6. We acknowledge that there is some heritage value associated with the Akaroa Wharf. We support the inclusion of design aspects to keep the "look and feel" of the old wharf, but once again stress that this should not be at the detriment of the functional design. Retaining some of the current asset to be used (where appropriate) in construction of the new wharf would facilitate a good acknowledgement of the history of the wharf itself. 7. Of high importance in the functionality of the wharf is its strength and ability to safely accommodate vehicles for loading. This primarily relates to the aquaculture sector who, for many years now, have had to operate an unloading process utilising forklifts running up and down the wharf to unload. This is both time consuming, but also raises extra risk for the public trying to enjoy a stroll down the wharf. 8. As highlighted in the Envisor report into user requirements – the Wharf has seen increased vessel activity in the last decade. This was primarily around the use by Cruise Ship Tenders, but also additional commercial and recreational users. We support the inclusion of a 3rd floating pontoon, and also suggest provision for a 4th should be made. Floating pontoons perpendicular to the wharf itself can be smaller than the current pontoon as would allow for vessels to tie to each side and a 4th "finger" would not have a big visual impact but would ensure the wharf is functional for many years to come without users getting in each others way. Whilst the majority of cruise ships will return to Lyttelton we expect some level of cruise ship activity post covid. 9. When designing these floating pontoons, they should also allow for an increase in vessel size. It is highly likely that within the next 5-10 years, both commercial fishing and tourism vessels will increase in size. 10. Retaining supply of fuel is key. We support the retention of a diesel fuel supply on the new wharf and welcome any additions. 11. Future "fuel sources" should also be considered at the design stage of the wharf. Although some of this technology may not be immediately available, both electrical and hydrogen supply should be considered, and design considerations made for how these can be incorporated in the future without much re-design required. 12. If the wharf is raised 500mm, as planned, the proposed structure would then sit above the level of our buildings. This will create access issues for our customers and present a health and safety issue by creating steps or ramps down to our level. We seek a discussion with CCC on a remedy for this issue created by the new wharf level. In summary, Black Cat Cruises support the general location and concept, but note there is much to still be confirmed, in particular with the private building owners adjacent to the wharf and how the current users of				

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	the wharf will continue to operate during the disruption. We welcome the opportunity to work with CCC to find suitable solutions to these obstacles.				
44711	Refer attached document	Chris	Ford	Wellington	Disabled Persons Assembly
44710	Refer attached document	Victoria	Andrews	Akaroa	Akaroa Civic Trust

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44709	I am a professional marine scientist who has studied Hector's dolphins around Banks Peninsula for almost 40 years. Of particular relevance to the wharf replacement project is that I and one of my graduate students made a very detailed study of the responses of Hector's dolphins to the pile-driving that took place during reconstruction of the cruise ship berth in Lyttelton Harbour. The technology used was impact pile driving. This is the most commonly used approach, but creates very high levels of underwater noise at each strike of the driver. I'll attach two scientific papers we wrote on this topic. The first of these provides detailed measurements of the noise produced and how it propagated within Lyttelton Harbour. The second specifically addresses what effect those noises had on the habitat use of Hector's dolphins in the harbour. In summary, pile-driving significantly changed how the dolphins used the harbour; they were displaced from the vicinity of the pile-driving towards the outer harbour. Considering the importance of Hector's dolphins to Akaroa, both culturally and economically, all reasonable steps should be taken to ensure this does not happen here. From this research base, I make the following recommendations. 1. If possible, screw piling technology should be used. This creates low levels of underwater noise. 2. In terms of underwater noise, vibration pile-driving is no better than impact pile driving, and should not be preferred. 3. If impact pile-driving must be used, the pile-driving operation should take place in winter, when there are far fewer dolphins present in the middle parts of Akaroa Harbour. Professor Steve Dawson	Stephen	Dawson	Akaroa	New Zealand Whale and Dolphin Trust
44708	I am in favour of replacing the Akaroa Wharf. In order to be in keeping with the wharf being in a Marine Mammal Sanctuary, set up to protect Hector's dolphin, it is important to consider the potential impacts on the dolphins. Research in Lyttelton Harbour has shown that Hector's dolphins are impacted by pile driving. There is a readily available alternative, in screw-in piles. These are no more expensive, and much more environmentally responsible.	Elisabeth	Slooten	Akaroa	

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ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44707	hi there I wish to make a submission in person in front of a full council, rather than have my arguments presented via the community board, as, with the greatest of respect to the latter, i do not believe such a significant and expensive scheme can be adequately debated in that way. The council appear not to have taken on board many of the recommendations of the consultants they have retained - namely; origins, Enviser ltd, Planz and Tonkin and Taylor. Furthermore the adoption of the knuckle, despite claims that it is culturally essential, seems to me to be a thoroughly inappropriate bolt-on design affectation and entirely unsuited to a pseudo heritage design initiative which the council is pursuing. More than any other reason, the health and safety issues which the knuckle will impact on very severely, appear not to have been appreciated by the designers at all. A working wharf has continual heavy traffic to contend with, and this should never be mixed with recreational sightseers, tourists and others who will be encouraged to access the wharf via the steps of the knuckle at precisely its most congested part. I would also like confirmation of the council's pledge that the concrete construction will be faced with timber, in a concession to the wharf's heritage status, particularly the decking. Thank you for your consideration	Michael	Norris	Akaroa	

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ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44705	I have a home in Akaroa, and have long valued the amenity of Akaroa wharf, and the visual beauty and cultural significance of this historic structure. There is now a proposal by Christchurch City Council to replace the existing structure. As a mother and grandmother, I am concerned both about the safety of our children, and the environmental future of the planet. Therefore, having seen the Akaroa wharf proposal I wish to raise two concerns. Firstly, regarding the creation of an unnecessary, and potentially hazardous, 'crossroads'. Secondly, regarding the apparent use of concrete in the proposed replacement wharf, particularly the 'knuckle' design feature. The 'Crossroads'. Akaroa wharf is very heavily used. It accommodates the needs of commercial fishermen, commercial tourism operators, cruise ship passengers, tourists, recreational users and members of the general public. Therefore there is heavy traffic up and down the wharf, not only significant foot traffic, but also vehicles and machinery, including emergency vehicles. Although frequently heavily congested, the existing wharf has generally coped safely with these large numbers, as the 'traffic' has flowed up and down the wharf. However, the proposed replacement wharf introduces a new design feature, the knuckle, which creates a 'crossroads' at the busy entrance to the wharf. There are wide stepped structures on either side of the wharf, which create a cross route, at right angles to the existing flow of 'traffic'. On seeing the design I immediately envisioned my seven year old granddaughter delighting in running up one side, across the wharf and down the other side. What child (and their dogs) wouldn't love such an adventure, with the temptation of touching water on either side. This is a recreational/tourist location, where families are likely to be relaxed, and less conscious to the need to be alert to 'traffic' hazards. Children dashing across the route of vehicular traffic, clearly creates significant potential risk, and possible fatalities. Therefore I would be grateful to know (contact details above) if the design team has undertaken a health and safety assessment, around the risk to children inherent in the proposed design. Has any alternative design been considered for providing access to the foreshore and water, which not only is safer for children, but also provides disabled access? Concrete. If the cement industry were a country it would be the world's third largest emitter of CO2. It is recognized as contributing 8% of annual global CO2, a greater share than any country other than China or the US. Cement is the basic ingredient of the construction material, concrete. Given environmental concerns about the detrimental effect of CO2 emissions on climate change, countries around the world are actively moving away from the use of concrete in construction projects. For example, France is now requiring all public buildings to be constructed of 50% wood or other sustainable materials.	Kay	Terry	Akaroa	

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	The existing Akaroa wharf is notable for the tactile nature of its wooden construction, which has gained character by natural weathering. The cross-bracing of the proposed replacement wharf does reference this history. However it is concerning that the replacement wharf proposal does not appear to align with current global best practice construction trends, as it appears, particularly the 'knuckle' element of the design, to be constructed of concrete. This seems a lost opportunity to adopt a world-leading sustainable design. World cities are increasingly focussing on sustainability and lower carbon emissions. Indeed, Christchurch City Council declared a climate emergency in May 2019. Therefore I would be grateful to be provided with information (contact details above) about the percentage of sustainable materials that would be used in the proposed replacement wharf, and how this aligns with the Council's 'green' agenda.				
44704	I have had a long association with Akaroa, I first started coming here regularly as a holiday maker in the 1970s, and have been living here full time since 2015. I wish to be heard in support of my submission. In addition to the points below I wish to emphasise that: i. I would not like to see the commercial buildings footprint increase on the wharf. It is starting to feel like Westfield. I was in Russell a year or two ago, which is a historic village similar to Akaroa. The wharf there was pleasantly uncommercialised in comparison. ii. I support the cultural requirement that decking with steps down to the water's edge should be provided near Fisherman's Rest building. The main points are as follows.	Sara	Black	Akaroa	

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	1. The Akaroa Wharf is a highly valued and much loved community resource. It has sustained the livelihood of numerous families in the area for generations as well as providing pleasure to recreational users and visitors. 2. However, while developing the wharf's replacement the Council has largely overlooked the recommendations in the reports that it commissioned including The Akaroa Wharf Conservation Plan May 2019, Origins Consultants, User Requirements Needs Assessment, Akaroa Wharf, March 2021, Enviser Ltd and Main Wharf Akaroa July 29, 2019, Planz Consultants. 3. The council has a responsibility and duty of care with regard to individuals walking on and using the structure. Health, safety and wellbeing should be high priorities. The Council must reduce the element of risk for anyone who accesses or uses the wharf. 4. The Akaroa Wharf is a dual purpose facility, it serves visitors, recreational users as well as commercial operators. 5. Commercial operators necessitate the use of machinery, vehicles, vessels, equipment, tools, pipes, forklifts, delivery and emergency vehicles. A separate access area for these activities is a necessary requirement to ensure a safe working wharf and port facility while members of the public are present. 6. The Knuckle proposal, with steps on either side of the wharf down to the water, will create congestion at its busiest point. It is an unnecessary design feature and it is not structural. 7. The Knuckle, when the wharf is congested with people and children, will impede commercial operations which require the movement of vehicles, trucks and forklifts as well as emergency vehicles attending call outs. 8. Cultural associations relating to the water can be accommodated along the shoreline, not directly on the wharf itself. Alternative locations are readily available in proximity to the wharf. 9. The main wharf forms one of Akaroa's most significant cultural landscapes. 10. Materials used to construct the new wharf should reflect, compliment and be in keeping with the existing historic character of the immediate area. The surface of the wharf should remain hardwood timber as well as railings, seating and detailing. Visual links and references between the old and new wharves should include the use of wood, similar railings and simple shapes for all buildings and benches. Cross bracing below the wharf continues a long established tradition as recommended in the Conservation Plan. Cross bracing also provides visual continuity between the old and new structure.				

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	Colours should remain muted or dark to reflect the wood and character of the old wharf. The old wharf and abutment are highly textured. Sketches of the new abutment and wharf lack character, texture and colour. No further commercial development should be allowed on the wharf itself and existing buildings should not be allowed to expand beyond their existing footprint.				
44703	Council needs to replace the wharf as soon as possible and stop getting further reports which have no conclusions and do not address the issues which have previously presented by those you use the wharf. Council needs to provide an acceptable alternative wharfage facility for the present commercial users so the present businesses do not go out of business which will affect the economy of the whole Akaroa township. (This was mentioned in the November Calibre report 8.2 but not addressed.) The Calibre report does not consider budget requirements for alternative facilities during the wharf replacement and the necessary facilities associated with a working wharf (power, street lighting, fuel, cranage, sewer, seating, access ladders dingy storage, etc). This all needs to be considered in the wharf replacement budget. The replacement wharf should include concrete piles and a full concrete structure which will then allow for the berthing of larger vessels (also hardwood is uneconomical and environmentally unacceptable). The wharf should have a design life of 200 years and the use of repurposed hardwood will not achieve such (unlikely to achieve 100 years). By fitting fender piles at 3-000m centres will provide a visual blanket to the concrete structure and also provide for large yachts to use the wharf (rather than using the proposed floating pontoons). Super yachts would be too large for the floating pontoons. The proposed steps to the norther side of the solid abutment have no practical use and will become slippery and dangerous to persons trying to use them?? (these should be eliminated from any final design.) Just get on and replace the wharf.	Ian	Le Page	Akaroa	
44702	The Akaroa Main Wharf has very high heritage and landscape value – much higher than its value for actual use. Think of Christchurch Cathedral – not much value there for actual use, but very high heritage and landscape values to the City. That is why the Cathedral is being rebuilt in its former style and form. While it stands – and there is no indication of imminent collapse – the Akaroa Main Wharf needs to be retained (although possibly stabilised) in its present form or as close to that a reasonably possible. The plans by the Council seem to miss an important point. Although the structure is called a ‘wharf’, it	Michael	de Hamel	Kaiapoi	

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	actually functions as a 'pier' or possibly 'jetty'. While vessels occasionally lie alongside, and vehicles sometimes move down it, that is for convenience (eg fuelling) and lack of alternatives rather than necessity. The bulk of the wharf's use is actually as a pedestrian walkway and recreational fishing structure. Tour vessels and tenders operate off floating pontoons, with the wharf only providing pedestrian access to these. Fishing and other boats only use the wharf because it is easier than using Wainui or Lyttelton. A relatively small upgrade to the facilities at Wainui (which has much deeper water) would eliminate the need to use Akaroa's fragile wharf and the present safety conflicts between pedestrians and commercial use. The structural requirements for the Wharf to serve as a pedestrian walkway are very different from those proposed. While a few new piles might be needed, the main requirement would only be a series of light-duty pedestrian 'bridges' between stable sections of the historic surface of the Wharf. Yes, if fixed up to a pedestrian standard the Wharf would still be at risk from severe storms and sea level rise effects – but that would be understandable as a natural risk, not like the effects of a contractor with demolition machinery. Money saved from what would be a much cheaper solution could then be spent on upgrading facilities at Wainui where recreational and commercial use do not conflict with each other. See attached photograph of the Wharf's usual function - kids fishing! 				

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ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44700	I largely support the project and the proposals as in the plan. I made an initial submission in the early stages and then attended the Akaroa Consultation session where I provided feedback. I agree that the best option is replacing the wharf on the current site although I have concerns about the process of doing so. Until recently I was keen on keeping something similar to what currently exists in terms of design and materials but a recent experience has turned that upside down. Due to some surgery I have spent a couple of months on crutches and very limited mobility that made me realise that the traditional wooden surface is a nightmare and even the best is quite unsafe. Gaps, uneven footing, the slipperiness when wet are huge problems. My preference would be for modern composite materials that balance durability with grip, a safe surface, and even some fall protection. I believe it is important that any structure be future proofed and fit for purpose. The wharf(s) in Akaroa have always been first and foremost working wharves and that should stay. They should also be 100% open access - many wharves around the country have limited or no public access and this would be quite unacceptable. I understand that in some cases Health and Safety requirements mean fences/barriers are required along the edges. Again I urge the designers to resist this as ease of fishing and jumping off the wharf are rites of passage for our youth. It is important the council carefully considers the businesses that operate from and on the wharf both during construction and into the future. This is not a simple issue and one which has not, in my view, received sufficient consideration. My understanding is that the existing structures on the wharf have been added over many years in an ad hoc and unplanned basis and the uses have changed over time. I understand they are not consented (and may not need to be) and there is some issues about ownership and control. As the plan rightly proposes to increase the height of the wharf (but please remember accessibility) the future of these structures must be in question. Aesthetically they are of no value and I suspect structurally they may be suspect, but commercially they are of great value. The issue of who pays and who benefits does not appear to be addressed. Fishing, both commercial and recreational, has always been a mainstay of the wharf. In recent times there was controversy when the historic fisherman's landing was built over without consent (and then no subsequent consequences seemed to occur). The crane and fuelling, watering and provisioning systems need to be kept and brought up to modern standards. Again I assume that the council has worked with these groups to find out what is needed. There is the issue of what happens during construction to allow the businesses to survive. Covid has been a huge hit and if the council gets this wrong it could mark the death knell for some. Provision must be made in conjunction with the business to allow them to operate effectively during construction. For the "building based" ones that seem simple. However the various marine operators need access for passengers, suitable arrangements for fuel, water and other services, storage etc. While there are other wharfs available it is important that whatever solution it be in Akaroa to protect the wider businesses. Perhaps the current pontoons could be relocated (perhaps to Dalys wharf or the Yacht Club wharf) with suitable agreements. I'm not sure about the proposals about the standing areas around the start of the wharf. I also urge the	Kevin	McSweeney	Akaroa	

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	engineers to look at the effect of the current solid first 50 m of the wharf. I have a background in ecological sciences and the difference in the tidal areas on either side is fascinating to me.				
44699	I think the Akaroa Wharf should remain as close as possible to it's original design. It is an iconic part of Akaroa and as is mentioned has cultural and heritage significance.	Meg	Errington	Akaroa	

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ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44698	• I wish to be heard in support of my submission. • I support the submission of the Akaroa Civic Trust. The main points of my submission: • I support the expression of Maori cultural values. However, greater consideration must be shown to the expression of European/New Zealand cultural values and associations. New Zealand is a bicultural-multicultural country. • The knuckle feature introduces a modern design element into a recognised historic precinct. It is not structural and it will add to the cost of the project. Extensive use of concrete is not sustainable which is contrary to the principles of the council's climate change emergency resolution passed in May 2019. • The knuckle will encourage greater recreational use at the entrance to the wharf where it will be in conflict with commercial users which will create an unnecessary element of risk on the part of the council. The real issue is one of public health, safety and wellbeing. • The wharf and new abutment should relate and refer to the historic setting, streetscape and the old wharf (i.e. the use of a timber decking and cross bracing) with regard to the use of materials. • Increasing the height of the new wharf deck by only .5m is insufficient according to the Coastal Hazard report by Tonkin and Taylor and Taylor dated September 2021 (please refer to attachment). If the new wharf is going to remain operable for the next 50-100 years then it must accommodate the projected sea level rise of 1-1.5 metres in the Akaroa harbour area. In my view 1. The Council has overlooked the recommendations of the following reports. a. The Akaroa Wharf Conservation Plan May 2019, Origins Consultants b. User Requirements Needs Assessment, Akaroa Wharf, March 2021, Enviser Ltd. c. Main Wharf Akaroa July 29, 2019, Planz Consultants d. Coastal Hazard Assessment for Christchurch District, Summary Report, Tonkin & Taylor, September 2021 2. As the owner of the Akaroa Wharf, the Council has a responsibility and duty of care with regard to individuals walking on and using the structure. Health, safety and wellbeing should be high priorities. The Council needs to reduce the element of risk for anyone who accesses or uses the wharf.	Victoria	Andrews	Akaroa	

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	3. The Akaroa Wharf is a dual purpose facility, it serves visitors, recreational users as well as a commercial operators. Therefore the Council should construct the wharf in a manner that ensures the safety of members of the public as well as commercial users. a. Safety measures are a requirement for an active, working wharf and port faciality with regard to commercial activity. The future use of the structure should include the needs of fishermen, aquiculture, tourism operators, coastal shipping, passenger transport, cruise tenders, recreational users and members of the public. b. Commercial operators necessitate the use of machinery, vehicles, vessels, equipment, cranes, tools, pipes, delivery and emergency vehicles and forklifts (refer to Enviser report page 14, Table 7: record of infrastructure requirements from wharf users). 4. The Council has not fully considered sea level rise (Tonkin and Taylor CCC Coastal Hazard Assessment Summary Report September 2021, Key Findings, Short Term: now to 2050; 0-20cm sea level rise; Long Term: 2100 and beyond; 1 to 1.5m sea level rise; see attachment). However, the deck of the Akaroa Wharf will increase by only 500 millimetres. 5. The prosed knuckle feature will attract individuals, families and children to congregate at the wharf's busiest point. The knuckle will impede commercial operations including the access of emergency vehicles, delivery trucks and equipment due to congestion on the wharf itself and in the water around the structure. Recreational users including kayakers, swimmers and paddleboarders will be attracted to the knuckle feature in the same area where commercial operators tie up to and depart the wharf. 6. The council's consultation phase, scheduled to take place over the long holiday period, was poorly timed since ratepayers have been distracted with family, friends and vacations. Seeking information from council staff has proved difficult since many remain on holiday and away from the office. In my experience, and in my view, the council's request for consultation often results in a tick the box exercise. The council has devoted considerable time, money and effort in developing the Akaroa wharf proposal over a period of several years and at this late stage I am doubtful that it will take notice of the feedback provided by submitters. The fact that the Banks Peninsula Community Board will make a recommendation to the council on or around February 28, 2022 after considering submitters comments indicates the outcome is a fait accompli. There is no formal hearing scheduled as is normal on matters as important as this. Ratepayers are not being allowed the option of addressing the mayor and councillors on the replacement of the Akaroa wharf which is critically important. The new structure will have a significant impact the community of Akaroa and wider area of Banks Peninsula for the next 50-100 years. The council has already stated that the approval for the design, consent and construction of the new wharf will commence during the first quarter of 2022 according to Next Steps, page 6, Have your say, Akaroa Wharf				

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	replacement. In my opinion, the consultation exercise is viewed as a necessity to satisfy the requirements of the Local Government Act.				

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ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44696	This wharf is really means more than just 'ICONIC' any alteration to it let alone DEMOLITION!! 'SACRILEGE' This project is going totally 'Overboard'! and total waste of money as it Stands A new wharf is not necessary the existing one can be strengthened with new piles inside the old ones/deck can be modified still using the existing old timbers . Upright timbers/decking planks/piles and all. Replacement project should be Restoration project. I know the wharf well and as an ambassador for the cruise ships, i could see the pit falls of usage by many people being on it at one time. As for maintenance (What real maintenance? yes additional work carried out to accommodate the tender boats for cruise ships/concession businesses. The biggest problem occurred regarding the wharf was having the parallel decking planks over the horizontal ones (It took us (Cruise Ambassadors) It took a long time to get the council to highlight the danger of the difference in depth creating a groove! Eventually it was a painted marker line. Finally re finance for this project. What happened to the thousands of dollars paid by cruise companies for MOORING HARBOUR FEES? AND CONCESSION FEES FOR USE OF WHARF SPACE (Black Cat/ Blue Pearl +others). Save the Wharf/restore not Destroy	JOHN	THACKER	Governors Bay	N/A
44695	I applaud the construction of a new wharf and the design seems strong. In particular: - stepped access steps to the water. - increased pontoons for boat mooring. - retention of the blue sheds. It would be good to see: - more seating on the wharf - a concession for a cafe/bar at the west end of the blue sheds (consider popularity of Harbour). - raised viewing platform at end of wharf, with open-sided pavilion. It would provide an additional visitor experience and reference the pavilion on Daly's wharf.	Peter	Marshall	Christchurch	

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44693	I want to be heard in support of my submission and I support the submission of the Akaroa Civic Trust. I am disappointed the council has decided to demolish the old wharf but understand the need to accommodate sea level rise in the coming 100 years. I can see it happening now around the Akaroa harbour. However - increasing the height of the wharf deck by 500 millimetres does not meet the threshold of what is required according to information contained in the Coastal Hazard report by Tonkin and Taylor dated September 2021. Why is the council being so shortsighted? The Akaroa wharf is a lifeline into the future for the long term wellbeing of the community and Banks Peninsula. Freight and passenger service may return to the use of ships. The new wharf will be critical in terms of serving the needs of the area and it will likely need an elevated incline for vehicle access to avoid rising sea levels. I have lived in Akaroa for more than 26 years and I have witnessed how busy the wharf area can become yet the council is proposing to build a concrete decorative add on, the knuckle, at the busiest point at the start of the new wharf. This is madness. It looks like the council sees the Akaroa wharf as being for recreational use but in reality it is a working wharf that has also been used by international cruise ships as a port facility for many years. The Lyttelton Port Company would never be allowed to host recreational use within its confines much less on a working wharf structure. The council should be concerned about public health and safety instead of fussing over decorative features which are unnecessary and potentially dangerous. If the knuckle is built it will attract people to linger and lounge at the very point where ambulances, trucks, delivery vehicles and forklifts drive onto the wharf. The knuckle has no visual relationship to the historic streetscape of Beach Road or Akaroa's historic area. I think whoever came up with the idea must have been looking at photographs of steps down to the water because it is a common trend in European cities. If the council is going to spend over $19 million to build a new wharf then please use hard timber for the decking and cross bracing. Otherwise it will look just like the New Brighton Pier in Christchurch and Akaroa is not Christchurch. The images that I have seen of the new wharf make it look minimal and contemporary whereas the old wharf and general area has a lot of texture and is dark and in terms of colour. The council needs to remember that tourists and visitors come to Akaroa because of its historic character and unique sense of place. The new wharf looks totally out of place in the context of Akaroa. Fishermen and tourism operators have to make a living and the wharf is crucial to many livelihoods and families in the area. Commercial operators should not have to contend with kayakers, swimmers and paddleboarders swarming around and under the wharf as they work nor should they be required dodge people walking on the wharf when they have to drive their trucks and delivery vehicles onto it on a daily basis. The two activities, passive recreation and commercial, need to be safely separated as a matter of urgent public safety. No more buildings should be allowed on the new wharf because it is open public space, tourism operators will take over if permitted to do so and existing building should not be allowed to expand or become larger. The council is on track in terms of turning Akaroa into a Disneyland facsimile and the waterfront	Angus	Davis	Akaroa	

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	development, created by the former Banks Peninsula District Council about 20 years ago, was the first step in that direction. The town does not need expensive pedestrian build outs and tack tile pavers on every corner. Why does the council waste ratepayers money? It should instead be applied to issues that are important like the conservation, maintenance, landscaping and interpretation of the Britomart Memorial.				
44689	As a consulting engineer, director of OCEL, specializing in marine related work I have the following immediate comments on reviewing the documentation presented. The provision for Sea Level Rise (SLR) is too low at 0.5 m for a structure that can be considered as major infrastructure and can be expected to last for over 100 years. OCEL has done strengthening work for Port Marlborough NZ Ltd. (PMNZL) on the Waitohi Wharf in Picton Harbour that was built of reinforced concrete in 1910 and is still in everyday use. The Akaroa wharf concept is for a fixed structure the deck level of which has not been designed to be adjustable. It cannot easily be jacked up if the SLR provision is inadequate. The evaluation of wharf concepts has not considered floating wharves. A floating wharf adjusts with SLR and allows walk on walk off access the full length of the berthing face both sides of the wharf which is important for tourist type operations and a feature of the existing floating pontoons alongside the existing wharf designed by OCEL. Floating wharves have been designed by OCEL for the PMNZL in Picton, two are in service and floating wharves designed by OCEL have also recently been put into service (2021) in the ports of Greymouth and Westport for the local fishing fleets. The floating wharves were cheaper options than fixed	Gary	Teear	CHRISTCHURCH	OCEL - Offshore & Coastal Engineering Ltd.

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	wharves. For Akaroa the floating wharf option would allow drive on drive off access via a ramp, walk on walk off access for tourist and recreational vessels and given the $19 million budget allowed for a 155 m long by 8 m wide wharf would be cheaper than the fixed wharf replacement proposed for Akaroa. The cost/m2 rate allowed for the Akaroa estimate is more expensive than the $ /m2 rate that applied for the most recent heavy duty concrete container wharf at Port Otago (2019) designed by OCEL. An OCEL floating wharf option for Akaroa would feature a fixed end caisson like solid exterior structure that provided some wave protection to the berthing faces, featured an attractive architect designed structure to host a restaurant, elevated viewing platform and amenities in place of a blank featureless concrete wharf. The deck on the end structure would be designed to be jacked up to accommodate SLR. The floating elements would be built off site while the existing wharf remained in service minimising changeover time and could at some time in the future be towed to another location as SLR accelerated. If these thoughts were of interest I would be happy to attend a meeting to elaborate further.				
44688	I wish to be heard re my submission, I am concerned that the council staff haven't be transparent with their consultation. We have dealt with the CCC over the last 30 years and found that they give lip service to consultation, so they can tick that box, but it appears they have no interest in what the community want and don't have any interest in saving rate payers money as it isn't there money, that is why our rates in are 3 time what they are in Australia. I have requested information on the cost of repairs to the current wharf and have not been provided with this information. I have also requested it under the official information act and have had no information or reply to my email request, which under New Zealand Government law requires a response and the information supplied. If they have nothing to hide why cant they disclose those figures. This reflexes very badly on the Council staff, as they are not above the law and they seen to forget they are working for the rate payers not the other way around. I don't believe that the cost of repair would be anything like the cost of a new wharf approx $19m, which will blow out as building costs have increased in the last 18months by about 30% and now we have inflation it will increase cost even further. Some factors to consider which the CCC haven't seemed to consider. 1/ The current wharf has been there since the 1880s and families have a deep connection with the current wharf.	Dean	Marshall	Akaroa	

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	The wharf is very much loved by the community and the European history of New Zealand as well as the Maori connect to this current wharf cannot be under stated. 2/ The wharf this one or a new one is a working wharf as well as a recreational wharf. 3/ Has the CCC considered the Akaroa conservation plan may 2019 Origins consultant's, user requirements needs assessment, Akaroa wharf march 21, Enviser ltd and main wharf Akaroa july 29 2019 planz consultants, it doesn't appear so . 4/ I think the designers and council staff have not considered the health and safety aspects of the design. Remember this isn't just a recreational wharf it is a working wharf as well as a tourist wharf. 5/ There are vehicles, machinery and fishing and commercial tourist dolphins operators. There is considerations re access on and off the wharf re safety. 6/The designs I see as an issue that hasn't been thought through well is the following. a/ The fact the new wharf would need to be built 500-600 above current wharf height according to the council staff but in fact when you look at the reports on sea level raises the Councils' own reports say that the sea level will increase up to 1.5 m, in which case looking at the flood maps ,the shops on the main street will be flooded, if the 500-600 or the 1.5 m is to be achieved, how will they get the gradient to work or will they need to build steps or go across the other side of the road to active this height difference. There was nothing in the CCC plans that show how this was to be dealt with. b/ The knuckle, well if the above is to be considered re the height of the new wharf, the Knuckle will be an eye sore. c/ Again as this is a working wharf ,there need to be good access for vehicles including Ambulances and the knuckle will effect access, due to too many people at the entrance to the wharf. d/ The knuckle will be a health and safety issue with the possibility of older persons or children falling down the steps onto the rocks. 7/ As the wharf is one of the main features of Akaroa, it is important to get the materials of construction right. This needs to be in keeping with the historic character of the town. 8/The surface of the wharf should stay hard wood and not the cheaper wood the CCC have been doing repairs with in recent years ,which just have added to the detrition of the current wharf. 9/ All aspects of design should consider the historic references to the current wharf and Akaroa township.				

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	This isn't a small matter and as rate payers we want the best for the community, but we also want a community we can all afford to live in with the ever growth numbers of Government employees both central and local, this isn't guaranteed that we or future generations will be able to afford it so it is all our responsibility to be careful what central and local Government CCC spend. 10/any buildings on the wharf should be in keeping with the character of a historic wharf.				
44681	We would like to be heard in support of our submission. · The Akaroa Wharf is a highly valued and much loved community resource. It has sustained the livelihood of numerous families in the area for generations as well as providing pleasure to recreational users and visitors. · However, while developing its replacement plan the Council has largely overlooked the recommendations in the reports that it commissioned including The Akaroa Wharf Conservation Plan May 2019, Origins Consultants, User Requirements Needs Assessment, Akaroa Wharf, March 2021, Enviser Ltd and Main Wharf Akaroa July 29, 2019, Planz Consultants. · The council has a responsibility and duty of care with regard to individuals walking on and using the structure. Health, safety and wellbeing should be high priorities. The Council must reduce the element of risk for anyone who accesses or uses the wharf. · The Akaroa Wharf is a dual purpose facility, it serves visitors, recreational users as well as a commercial operators. · Commercial operators necessitate the use of machinery, vehicles, vessels, equipment, tools, pipes, forklifts, delivery and emergency vehicles. A separate access area for these activities is a necessary requirement to ensure a safe working wharf and port facility while members of the public are present. · The Knuckle proposal, with steps on either side of the wharf down to the water, will create congestion at its busiest point. It is an unnecessary design feature and it is not structural.	Elizabeth and Peter	Haylock	Akaroa	

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	· The Knuckle, when the wharf is congested with people and children, will impede commercial operations which require the movement of vehicles, trucks and forklifts as well as emergency vehicles attending call outs. · Cultural associations relating to the water can be accommodated along the shoreline, not directly on the wharf itself. Alterative locations are readily available in proximity to the wharf. · The main wharf forms one of Akaroa's most significant cultural landscapes. · Materials used to construct the new wharf should reflect, compliment and be in keeping with the existing historic character of the immediate area. The surface of the wharf should remain hardwood timber as well as railings, seating and detailing. Visual links and references between the old and new wharves should include the use of wood, similar railings and simple shapes for all buildings and benches. Cross bracing below the wharf continues a long established tradition as recommended in the Conservation Plan. Cross bracing also provides visual continuity between the old and new structure. Colours should remain muted or dark to reflect the wood and character of the old wharf. The old wharf and abutment are highly textured. Sketches of the new abutment and wharf lack character, texture and colour. No further commercial development should to be allowed on the wharf itself and existing buildings should be pared back.				
44651	Built in the 19th century, the Akaroa Wharf is protected as an archaeological site under the Heritage New Zealand Pouhere Taonga Act 2014. Under the Act, an archaeological authority is required for demolition of a pre-1900 structure. HNZPT has been in discussions with Christchurch City Council, led by Kristine Bouw and the Heritage Team, and we look forward to continuing this communication as the project, and application for archaeological authority, progresses. The Wharf and surrounding area have high Cultural and Spiritual value and we are encouraged to see Council staff have been working in partnership with, and receiving input from, Ōnuku Rūnanga on the cultural opportunities the new wharf brings. A draft Cultural Design Narrative is underway, and the conservation plan clearly outlines the relationship of mana whenua to this significant area.	Fiona	Wykes	Christchurch	Heritage New Zealand Pouhere Taonga

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44648	Submission on Akaroa Wharf Replacement I wish to make a submission on the Akaroa Wharf Replacement as a former resident of Banks Peninsula and a long-time member of the Akaroa Civic Trust who has had an interest in preserving the historic character and general amenity of Akaroa for more than 30 years. I wish to be heard in support of my submission. I concur with the view of the Akaroa Civic Trust that: The Akaroa Wharf is a highly valued and much loved community resource. It has sustained the livelihood of numerous families in the area for generations as well as providing pleasure to recreational users and visitors. I would add that the wharf has been a key part of the historic infrastructure of Akaroa and that the replacement wharf will also contribute to, or harm, the town's visual appeal. To avoid any harm the replacement wharf must look as much as possible like the old wharf, I also share the Civic Trust's opinion that: While developing the wharf's replacement the Council has largely overlooked the recommendations in the reports that it commissioned including The Akaroa Wharf Conservation Plan May 2019, Origins Consultants, User Requirements Needs Assessment, Akaroa Wharf, March 2021, Enviser Ltd and Main Wharf Akaroa July 29, 2019, Planz Consultants. I would submit that 1. The council has a responsibility and duty of care with regard to individuals walking on and using the structure. Health, safety and wellbeing should be high priorities. The Council must reduce the element of risk for anyone who accesses or uses the wharf. 2. The Akaroa Wharf is a dual purpose facility, which serves visitors, recreational users as well as a commercial operators. 3. Commercial use of the wharf involves the use of machinery, vehicles, vessels, equipment, tools, pipes, forklifts, delivery and emergency vehicles. A separate access area for these activities is a necessary requirement to ensure a safe working wharf and port facility while members of the public are present. 4. The Knuckle proposal, with steps on either side of the wharf down to the water, will create congestion at its busiest point. It is an unnecessary design feature and it is not structural. 5. The Knuckle, when the wharf is congested with people and children, will impede commercial operations	John Malcolm	Wilson	Arthurs Pass	

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	which require the movement of vehicles, trucks and forklifts as well as emergency vehicles attending call outs. 6. Cultural associations relating to the water can be accommodated along the shoreline, not directly on the wharf itself. Alterative locations are readily available in proximity to the wharf. 7. The main wharf is a crucial part of Akaroa's significant cultural landscape. 8. Materials used to construct the new wharf should reflect, complement and be in keeping with the existing historic character of the immediate area. The surface of the wharf should remain hardwood timber as should the railings, seating and detailing. Visual links and references between the old and new wharves should include the use of wood, similar railings and simple shapes for all buildings and benches. Cross bracing below the wharf continues a long established tradition as recommended in the Conservation Plan. Cross bracing also provides visual continuity between the old and new structure. Colours should remain muted or dark to reflect the wood and character of the old wharf. The old wharf and abutment are highly textured. Sketches of the new abutment and wharf lack character, texture and colour. No further commercial development should to be allowed on the wharf itself and existing buildings should not be allowed to expand beyond their existing footprint.				
44645	The wharf in Akaroa is a very important and historical structure and great care needs to be taken when replacing such a structure. It is important that the wharf relates to its history, as much of Akaroa still does, and not become a modern structure because it costs a little less. If the new wharf is built of concrete I think it is most important that wooden planking on the top should be used with as many of the old timbers reinstalled as possible. I find the build out on north side most intrusive and quite out of keeping with the old wharf. If for cultural reasons it is necessary to tie the wharf to the water for access reasons (?) it would much better to run parallel with the north face but coming out from the adjacent sea wall. This would not interrupt the length of the wharf and prevent the new wharf having a most modern appearance	patricia	dart	akaroa	

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44642	Akaroa Wharf Replacement I have read with great interest the proposals for the Akaroa Wharf replacement and I would like to add my comments in the hope that more thought can be given to a structure that has been an integral part of the landscape of Banks Peninsula since 1834. But first I would like to quote from the Christchurch City Council in its own words. This is its report from fifteen years ago which is relevant to the present City Council's Akaroa Wharf Replacement plans 'Have Your Say' booklet. The report I am referring to is the Akaroa Harbour Basin Settlements Study Christchurch City Council October 2007. I quote from page 25 of the document. Under the heading 'Historical Context': 'The Akaroa Harbour Basin has a dramatic and nationally important history that shapes the context within which community identity and visitor perception is formed today.....'. Under 'Cultural and Built Heritage': 'Akaroa is described as an exceptionally well preserved example of a colonial New Zealand town of the second half of the 19th century.....' Under 'Influence of Heritage on Community Identity': 'The community has expressed a strong desire to maintain the historic character of Akaroa.....' As you will appreciate 15 years ago there was already significant concern from Akaroa residents that a town plan was needed hence this strategic planning study of 2007 carried out by the Council. In my submission to you I would like to repeat to you as I am sure many of my friends in this township have, that I, too, feel that the heritage and look of the town is rapidly being destroyed. I will give you just one recent example. When one drives on the main road to Akaroa at the 'entrance' to the township there is a new development on the left-hand side of the road. In my opinion the block of four box-like houses on the hillside represents ugly modernity not in keeping with Akaroa's heritage. There is even an industrial type of heavy fencing around one of these properties. The development screams to me that the Council is not listening to us in its plan of how Akaroa should look and feel. There is a potential problem, in my opinion, when people make the final decisions on town plans when they do not live in the area, and therefore do not have their lives invested within that community. Akaroa residents need to have 'the last word' in future developments of any kind in and around their village.	Jacqueline and Peter	Smart	Akaroa	

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	Any future development including the Akaroa Wharf Replacement needs to be in keeping with the historic character of Akaroa that you quoted so many years ago. Let's keep this in the forefront of the minds of councillors before it is too late. I now refer specifically to your proposal on the Akaroa Wharf Replacement. 1. The wharf is one of Akaroa's major draw cards for tourists and locals alike. They enjoy a stroll to the end, to fish, and to admire the views of the harbour and to wonder at our wildlife. They use the wharf to board the ferries, and to shop. However, it must not be forgotten that the wharf needs to look attractive and appealing as well as being functional. However, on page 5 of your 'Have Your Say on the Akaroa Wharf Replacement' booklet the view from the north appears cumbersome. It is a mass of concrete more akin to the brutalist architecture popular in the 1970s. This sort of design has no place in an historic village by the seaside. The new steps appear to lead to nowhere on the north view and are a recipe for disaster. Is there not a danger that children will use the steps as a diving/jumping platform into shallow water? This shared space means that there will be boats arriving and departing the wharf nearby. There is potential for people slipping on the wet steps and as people emerge back up the steps there is a danger of commercial vehicles running them down. With regard to the artist's impression on page 3 where more steps have been designed, this time leading to the beach on the south side. Might I suggest that there is already easy access to the beach and the sea from the main road on the south side. Therefore, you do not need these steps. In summary it is an unnecessary expense for the steps to be built at all on either side of the wharf. 2. Also on the artist's impression on page 5 as you look at the wharf from the road side to the left of the wharf you have two different constructions for the wall, firstly there is a fence, then railings leading up to the building. Would it not be ascetically better to have railings right along that side of the wharf so that people can look down through the railings to the water? You then have continuity of view of the landscape. 3. You mention that the new wharf deck height will be raised by 500 mm. However, I cannot find any drawing in your booklet to show how the main road leading to the wharf will look like. This artist's impression needs to be addressed before any meaningful decisions can be made. Surely this was an essential diagram that needed to be published in your booklet as it is very difficult to visualise how the transition between the main road and wharf will work successfully. 4. I would like to see hardwood used on the wharf floor as it is a natural feature of wharfs around the coasts of New Zealand. This would fit in well with the wharf's heritage. If you are looking for other contemporary examples of this, look no further than the town of Oamaru. The Council is working on its replacement wooden flooring of Holmes Wharf as we speak. They are making a fine job of it. I would hate to see Akaroa's wharf changed to concrete. 5. With regard to the buildings on the wharf it is important that the structures are not oversized in relation to the wharf. If you look at the picture on the front cover of your booklet, the present buildings appear				

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
	oversized. This is not helped by extra box like structures which have been added onto them more recently on the side of the roof facing the wharf. In my opinion, these additions have made the structures appear ugly and out of proportion. I would go as far as to say they are monstrosities. Also, I think it would be more in keeping with an historical perspective if the structures were wooden in appearance and that they had wooden window frames and were painted in heritage colour schemes if they had to be painted at all. 6. If you are intending to give an overview of the history of the wharf, please could you make sure that the interpretation board does not block out the views. The board would be best placed on the side of the building rather than spoiling the views of the landscape looking out to sea. I do hope that you can spare the time to take my ideas on board as it is imperative that we get the look of the wharf right for those who live and travel here and for future generations. Akaroa is already being spoilt by a blanket approach of giving it a look of an inner city ie with the pavements demarked in white and yellow and road speed signage stretching above the eye line like enormous lollipops. Visitors and locals alike are attracted to Akaroa for its heritage. Please do not spoil any more of the place we call 'home'. With extra thought and first-class design, Akaroa could be even more of a draw card for New Zealanders and the World alike. With kind regards. Yours sincerely Jacqueline and Peter Smart				
44638	The Akaroa wharf is of historic significance and a major attraction for tourists as well as a functioning port facility. If it is not viable to repair then any replacement should attempt to replicate the existing one, maximising the use of timber and minimising the use of concrete and steel. Otherwise any link to the past will be lost.	Mervyn	Spurway	Akaroa	

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ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44636	Both Calibre Consulting Ltd Renewal Options and the CCC Akaroa Wharf Replacement booklet give excellent summaries of options and proposals. Despite arguments for retention of historic, cultural and spiritual values, (mere word-play), the practical approach must be paramount. Cost issues too, will take precedence. Concrete piles and beams should be used for strength, longevity, sustainability and the cost factor. I question the need for any more than minimum timber use to disguise the concrete structure. And any timber so used should be recycled from the existing wharf. The tin sheds are an eyesore and have no historic value. Building owners will have the opportunity to re-design during construction. CCC should ensure the new design is in keeping with Akaroa's heritage. Concrete steps from the abutment look like a good option for easy access to the water on the sheltered north side, and the addition of an end T and another pontoon or two would make the wharf more available to the casual user.	Nigel	Ferguson	Akaroa	
44631	I think the Akaroa wharf should be in timber to be in keeping with the historical aspects of the village. Please do not put a hard modern surface such as concrete it would be ugly and aesthetically unpleasing	Hilary	Hancock	akaroa	
44572	The replacement wharf must have wooden decking, there is no place for concrete decking on the replacement of such an iconic structure. The new wharf should continue to cater for a broad range of activities, these activities, commercial and individual, are the current structure's life force. I support steps on the southern side of the wharf giving access to and from the beach in front of Britomart Reserve.	Elizabeth	Mars	Akaroa	

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44463	Having read through the current Akaroa wharf proposal, I would like to strongly object to the use of concrete instead of wood. We will end up with a wharf that looks like New Brighton Pier and is not in keeping with the historic French theme of the village. Full Restoration of the existing wharf with like for like hardwood timber would be the best option but full replacement with a mixture of concrete and hardwood timber (visible) would be acceptable and concrete would not be acceptable. members would be hardwood) ▪ Full Replacement with modern reinforced concrete The consultation document also considered three potential locations	Wendy	Risdon	Anne	
44434	There has been discussion over many years relative to the construction of a stone breakwater in the general direction from the end of the main wharf structure towards the lighthouse, with appropriate gaps in the breakwater for entry and exit. The purpose of the breakwater would be: -to improve the safety for all forms of boating and provide a safe haven for boats from the existing wild weather fluctuations of the area, as well as the effects of future global warming. -to protect the new wharf from the wild weather fluctuations of the area, as well as the future effects of global warming. -to eliminate or reduce tidal and weather surges in the wharf area and enhance the safety and comfort of onloading and offloading of passengers -to provide a safe haven for moored boats that are otherwise exposed to extreme weather conditions. I would like to see a future breakwater proposal mentioned and considered in the wharf design to ensure that the wharf design is compatible with the future development of a breakwater. Akaroa Harbour is a beautiful environment that requires careful long term planning, and a breakwater would considerably enhance both the safety aspects mentioned above, as well as the aesthetic and natural beauty of harbour.	Paul	Burrowes	Christchurch	
44356		Michele	Moore	Hororata	

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44345	1. While construction is in progress, we as operators (commercial) from the Wharf would like Drummonds wharf to be upgraded for ourselves and Black Cat Group so we can continue to trade. At the end of construction this would leave a community asset for future use. 2. We are current tenants of the Council owned "Weighbridge" small building at the entrance to the main wharf. During construction we would to close this ticketing office and have the Council provide a container/kiosk to use as a ticketing office close to Drummond's wharf. 3. We would like the floating platforms to be at 90 degrees to the new wharf and to be one simple length of 30m with staunching's and white fenders - not black. 4. We would like fuel, water, sewerage and electricity to be accessible to all users	Hugh	Waghorn	Akaroa	Akaroa Dolphins
44154	It is really vital for boating safety that passengers can be loaded/unloaded on and off the three pontoons into private/recreational vessels, as Akaroa has very poor public access for this purpose at any of the public slipways in Akaroa at all, especially for the elderly or handicapped persons, and for the unloading of injured or medical assessment patients too at the main wharf The Enviser report dated 03/09/21 is also very misleading with respect to Page 29, refering to the Rec Ground ramp as "Dual access" when one side would never meet any public Health & Safety requirements ever. There is no "Floater" attached to either side on the Rec ramp, which is also a Health & Safety matter, and extremely poor washdown facilities provided at this ramp or anywhere nearby. Simon Duncan - Westpac Rescue Helicopter - general manager	Simon	Duncan	Christchurch	GCH Aviation Limited

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
44145	The ramp and wharf facilities for recreational boat users are below standard (steep, pot holed, drop offs, vertical ladders, tidal and difficult to access at certain tides). The main wharf is seldom used by recreational boat users due to the proximity to car/ boat trailer parking. This submission proposes that the ramp and wharf facilities for all users in the Akaroa area are considered and following aspects incorporated 1. A ramp that can be used in all tides. Use of Daly wharf ramp is unsuitable and dangerous and means users tow boats through the main street and and down past Ma Maison and often long ques result 2. A pay to use boat wash is installed to discourage unlimited boat washing on the streets from town supply which is in short supply and often has restrictions on it. 3. Suitable floating wharf modules are installed so access to boats is safe and functional. It is impossible for elderly or disabled persons to get onto boats from Dalys or Main ramp jetties at certain tides. I know is outside your main wharf scope but a quick look around any other port in NZ would see facilities like those proposed and surely we deserve better in Akaroa.	Charles	de Lambert	Akaroa	
44057	Please consider options for cruise ship tender berthing	D	Coulter	Christchurch	
44017	Would it not be possible to build the new wharf alongside the existing one for the majority of it's length, allowing for continued use of the existing structure while the majority of the new one is built and utilising the existing wharf as a building platform, then only the short tie section to shore needs to be out of action for a short period at the end of construction. https://unitedcivil.co.nz/project/paihia-wharf/	Christopher	Marett	Christchurch	
43985	I just have one question. The dimensions of the wharf will be the same. Is provision made for future extension of the wharf to allow for extended use? e.g. as a marina, or to accommodate expanding activities such as boat tours.	Keith	Jessop	Christchurch	Flow Kayaks 2017 Ltd

Submissions received on Akaroa Wharf Replacement, March 2022

ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
43951	I would like to see the current Wharf repaired or replaced on it's existing site. Having 2 wharfs means having to maintain both and is not necessary.	Ian	Little	Christchurch	
43878	You need to make the new wharf wider, at least out to the private buildings. When I was last there pre-pandemic, during peak tourist season, there was a large number of pedestrians on the wharf and it was very crowded. If this new wharf is intended to last a long time (many decades), it needs to be able to cater for future growth in users, so that it is not so crowded.	Mark	Relling	Christchurch	
43877	The new wharf, while likely fully planned, needs to provide a larger floating pontoon for leisure craft from around the harbour. The ability to safely moor for 2- 6 hours at the wharf is currently challenged by lack of space. Increasing capacity will encourage increased spend on F&B and the like by locals and holiday makers. Currently the floating pontoon is too small or not available at all when cruise ships are in. The need to keep adjusting mooring ropes based around tidal movements for small craft on a high wharf just does not work. By increasing wharf mooring, we will look to reduce road traffic in the harbour area, and potential carbon foot print.	Anton	Wilke	Christchurch	
43875	We support this proposal as it currently stands. Thank you for your time with this. Mary and Peter Gluyas	Mary	Gluyas	Akaroa	
43850	The explanation provided in the feedback plan of the need for the wharf replacement and the look of the new wharf satisfy my interest.	Graham	Ewing	Christchurch	

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ID	Please provide any feedback you have on the Akaroa Wharf replacement project	First name	Last name	City/Town	Name of organisation
43818	As an owner of property in Akaroa my wife and I would like the new wharf to have stalls (small shops) available to sell locally made arts and craft as well as local produce. We would also like to see safety railing at the end of the wharf to make fishing safer for children and older people. We noted kids fishing had nothing to hang onto. We would also like to see cruise ships back in the harbour so docking for the ships tender boats would need to be catered for. If business used the retail stalls and the cruise ships were charged for docking tenders this would help pay for the new project. Second submission. We would also like to see extensive lighting for use of the wharf at night preferably using solar lighting and an area where a band etc could operate. Akaroa needs a better night life and the wharf could help with that.	Ian	McPHAIL	Akaroa	

Submission #44715

Akaroa Ratepayers and Residents Association Inc

To: Christchurch City Council
PO Box 73016
Christchurch 8154

Date: 31 January 2022

Attn: Ms Ann Tomlinson, Senior Engagement Advisor

SUBMISSION REGARDING THE AKAROA WHARF REPLACEMENT

The Akaroa Ratepayers and Residents Association (ARRA) is an Incorporated Society that has been established to promote the interest and wellbeing of the community in the Akaroa area. This submission is made on behalf of the members of this organisation, and we believe this also represents the general interests of the wider community.

This submission has been prepared by Harry Stronach, the President of the Society. The preparation of this submission has been severely constrained by the December flooding event on the Peninsula, and a supplementary submission may be made in due course.

We wish to be heard in support of this submission.

Key Points
The Akaroa wharf is of fundamental importance to the town. Take the time to get it right, so that we can all be proud of the result.

Background
The main wharf in Akaroa has been in operation for around 130 years, and is currently in fairly poor condition. Christchurch City Council (CCC) has proposed that the wharf should be rebuilt, in broadly similar size and location as the existing wharf, and has invited public comment. The comments of ARRA are given below.

It is important to note that the wharf is a dominate feature and focal point of the town, and any major rebuild or replacement will have a long life expectancy and will "set the scene" of the Akaroa waterfront in a rather permanent fashion.

Community Asset
The wharf is a community asset. Christchurch City Council may be the current custodians, but they are simply holding the ownership of the wharf in trust, on behalf of the community of in the Akaroa area. Decisions on the future of the wharf must be driven by community consensus, with the opinions of council staff being useful inputs rather than determining factors.

Current users of the wharf will clearly have valid and important contributions to make, noting that those parties will generally have a focus on their own particular requirements. Such inputs need to be balanced against the fact that the current users are only "temporary residents", in the context of a wharf that is likely to exist for over 100 years. We believe that it is important that the design process takes a very broad perspective on future wharf usage, with input from the wider community being given substantial weighting.

What is the purpose?

The wharf is primarily a structure for commercial vessels, including fishing boats and tourism operators, but it is also used by private vessels, both local and those visiting Akaroa. It is also a recreational area for the public, whether simply wandering, taking in the sea air, or dropping a fishing line over the edge[1].

CCC commissioned a "User Requirements Needs Assessment" which was presented in March 2021, and is referred to as the Envisor report. That study was rated as "fair enough", as far as assessing the current operations are concerned.

On the matter of analysis of trends, likely future growth and future activities the Envisor report was very weak and lacked any real strategic analysis. These aspects need to be evaluated in far more depth, given the importance of the wharf project to the township.

In particular, the project needs to be far more ambitious regarding the maximum sized vessel that can be berthed. For example, the sail training vessel Spirit of New Zealand would[2] use the wharf when they come to Akaroa if they could do so. Currently, vessels of that size (33 m on deck and 4 m draught) are not permitted to use the wharf due to structural issues. The chatter in the marine industry suggests that we are going to see more sailing vessels of broadly that size in NZ waters in coming years, plus many more medium-sized private vessels.

There would be widespread support from the community for such visiting vessels to use the wharf. The regular talk about attracting high value tourists to the area could be given some practical meaning, by providing a wharf that can accept private vessels (so called superyachts) of an appropriate size.

The use of the wharf as a "tender terminal" is not a prime consideration, and a concept for sustainable tourism in Akaroa needs to be developed and agreed before any particular consideration is given to tender operations to the Akaroa wharf. We note that the cruise ship industry does not have any ownership stake in the infrastructure in this area, and when approached on this specific subject they declined to make any contribution whatsoever to the local community.

Where does all this fit into the big plan?

We just do not know, because there is no big plan, no common strategic vision, for the Akaroa town and surrounding area. That is a major concern.

[1] Or jumping over the edge, depending on your age and the water temperature
[2] Confirmed by discussions with the Spirit of Adventure Trust, which operates the vessel

It is essential that we have a comprehensive strategic plan for the entire township, before the wharf project proceeds. The Envisor report seems to think it is going to be "business as usual" regarding cruise ships - which is completely at odds with the ambitions of most residents. There are also related issues regarding the wisdom and risks of mixing commercial activities (unloading mussels etc) and recreational activities, on a wharf that is open for general public access,

Private Buildings

There are privately owned structures adjacent to (and partly connected to) the wharf, which perhaps have not been issued with consents in a proper manner, but rather have evolved over time.

Any complete rebuild of the wharf will clearly enhance the value of those buildings and the associated businesses. In fact it is clear that those enterprises benefit greatly from the wharf and, with their numerous clients, are major wharf users.

From the ratepayers' perspective there is an issue as to whether those building owners have been, and will be, paying an appropriate and fair proportion of the associated costs. Or are they going to get a free ride courtesy of the ratepayers?

The proposed rebuild of the wharf is an ideal and appropriate opportunity to remove any illegal and/or non-compliant structures, regardless of any past history of acquiescence by CCC. Given that this is a matter of public interest, and the ratepayers are paying, we expect to see complete transparency on this subject from CCC.

Wharf Height

We all know that there really is going to be sea level rise during the life of this new wharf. But exactly how high that rise will be remains uncertain, and that uncertainty becomes speculation as we peer further into the hazy future.

CCC have accepted a consultant's suggestion that an increase in deck height of 500 mm is going to be the "right" decision. Our view is that the science of climate change impact is not yet mature enough to make that call, and it could be that 500 mm will be seen to be completely inadequate, or excessive, in say 30 years time.

In addition, there has been no visible thought given to the costs associated with an increased height, the most obvious being the increased construction costs. There are also real, although less quantifiable, costs associated with the inconvenience of having to go up even 500 mm each time you walk down the wharf, just so that you have further to climb down[3] to get to your vessel.

A more prudent solution would be to design a fixed-height underlying structure, with a deck that could be raised at a future date if that proved necessary, say at 25 year intervals. Such

[3] And associated safety risks, whenever ladders and ramps are involved. Why deliberately make a ladder higher than necessary, in a situation that may exist for decades, if it is not proven to be necessary. Nuts.

an approach may have no appreciable increase in building costs, given the savings associated with lower initial height, and with the cost of any future work being heavily discounted in present value terms. From an engineering perspective it would not be difficult to put this concept into practice.

Wharf Appearance

We support the view of the Akaroa Civic Trust and other submitters, in that the layout of the wharf should largely follow the existing arrangement, and the appearance of the wharf should be a meaningful enhancement to the style, character and heritage of the town.

Some aspects of the design concepts presented to date, such as the "knuckle" are simply silly, and show an inadequate grasp of the design priorities[4].

The existing wharf has a 30 m long solid abutment (sometimes referred to as a quay) at the landward end. In the design concepts shown to date, that feature is reduced or even eliminated, which would be a retrograde step. Apart from detracting from the overall appearance, the abutment provides a degree of shelter to vessels and persons on the northern side. Given that the abutment is by now long established, its absence would be likely to change the local waterflows and deposition of marine materials in unpredicted ways.

The detail design of the wharf needs to take account of all user requirements, and public concerns, and we look forward to meaningful discussions on these aspects.

Construction Materials

There seems to be an assumption that concrete and/or steel will be the materials of choice, at least for the main structure. The alternative option, of using hardwood timbers seems to have been relegated as being too difficult, or perhaps old fashioned, or high maintenance. While the timber option does certainly require more planning, suitable timbers are known to be available from suppliers in Australia.

And look, CCC has a "Climate Resilience Strategy" document, and an ambition of achieving carbon neutrality by 2045, and here is an opportunity to put some real meaning into those feel-good ideas. Construction using suitable timber as extensively as possible utilises a renewable resource, and is a carbon sink. On the other hand the industries that produce concrete and steel are major greenhouse gases emitters. I think it is fairly obvious which side of that debate we want to land on.

Spend a moment to contemplate just how good-looking a new timber wharf could be, and how it would enhance the appearance and style of the town.

And then go and take a look at some concrete wharfs that have been built recently in NZ, and you may realise just how great a mistake the concrete version would be.

[4] And a fundamental lack of common sense

Submission #44715

Environmental Impact
The CCC documents available to date seem to provide no contemplation of the effects of the project in one important stakeholder group – the dolphins. There is no doubt that the dolphins are star players in the Akaroa environmental and tourism scene, and so some consideration is certainly due[5].

At the same time there is increasing concern in the technical press about the deleterious effects of underwater noise on marine mammals. Given the fact that the dolphin population has been declining in the harbour over recent years, it would obviously be counterproductive to undertake a major pile-driving project if that could be avoided or minimised.

The option of retaining, or even extending, the solid abutment needs to be seriously considered, as that would be likely to reduce piling activity and noise. In addition, the types of piles used, and the installation machinery and techniques need to be selected specifically with a view to minimising underwater noise.

Consultation Process
Recently we make a submission to CCC on the subject of their revised "Community Strategy" which had much talk about partnerships, and strengthening communities. There was no complaint about the CCC strategy, but it's the actions that count.

The subject of the Akaroa wharf replacement is a prime opportunity for the CCC to develop a meaningful partnership with our community, and both parties would end up strengthened as a result.

Sadly, the process to date has simply following the standard CCC format. Consultants have been no doubt well paid, there have been long periods of silence while staff presumably beaver away at something, with occasional "Have your Say" consultation exercises that are widely regarded by the ratepayers as a sham.

With this project we are talking about spending around $20m, which will ultimately be funded primarily by ratepayers[6], on creating an asset that will have a likely life of over 100 years. The subject is of fundamental importance to the future of Akaroa, and we therefore expect that an appropriate level of strategic thought and visions is applied to this project. But has this been happening?

There is an opportunity here for CCC to do so much better. We look forward to seeing a more meaningful engagement process with the community as this project continues.

Submission by

Harry Stronach, (Akaroa Ratepayers and Residents Association Inc)

[5] Of course, the effects that the wharf building and piling noise will have on humans in the area has not been considered either

[6] It is true that wharf users also pay fees in various ways, but in practice that is unlikely to even cover ongoing maintenance costs rather than contribute to the capital costs. CCC have not provided any detail on the financial framework around the wharf replacement project.

Submission #44711

Disabled Persons Assembly NZ

January 2022

To Christchurch City Council please find DPA's submission on the Akaroa Wharf Replacement

Disabled Persons Assembly NZ

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Submission #44711

Introducing Disabled Persons Assembly NZ

The Disabled Persons Assembly NZ (DPA) is a pan-disability disabled person's organisation that works to realise an equitable society, where all disabled people (of all impairment types and including women, Māori, Pasifika, young people) are able to direct their own lives. DPA works to improve social indicators for disabled people and for disabled people to be recognised as valued members of society. DPA and its members work with the wider disability community, other DPOs, government agencies, service providers, international disability organisations, and the public by:

- telling our stories and identifying systemic barriers
- developing and advocating for solutions
- celebrating innovation and good practice

The submission

DPA welcomes the opportunity to submit on the Akaroa Wharf replacement. This new replacement wharf will ensure that all disabled people and their whanau will be able to access and enjoy the events Akaroa has to offer. It will also cater to the growing number of disabled people who will visit this great tourist destination in the years ahead.

The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD)

The UNCRPD Articles most relevant to our submission are:

- Article 4.3 Involving disabled people and our organisations in decisions that affect us
- Article 9 Accessibility
- Article 9: Accessibility
- Article 19: Living independently and being included in the community
- Article 20: Personal mobility
- Article 30: Participation in cultural life, recreation, leisure and sport

New Zealand Disability Strategy 2016-2026:

- Outcome 5 - Accessibility

Submission #44711

DPA's recommendations

Recommendation 1: DPA strongly recommends that the wharf is repaired and made accessible for all users, and this especially includes disabled people who are mobility impaired such as, for example, people using wheelchairs, mobility scooters, and walking frames as well as for people pushing children's strollers.

Recommendation 2: DPA welcomes proposed changes to the height and width of the replacement wharf. It appears to us from the architect's drawings on the website that it will be made wider than the current wharf in order to accommodate more people and this will be beneficial for disabled people who use wheelchairs, mobility aids (such as walking frames) and people pushing children's strollers. Indeed, ensuring full and safe accessibility for all pedestrians and other wharf users will be vital.

Recommendation 3: DPA strongly recommends the availability of wheelchair and mobility aid user-friendly hoists to access boat trips departing from the wharf.

Recommendation 4: DPA strongly recommends that there be an accessible entrance created for everyone to commercial sites on the wharf, and this includes for disabled people using mobility wheelchairs, scooters and other aids as well as blind and low vision people.

Recommendation 5: DPA strongly recommends that there be tactile strips placed at strategic points along the wharf and jetty area to accommodate the needs of both blind people and low vision people navigating the area.

Recommendation 6: DPA strongly recommends the incorporation of safety features along the wharf including the erection of small wooden barriers to prevent people (including disabled people) from falling into the water and the placement of warning signs in accessible formats (i.e., New Zealand Sign Language) to indicate elevated risk areas.

Recommendation 7: DPA strongly recommends that seating be placed at strategic points along the Akaroa wharf of varying heights (either higher or lower), and these should include armrests so that people with mobility impairments, children and older people can easily get in or out of the seats.

Recommendation 8: DPA strongly recommends that there are sufficient mobility car parking spaces made available to accommodate the growing number of disabled visitors to the wharf area and that these be placed near the wharf.

Recommendation 9: DPA strongly recommends that it be involved alongside other disabled people's organisations (DPOs) as part of a comprehensive co-design

process and these organisations include People First, Deaf Aotearoa, Muscular Dystrophy Association, Kapo Maori and Blind Citizens. To this end, our local Kaituitui and DPA members are available to become involved in this project to ensure its accessibility.

Conclusion

DPA welcomes the City Council's proposal to replace the ageing Akaroa Wharf with what will hopefully be a more inclusive, accessible and safer wharf designed to meet the needs of both the Akaroa community and visitors going forward.

DPA looks forward to hearing the Council's response on our submission.

Submission #44710

AKAROA
CIVIC
TRUST
P.O. Box 43 Akaroa 7542

January 30, 2022

R**e: Executive Summary - the Akaroa Civic Trust's Akaroa Wharf Replacement Submission**

The Akaroa Civic Trust has an established track record of community and public service for more than fifty two years. In our view the Council has not to fully considered important issues that will significantly impact the health, safety and wellbeing of the community as well as anyone who uses the proposed new Akaroa Wharf.

The Akaroa Civic Trust

- Supports the expression of Maori cultural values.
- Encourages more consideration of the expression of Pakeha/European cultural values.
- Is concerned about the "Knuckle" feature of the new wharf as it introduces a modern design element into a recognised historic precinct.
- Is concerned, for health and safety reasons, about encouraging more recreational use at the entrance to the wharf where it will be in conflict with commercial users.
- Strongly encourages the use of materials and design elements that refer to the historic setting, streetscape and wharf (the inclusion of a timber decking, cross bracing).
- Notes that the new wharf is to be built .5m higher than the existing to allow for sea level rise, but that predictions are for a much greater increase in sea level over the life of the new wharf.

<u>The main points of our submission are as follows</u>.

1. The Council appears to have overlooked the recommendations of the following reports.
    a. The Akaroa Wharf Conservation Plan May 2019, Origins Consultants
    b. User Requirements Needs Assessment, Akaroa Wharf, March 2021, Enviser Ltd.
    c. Main Wharf Akaroa July 29, 2019, Planz Consultants
    d. Coastal Hazard Assessment for Christchurch District, Summary Report, Tonkin & Taylor, September 2021

2. As the owner of the Akaroa Wharf, the Council has a responsibility and duty of care with regard to individuals walking on and using the structure. Health, safety and wellbeing should be high priorities. The Council needs to reduce the element of risk for anyone who accesses or uses the wharf.

3. The Council should construct the wharf in a manner which ensures the safety of members of the public as well as commercial users. <u>The Akaroa Wharf is a dual purpose facility, it serves visitors, recreational users as well as a commercial operators</u>.

    a. Safety measures are a requirement for an active, working wharf and port faciality with regard to commercial activity. The future use of the structure should include the needs of fishermen, aquiculture, tourism operators, coastal shipping, passenger transport, cruise tenders, recreational users and members of the public.

    b. Commercial operators necessitate the use of machinery, vehicles, vessels, equipment, cranes, tools, pipes, delivery and emergency vehicles and forklifts (refer to Enviser report page 14, Table 7: record of infrastructure requirements from wharf users).

4. The Council has not fully considered sea level rise (Tonkin and Taylor CCC Coastal Hazard Assessment Summary Report September 2021, Key Findings, Short Term: now to 2050; 0-20cm sea level rise; Long Term: 2100 and beyond; 1 to 1.5m sea level rise). However, the deck of the Akaroa Wharf will increase by only 500 millimetres.

5. The prosed Knuckle feature will attract individuals to congregate at the wharf's busiest point.
    In our view, the Knuckle will impede commercial operations including the access of emergency vehicles, delivery trucks and equipment due to congestion on the wharf itself and in the water around the structure.

1

Submission #44710

AKAROA
CIVIC
TRUST

P.O. Box 43 Akaroa 7542
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January 30, 2022

Ms Ann Tomlinson, Senior Engagement Advisor (email: Ann.Tomlinson@ccc.govt.nz)
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☑ The Akaroa Civic Trust wishes to be heard in support of its submission.

Introduction

The Akaroa Civic Trust is a volunteer organistation that has been working to preserve the historic character and natural amenity of the town and surrounding area since 1969. Membership is composed of local residents as well as ratepayers living in Christchurch and around New Zealand. Some members live overseas and visit Banks Peninsula whenever possible.

Akaroa Wharf Replacement Submission

Thank you for the opportunity to comment on the Akaroa Wharf Replacement proposal.

The Civic Trust acknowledges and supports the expression of Maori cultural values relating to the Akaroa Wharf, harbour and surrounding countryside as well as the expression of European heritage values and cultural associations. In the context of the Akaroa Wharf, appropriate bicultural interpretation panels and markers can be located in close proximity or at the Britomart Reserve.

In our view the Council has not to fully considered several important issues which will impact and significantly alter the visual character and amenity of the new wharf with regard to the existing heritage setting and historic streetscape.

The main points of our submission are as follows.

6. The Council appears to have overlooked the contents and recommendations of the following reports.
    a. The Akaroa Wharf Conservation Plan May 2019, Origins Consultants
    e. User Requirements Needs Assessment, Akaroa Wharf, March 2021, Enviser Ltd.
    f. Main Wharf Akaroa July 29, 2019, Planz Consultants
    g. Coastal Hazard Assessment for Christchurch District, Summary Report, Tonkin & Taylor, September 2021

7. As the owner of the Akaroa Wharf, the Council has a responsibility and duty of care with regard to individuals walking on and using the structure. Health, safety and wellbeing should therefore be high priorities. The Council needs to reduce the element of risk for anyone who accesses or uses the wharf.

Submission #44710

8. The Council should construct the wharf in a manner which ensures the safety of members of the public as well as commercial users. The Akaroa Wharf is a dual purpose facility, it serves visitors, recreational users as well as a commercial operators.

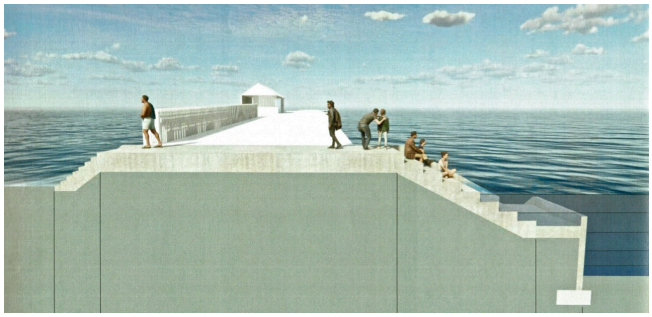
    c. Safety measures are a requirement for an active, working wharf and port faciality with regard to commercial activity. The future use of the structure should include the needs of fishermen, aquiculture, tourism operators, coastal shipping, passenger transport, cruise tenders, recreational users and members of the public.

    d. Commercial operators necessitate the use of machinery, vehicles, vessels, equipment, cranes, tools, pipes, delivery and emergency vehicles and forklifts on the wharf (refer to Enviser report page 14, Table 7: record of infrastructure requirements from wharf users).

Ambulance attending a call out March 2019

    e. A separate operational access area is a required to ensure a safe working wharf and port facility. Providing this space will alter the appearance of the structure, especially if the wharf is to be 'future proofed' for the long-term use and benefit of the community for the next 50-100 years.

The Civic Trust has reservations regarding the Knuckle design feature (referred to as Option A, below, although no other 'option' has been presented for consideration or discussion).



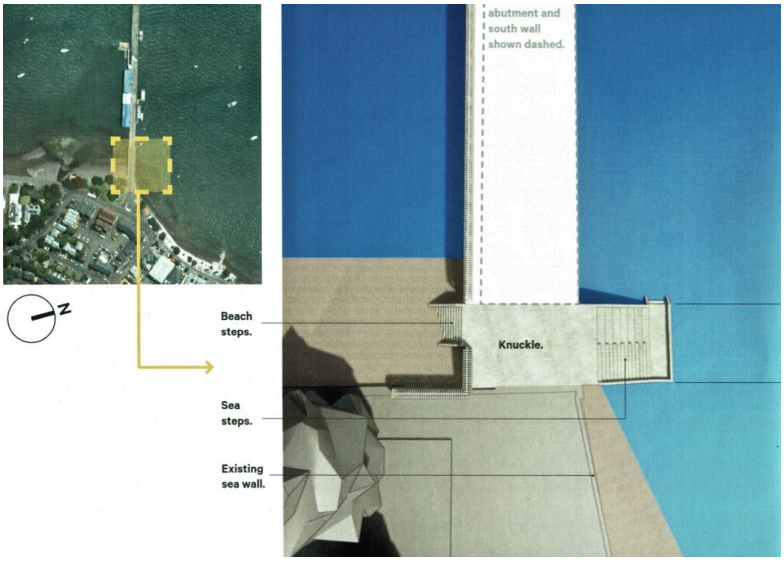
The start of the wharf is often a location of congestion.

The Knuckle will encourage individuals and children to gather in the vicinity.

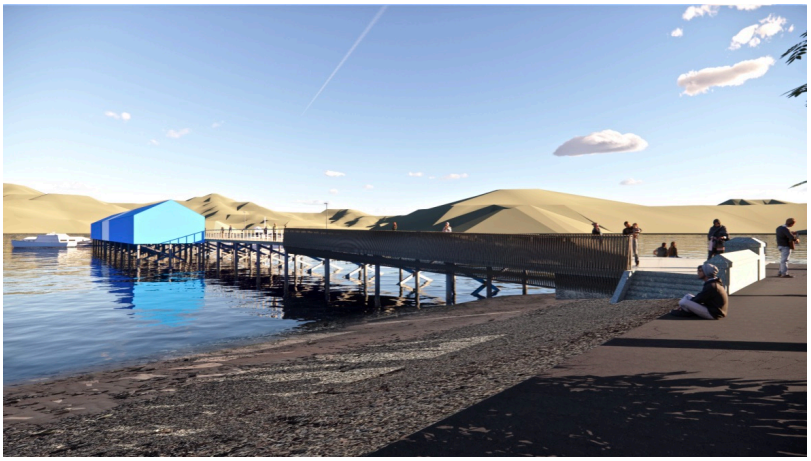
Option A, Isthmus, September 6, 2021

Submission #44710

In our view, the Knuckle requires an independent assessment with regard to risk and safety issues.



Images courtesy Christchurch City Council, December 2021



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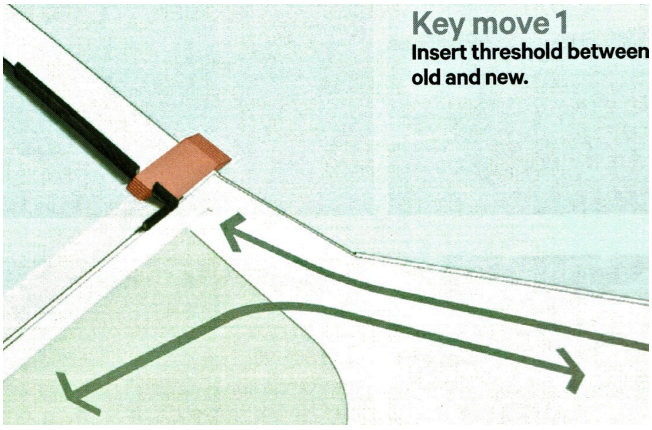


Key Move 1
Insert threshold between old and new
Isthmus, September 6, 2021

The concrete Knuckle is a design concept developed by Isthmus. Timber laid in a contrasting direction could be used instead to signify the demarcation between old and new at a far lesser cost and with a reduced degree of visual impact.

The area where the abutment commences experiences a high degree of activity and at times is heavily congested, see image below. (photos: Victoria Andrews)

December 2018

Kayakers, Akaroa Wharf 2022

Maritime NZ and Environment Canterbury (ECan) should be consulted in terms of providing expert advice with regard to the management of water-based activities i.e. boats used by tourism operators, scientific vessels, recreational users and cruise tenders are being used in close proximity to kayakers, paddle boarders and swimmers (noting that the Council pays ECan to monitor the use of the wharf when cruise ships access the harbour).

In our view, the Knuckle will attract and encourage greater recreational use under and around the wharf, which will bring people into potential conflict with commercial vessels.

Submission #44710

The Council needs to be mindful that some visitors, including families with young children, may not have adequate swimming skills to support themselves in the harbour as reported in recent news articles (Holiday drowning toll up 180 per cent on five-year average, Press, Jan 6 2022.The drowning toll for the official holiday period is up 180 per cent on the five-year average.)

The Knuckle is intended to provide access to the 'beach' and water as an expression of culture associations, however public access to the water is already available in close proximity to the wharf as seen in the image below. (photo: Victoria Andrews)

South side of the Akaroa Wharf next to the Britomart Reserve, 2022

Location of the Knuckle at the south side of the wharf.

The north side of the wharf consists of larger rocks along the shoreline.

No consideration appears to have been given to sea level rise with regard to the low seawall, Britomart Reserve and access to the shoreline. (Refer to Appendix A)

In our view, the Council should reduce the element of risk of people gathering a the abutment and the start of the wharf, which is its most congested point. The wharf is a working area that necessitates the use of vehicles, machinery and equipment.

- Access to the shoreline and water is available at alternative locations. The Knuckle is a tag-on design feature similar to those seen across Europe and in Singapore.

Sea Organ 2005, Nikola Basic, Zadar

Singapore water feature

Submission #44710

- Cultural associations relating to accessing the water can be accommodated via the low seawall area at the Britomart Reserve which does not require steps, modifications or visual intrusions.

- If steps are deemed to be a cultural requirement then decking with steps down to the water's edge can be provided near Fisherman's Rest on the north side of the wharf to avoid congestion and potential conflict between the public and vehicles and equipment used by commercial operators.

General Comments
The Civic Trust is concerned that tangible links and heritage values relating to the historic Akaroa wharf have been largely erased rather than being conserved or acknowledged.

The Akaroa wharf is not primarily recreational in terms of its usage, therefore it cannot be compared to the New Brighton Pier which was constructed for recreational users.

The Akaroa Wharf is a highly active, commercial structure in every sense of the word and it could also become an economic lifeline in terms of coastal shipping and transport in the next 50-100 years.

The Knuckle is a visual addition which reflects popular design trends around the world that are created to attract tourists and visitors to congregate in a particular area.

The Knuckle has no historic relationship with, or precedence in, to either Akaroa or the South Island of Aotrearoa/New Zealand. The Knuckle will not connect people to a beach area because the shoreline on either side of the wharf is composed mostly of rock. Wave action on the southside of the wharf will impact the Knuckle as debris and rocks build up against it.

The Knuckle will create a demarcation between the area of the authentic, historic wharf to important landmarks and the heritage streetscape of the Britomart Reserve and Beach Road.

The height increase of the new abutment and wharf will make the Knuckle a dominating design feature. In our view it will have a long term negative visual impact on Akaroa's Historic Areas (NZHPT 7330 September 6, 1996; NZHPT 7443 February 5, 1999).

The visual impact of the contemporary Knuckle design feature will reduce the heritage values and amenity of the immediate heritage setting and historic streetscape.

In our view the Knuckle and aspects of the new wharf are contrary to the Design Guidelines for Akaroa, Origins Conservation Report and The ICOMOS New Zealand Charter 2010.

> The ICOMOS New Zealand Charter 2010 - The ICOMOS New Zealand Charter, Te Pumanawa o ICOMOS o Aotearoa Hei Tiaki I Nga Taonga Whenua Heke Iho o Nehe is a set of guidelines on cultural heritage conservation, produced by ICOMOS New Zealand.
>
> The NZ Charter is widely used in the New Zealand heritage sector and forms a recognised benchmark for conservation standards and practice. It is used by central government ministries and departments, by local bodies in district plans and heritage management, and by practitioners as guiding principles.
>
> Heritage New Zealand / Pouhere Taonga, the Ministry of Culture and Heritage and the Department of Conservation use the New Zealand Charter to guide their heritage conservation work. It was used by Ngai Tahu in their Deed of Settlement and the Lotteries Grants Board uses it for guidance in its deliberations.

Submission #44710

The Charter has been adopted as heritage policy by a number of district councils and is used as a standard reference document in Auckland, Christchurch, Hutt City and a number of other local authorities.

The New Zealand Charter covers the purpose, principles, practice, and processes of conservation. It also provides useful definitions of the main conservation terms such as preservation, maintenance, restoration and so on.

- As the main wharf forms one of Akaroa's most significant cultural landscapes, the materials used to construct the new wharf should reflect, compliment and be in keeping with the historic character of the immediate area.

  Visual links and references between the old and new wharves should include the use of wood, similar railings and simple shapes for all buildings and benches.

  The surface of the wharf should remain timber as well as seating and detailing. The crane, owned by John Wright, should be retained as an historic feature.

  Bracing below the wharf continues a long established tradition as recommended in the Conservation Plan. Cross bracing provides visual continuity between the old and new structure.

  Colours should remain muted or dark to reflect the wood and character of the old wharf.

  The old wharf and abutment are highly textured but the sketches of the new abutment and wharf lack character, texture and colour.

  No further commercial development should to be allowed on the wharf itself; existing buildings should not be allowed to expand beyond their current footprint.

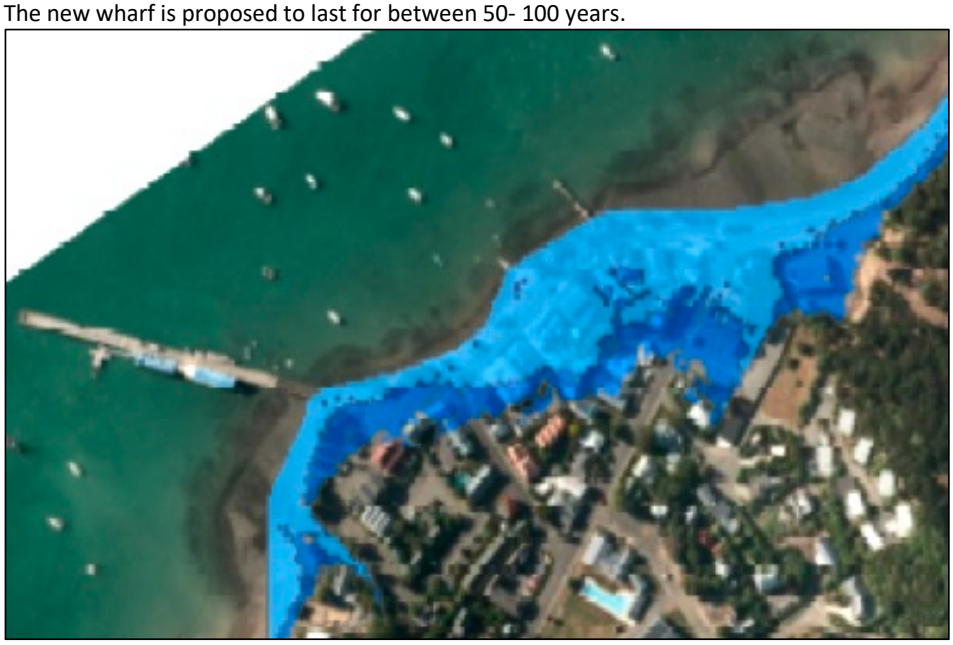
In Conclusion

The Council must needs to exercise regard for Akaroa's historic character and natural amenity with regard to the wharf's context, setting and streetscape. Akaroa has always been a bit "rough around the edges" as layers of time and history have washed over it. The revamped waterfront development along Beach Road in 2000 incorrectly sought to replicate the style of a seaside town along the French coast. The addition of hard, grey walls and limestone chip does not sit comfortably in the context of the historic streetscape.

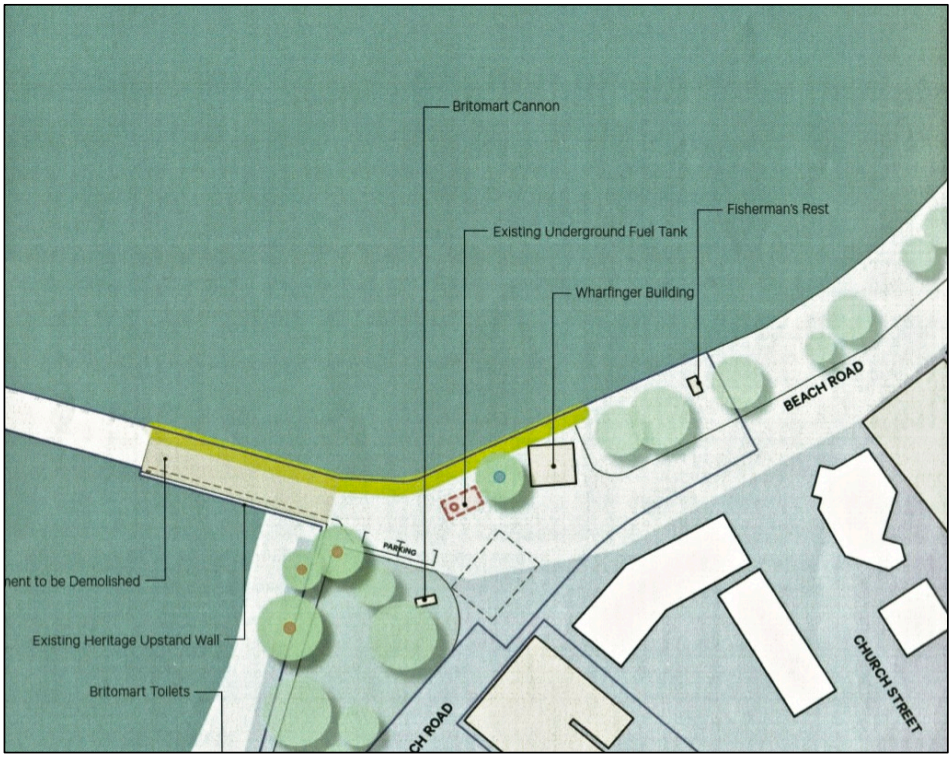
Over the past twenty five years the desire on the part of Banks Peninsula District Council and Christchurch City Council for uniformity has gentrified the township. Generic street furniture (heritage off the shelf), makes the task of ordering easier for the council and the continued use of tactile pavers and imposition of new curbing imposes generic uniformity on the historic character and amenity of the original heritage fabric of the town.

Submission #44710

Appendix A
The new wharf is proposed to last for between 50- 100 years.



Tonkin and Taylor CCC Coastal Hazard Assessment Summary Report September 2021
Key Findings
Short Term: now to 2050; 0-20cm sea level rise
Long Term: 2100 and beyond; 1 to 1.5m sea level rise



According to the Akaroa Wharf Replacement Concept Design Feasibility Study, Isthmus September 6, 2021, the new wharf deck will be raised by 500 millimetres.

Submission #44709

Marine Pollution Bulletin 135 (2018) 195–204

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Underwater noise levels of pile-driving in a New Zealand harbour, and the potential impacts on endangered Hector's dolphins

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ARTICLE INFO

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Hector's dolphin
Noise impacts
Marine protected area

ABSTRACT

Impact pile-driving generates loud underwater anthropogenic sounds, and is routinely conducted in harbours around the world. Surprisingly few studies of these sounds and their propagation are published in the primary literature. To partially redress this we studied pile-driving sounds in Lyttelton Harbour, New Zealand, during wharf reconstruction after earthquake damage. That Lyttelton harbour is routinely used by Hector's dolphins (*Cephalorhynchus hectori*), an endangered species found only in New Zealand, provided further context for this study. Steel piles of 0.61 or 0.71 m diameter were driven using three different pile-drivers. Maximum calculated source SEL was 192 dB re 1 μPa^{2}s @ 1 m (SPL_{0-p} of 213 dB re 1 μPa @ 1 m). Propagation of piling noise was strongly influenced by harbour bathymetry and a rock breakwater near the piling operation. We calculated range estimates at which Hector's dolphins may suffer temporary hearing threshold shift and behavioural change.

1. Introduction

Impact pile-driving produces impulsive, repetitive sounds that are among the loudest anthropogenic underwater sounds, particularly when steel piles are driven (Richardson et al., 2013). This form of noise pollution has been extensively studied in relation to windfarm construction (e.g. Bailey et al., 2010; De Jong and Ainslie, 2008; Nedwell et al., 2007) but there are very few studies of noise generated due to wharf construction that are published in the primary literature (for exceptions see Paiva et al., 2015; Würsig et al., 2000). Since several dolphin species routinely occur close inshore and in harbours (e.g. Dawson, 2018; Parra and Jefferson, 2018), this lack of literature is a potentially important weakness in the protection of these species.

Pile-driving noise has been established as a serious threat to some marine mammal species (Thompson et al., 2013). Wild harbour porpoise (*Phocoena phocoena*) show strong avoidance reactions to pile-driving (Brandt et al., 2011; Dähne et al., 2013; Tougaard et al., 2009). Temporary hearing loss has been documented in captive animals, following exposure to pile-driving noise (Kastelein et al., 2015). Hector's dolphin (*Cephalorhynchus hectori*), an endangered, nearshore delphinid found only in New Zealand, is routinely present in Lyttelton harbour. The Banks Peninsula Marine Mammal sanctuary (including Lyttelton harbour) was created in 1988 to reduce the impact of incidental catch in gill nets and trawling, the main threats to Hector's dolphins. That Hector's dolphins have very similar acoustic behaviour to harbour porpoises (Dawson, 2018; Dawson and Thorpe, 1990; Villadsgaard et al., 2007), are similarly sized and have broadly similar ecology (Würsig et al., 2018) raises the potential for pile-driving to be an additional impact, and provides the context for this study.

Impact pile-driving radiates noise into the water and sediment surrounding the pile. The majority of the underwater noise arises from radial expansion of the pile as it is struck by the hammer, radiating directly into the water column (Reinhall and Dahl, 2011; Tsouvalas and Metrikine, 2013). Energy is also transferred into the seabed, and can radiate back into the water, or travel as surface waves (Sholte waves) along the water-seabed interface (Tsouvalas and Metrikine, 2016a). For these reasons, pile-driving noise does not behave strictly as a "point" source. The spectrum of a typical pile strike is broadband, with most energy below 1 kHz but with significant energy extending to > 100 kHz, especially at close range (e.g. Nedwell et al., 2007; Tougaard et al., 2009).

Sound propagation is usually described as involving two kinds of losses, spreading losses and absorption. Spreading losses range between cylindrical (shallow water; 10*log(R), where R is range) and spherical (deep water; 20*log(R)). Absorption is frequency dependent, high frequencies are rapidly absorbed, while low frequencies can be detectable above ambient noise at very large ranges (Ainslie and McColm, 1998; Malme and Beranek, 1995). Shallow water, however, imposes a lower limit on the frequencies it can support to propagate based on depth (Forrest et al., 1993; Jensen et al., 2011). In practice, sound

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Item 4

Attachment F

propagation is complex, especially in shallow water, influenced also by the roughness of the surface, depth, the nature of the bottom, and any layering in the water column (Marsh and Schulkin, 1962; Pine et al., 2014).

Modelling propagation from impact pile-driving presents an especially difficult challenge, due to the influence of bottom layer properties (Lippert and von Estorff, 2014) as well as bottom and surface reflections in shallow water transmission (Marsh and Schulkin, 1962). Currently there is no available software that can adequately model this complex process in a realistic coastal setting, accounting for the various environmental factors, and beyond ranges > 1.5 km (Denes et al., 2016; Duncan et al., 2010; Fricke and Rolfes, 2015; Reinhall and Dahl, 2011). For these reasons a strong empirical approach to measuring propagation was used in the present study.

The 2010 and 2011 Christchurch earthquakes extensively damaged the city's port in Lyttelton harbour. Port development was combined with repair work, under the Canterbury Earthquake Recovery Act (2011), allowing the work to be carried out without the usual resource consent process, and therefore, under less strict environmental management. The construction work involved 15 months of pile-driving.

Our purpose in this contribution is to describe the acoustic characteristics of noise pollution generated by impact pile-driving during the wharf reconstruction in Lyttelton harbour, quantify the propagation of this noise within this harbour, and investigate the potential impact this noise may have had on the local Hector's dolphin.

2. Materials & methods

2.1. Study area

Lyttelton harbour (43°36′47″S, 172°44′24″E), on the east coast of the south island of New Zealand, is a shallow harbour (Fig. 1) with a dredged shipping channel.

Pile-driving was carried out using three different impact hammers (Table 1). In each of these, hydraulic power was used to lift a steel hammer which then dropped via gravity on the top of the pile. The piles were steel, hollow, and closed-ended, with a diameter of 0.61 m or 0.71 m. Each pile was approximately 80 m long and driven an average of 66 m into the seabed (HEB construction, pers. comm. 2015). The contractor's records of pile-driving activity, which specified pile location, pile-driver, and the sequence of lift heights used, were made available by HEB construction and Port Lyttelton. A "soft start" using the hammer on its lowest energy setting for the first 2 min, was standard practice (i.e. required by the pile-driver manufacturers). Pile-driving was scheduled from Monday to Saturday between 7:30 am and 6 pm. Weather conditions restricted the actual operation time.

Table 1
Pile-drivers used in Lyttelton harbour.

Model	Gross weight (t)	Hammer weight (t)	Lift height range (m)	Max energy (kJ)
BSP 1146	35	14	0.5–1.5	206
Bruce SGH 1015	28	10	0.2–1.5	147
Junttan HHK18A	18	9	0.2–1.2	106

2.2. Field techniques and data collection

Sound recordings were made using three autonomous recorders (two DSG Ocean recorders and a SoundTrap HF) and two boat-based recorders (for recording locations see Fig. 1). The SoundTrap HF recorder (sampling frequency, f_s = 288 kHz, frequency response 20 Hz - 150 kHz ± 3 dB) was moored in an average water depth of 6.5 m, approximately 370 m from the piling activity ('SoundTrap' in Fig. 1). This location (close to the breakwater at 'Sticking Point') was chosen to reduce the risk of the recorder being damaged by docking vessels while minimising the range to the noise source. A DSG recorder (HTI-96 min hydrophone, f_s = 80 kHz, max. frequency response 2–30 kHz), was moored just outside the harbour channel, in about 8 m of water, directly in front of the piling 750 m away ('DSG' in Fig. 1). These two recorders were moored and removed each recording day. A further DSG recorder ('Duty cycle DSG' in Fig. 1) was set up on a duty cycle, recording for 5 min every hour (f_s = 80 kHz) and moored in about 9 m of water, continuously from February 27, 2015 to March 25, 2015, near a channel marker about 1.9 km from the piling activity. This recorder was used to record ambient noise. All autonomous recorders were moored about 2 m above the seafloor. Water height varied within 1.5 m due to tide (https://www.linz.govt.nz/). The substrate was generally a very fine clay silt mixture, including a small amount (1%) of sand, with a fluid mud layer on top (5–8 cm thickness, up to 45 cm in the channel), due to the high sedimentation in Lyttelton harbour (OCEL Consultants NZ Limited, 2014).

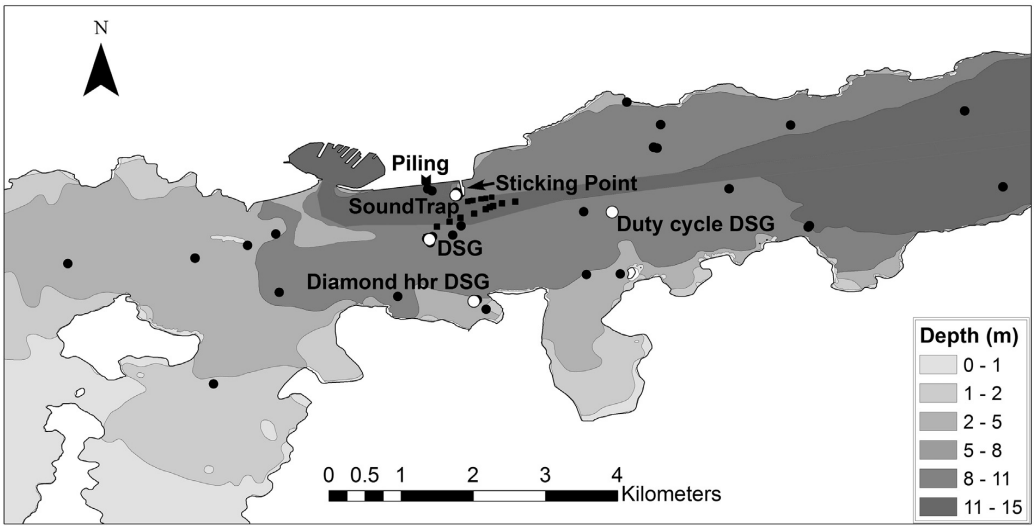

Fig. 1. Location of moored recorders (white dots) and boat based recordings (black dots) in Lyttelton Harbour.

Sound recordings were also made throughout the harbour at ranges of 92 m to 5.2 km from the piling, from an anchored or drifting 6.6 m research vessel (Fig. 1). For recordings beyond 400 m from the wharf, a sensitive, low-noise hydrophone specifically designed for measuring ambient noise (Reson 4032, Roland R-44 digital recorder, f_s = 192 kHz) was used.

To measure the broad spectrum of piling noise at close range (92–130 m) we used PAMGuard software running on a Laptop PC with a National Instruments 6351 A/D interface sampling at 500 kHz, with a Reson TC4013 hydrophone and VP2000 hydrophone amplifier. This hydrophone has a wider frequency response (20 Hz–170 kHz ± 3 dB) than the Reson 4032 (10 Hz–90 kHz ± 3 dB), and is better suited to recording very high signal levels due to its lower sensitivity.

Drift recordings enabled measurement of changes in pile-driving noise over small spatial scales, and were used to qualify the shadowing effect of Sticking Point. Distances from pile-driving were measured using a laser range finder (Leica Rangemaster 1000-R) and later compared to GPS locations recorded every 30 s on board the recording vessel.

All recording systems were routinely calibrated via a G.R.A.S. 42AA pistonphone (with appropriate couplers) with appropriate atmospheric corrections. All recordings were 16 bit. CTD (Seabird SB-19) casts were made at every recording location.

2.3. Sound analysis

Absolute sound levels were obtained using the pistonphone calibration tones on each recording. Calibration was carried out using the PAMGuide toolbox (from Merchant et al., 2015) in Matlab (Matlab 2014b, The Mathworks Inc.). The uncalibrated level a of the pistonphone tone at 250 Hz was determined using a power spectrum in PAMGuide (1 s Hanning window, 50% overlap). This was then compared to the known level b produced by the pistonphone (re 1 µPa: taking into account the effect of the couplers for each hydrophone) to produce a system sensitivity S:

$$S = b - a \quad (1)$$

S was then used as a correction factor for the corresponding recording.

Root mean square (RMS) broadband SPL is a useful metric to quantify an average level over a period of continuous noise (Merchant et al., 2015). An average level of ambient noise in Lyttelton harbour, was obtained close to the port, and at a location approximately in the centre of Lyttelton Harbour. Close to the port, we used recordings from the SoundTrap moored just inside Sticking point, and the DSG moored opposite the pile-driving (Fig. 1), gained on nine days between 4 January and 10 February 2015. From these recordings we calculated the overall RMS level for each day during the 30 min 'smoko' break in piling, and then took the median of those RMS values. In mid harbour, starting on 27 February, we used recordings from the duty-cycle DSG (Fig. 1), gained over a larger sample of days. For these recordings we calculated the RMS level over the entire record of 5 minute samples collected during the 26 day period it was moored in the harbour.

To analyse the noise from a particular pile-driver, hammer setting and pile location, a section which contained 10 strikes (as recommended by De Jong et al., 2011) was selected from the raw recording, avoiding flow noise, wave slap on the recording vessel and construction noise other than piling.

It has been shown that RMS level, a metric commonly used for measuring ambient noise, is not appropriate for transient signals such as a pile strikes (Madsen, 2005). The most widely used metrics for quantifying pile-driving noise are zero-to-peak Sound Pressure Level (SPL_{0-p}) and single-strike Sound Exposure Level (SEL), as defined in Southall et al. (2007). For transient signals, duration was defined as the '90% envelope' (T_{90}) (Madsen, 2005).

All measurements were made via a custom written script in Matlab. First the script applied the correction factor S and filtered the signal using a 30 Hz digital highpass filter. This removed most of the noise due to water flow past the hydrophone and wave slap from the vessel and had negligible effect on piling noise, which contained very little energy below 30 Hz. A peak-finding algorithm (Yoder, 2009) was applied to the filtered signal. Power spectral densities (PSDs) and third-octave-band levels (TOLs) were calculated (with 1 s inter-strike-intervals) using the PAMGuide toolbox (Merchant et al., 2015). A 1 s Hanning window was used with 50% overlap for TOLs and PSDs.

2.4. Propagation measurement and modelling

Our aim was to create a strong empirical base of measurements from many locations throughout the harbour, using a simple propagation model to interpolate between measurement locations, and to extrapolate beyond them. A model is needed because it is difficult to construct a noise map only from measurements, as it is unrealistic to make recordings at all map locations in time short enough that none of the above variables change (De Jong et al., 2011). We aimed to find a propagation model that was as simple as possible while being sufficiently adaptable to represent important influences on the harbour's soundscape.

Statistical modelling (using general linear models) was used to determine which factors ('energy' - hammer energy (kJ); 'pile driver'; (Bruce, BSP or Junttan); 'stage', stage of pile-driving (start, end or setting of pile); 'row', pile row on wharf (A–F); pile diameter (0.61 or 0.71 m); 'pile ID'; 'day', date of recording) significantly influenced the received level of pile-driving noise, using recordings from the DSG location (Fig. 1). The best fitting model was determined by comparing AICc scores and using ANOVA (stats package, R Development Core Team, 2006) to test the significance of each term. Results were used to determine a subset of data representing the largest collection of recordings made under similar conditions. These were used for modelling propagation.

Measurements were made over an average of 10 strikes for the stationary recordings, and over single strikes for the drifting recordings (because range was changing). The latter data were weighted at 1/10th of the averaged measurements in the fitting procedure.

We assumed that bottom layer properties and sea surface roughness were constant over the data gathering period. Boat-based recordings were restricted to wind conditions below Beaufort 3, a wind range having negligible effect on sound transmission loss (Norton and Novarini, 1996) to at least 4000 m from the noise source.

In harbours, absorption, spreading losses, effects of depth, and bottom hardness can all contribute to propagation loss. Considering that most of the energy in pile strikes is at < 1 kHz, absorption has little effect (< 1 dB; Ainslie and McColm, 1998) on the broadband sound level over the ranges in this study (< 4 km), and spreading losses will be much more important. The shallow depth of much of the harbour strongly restricts propagation of low frequencies. The lower cut-off frequency for water of 6 m deep (over a sandy-silt bottom layer) is approximately 2000 Hz (Jensen et al., 2011; Shumway, 1960), meaning that little of the acoustic energy present in pile strikes was likely to propagate into the inner harbour. Additionally, the soft bottom layer gives poor reflection of the sound waves as they travel through the harbour leading to increasing loss with range (Jensen et al., 2011). Hence, the -bR term (below) allows the model to reflect these losses as an effect that increases with range.

A model with source level (SL), geometric spreading coefficient (a) and absorption loss coefficient (b) was fitted to the dataset:

$$RL = SL - a\log_{10}(R) - bR \quad (2)$$

where RL is the received level (in dB re 1 µPa^{2}s) at range R (in meters) (Urick, 1983). Note that while absorption is heavily dependent on frequency, the absorption loss coefficient, b, in the propagation model (in dBm^{-1}) includes absorption across the entire frequency range of the

pile-driving noise, not just a single frequency.

2.5. Noise map

Because source levels of pile strikes varied with pile-driver, pile location, substrate, penetration depth and hammer lift, we show propagation as a contour map of losses instead of absolute sound pressure levels. The fitted propagation model was used to generate a grid of 'loss with range' points spaced 0.005° in both latitude and longitude. Using the grid of losses enabled smooth interpolation between all recording locations. The grid was adjusted to integrate results of recording locations where there was no detectable change in pressure between ambient and piling noise in the waveform. In these cases it was often still possible to hear the pile-driving in the recording. To determine what propagation loss would be required for the piling noise be indistinguishable from ambient noise, the average ambient broadband SPL was compared to the average pile-driving source SPL_{0-p}. While there is no exact way to compare these rather different noise measures, this approach most accurately represents the decibel difference between the peak levels of pile-driving noise and the average ambient noise. This level was obtained by first determining an average level for the ambient broadband SPL. The overall average of the source SPL_{0-p} was derived by converting the modelled source SEL using the linear relationship between the measured data for these metrics.

Interpolation between loss points was calculated in ArcGIS (v10.3) using the local polynomial technique (with settings: polynomial order 2, smoothing factor 0.2 and an exponential kernel). To give more weight to the empirical measurements, the levels measured from point (averaged over 10 strikes) and drift recordings were weighted 100× and 10× higher, respectively, than the modelled grid points. The contours were drawn at 6 dB loss intervals, representing successive halving of sound pressure.

2.6. Impact zones

Recordings throughout the harbour were used to estimate ranges of Temporary Threshold Shift (TTS) onset. These estimates were based on previous studies of TTS in harbour porpoise. The "equal energy rule" is a useful concept as it includes both effects of noise amplitude and duration on TTS (Finneran, 2015). TTS onset in harbour porpoise, although dependent on a combination of duration and peak sound pressure levels of the noise, does not follow this rule (Mooney et al., 2009). Additionally, it is well known that the equal energy rule overestimates TTS for intermittent noise (Finneran, 2015). Hence, different ranges of impact are estimated based on different types of noise exposure. The relevant results used were: (1) TTS induced in a trained harbour porpoise after exposure to a single airgun pulse with an SEL of 164 dB re 1 μPa^2s (Lucke et al., 2009); (2) TTS induced in a trained harbour porpoise after exposure to 1 h of played-back pile-driving noise (2760 strikes with an inter-pulse-interval of 1.3 s, with single-strike SEL of 146 dB re 1 μPa^2s; Kastelein et al., 2015); (3) a trained harbour porpoise exposed to a playback of pile-driving noise in a pool began to change its behaviour once the single strike SEL reached 133 dB re 1 μPa^2s (Kastelein et al., 2013a; this threshold was estimated to be similar to what was observed in studies of wild harbour porpoise, Tougaard et al., 2009; Brandt et al., 2011; Bailey et al., 2010; Dähne et al., 2013) and (4) the maximum threshold level for detection of pile-driving noise in a trained harbour porpoise in a quiet pool was at a single-strike SEL of 75 dB re 1 μPa^2s (Kastelein et al., 2013b).

3. Results

All platforms combined recorded a total of 147.5 h of underwater sound, of which 52 h were from the duty cycle DSG, 16.3 h were made on board the research vessel, and the remaining from the stationary DSG and SoundTrap. CTD casts made during the boat-based recordings indicated a well-mixed water column with a mean temperature of 19.0 °C (17.1–20.0 °C), and mean salinity of 34.1 PSU (33.3–34.3 PSU).

3.1. Ambient noise

Ambient noise levels measured over 26 days using the duty cycle DSG had a peak frequency around 300 Hz with a median PSD level around 60 dB re 1 $\mu Pa^2\,Hz^{-1}$. The RMS broadband level over this period was 117.9 dB re 1 µPa, with 50% and 95% exceedence levels at 101.8 and 108.9 dB re 1 µPa, respectively. Recordings made during breaks in pile-driving showed highly variable broadband levels (96–146 dB re 1 µPa), and generally had most energy below 5 kHz. Median RMS broadband levels across this period were 119.2 dB re 1 µPa for the SoundTrap (50% and 95% exceedence levels at 112.4 and 101.1 dB re 1 µPa, respectively) and 119.6 dB re 1 µPa for the DSG (50% and 95% exceedence levels at 111.6 and 100.7 dB re 1 µPa, respectively) (average = 119.4 dB re 1 µPa).

3.2. Pile-driving noise

Over 92 days, pile-driving occurred on 46 days, with an average of 125.5 min of piling per day (SE = 16.7 min).

Recordings made at close range (up to 370 m) show strikes with high peak-to-peak SPLs and steep rise times (Fig. 2). The strikes are broadband with most energy present below 1 kHz, though some energy extends beyond 100 kHz (Fig. 3).

The maximum recorded level (averaging 10 strikes) had an SEL of 158 dB re 1 μPa^2s and an SPL_{0-p} of 182 dB re 1 µPa at 370 m from the source. The fitted propagation model (see below) suggests that this would correspond to a point source SPL_{0-p} of 213 dB re 1 µPa @ 1 m.

All three drivers produced a similar distribution of energy across the frequency range: the highest energy was around 200–300 Hz, most energy contained between 50 Hz-10 kHz, but there was some energy to at least 100 kHz, particularly for the Bruce (Fig. 3).

Strike duration (T_{90}) varied between 59 and 624 ms. The longest durations occurred when the hammer was bouncing (Fig. 4), at the end of a piling sequence. Pile-driving stopped when pile movement was < 2.5 mm/blow on full power (D. Smith, HEB project engineer, pers. comm.). At this point the pile is considered to have hit solid substrate, and the elasticity of the pile causes the hammer to bounce. This produced the smaller secondary impulse closely following the main strike.

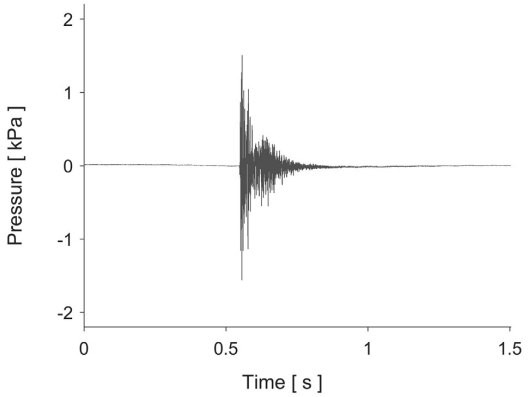

Fig. 2. Pressure waveform of pile strike, made by 'Bruce' hammer, recorded at 97 m from the pile-driving, frequency range 30 Hz–250 kHz (sampling rate 500 kHz).

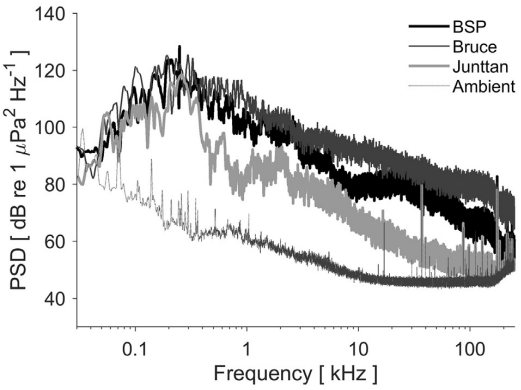

Fig. 3. Power spectral densities of all pile drivers and ambient noise, recorded at c. 100 m from the pile-driving, frequency range 30 Hz–250 kHz (sampling rate 500 kHz).

3.3. Statistical modelling

The formula of the GLM with the lowest AICc score, containing only significant terms (Table 2), was:

*SEL~energy*pile driver + stage* (3)

The '*' indicates an interaction between the variables energy and pile-driver. It was concluded from this model that row, diameter, pile ID and day did not significantly influence the received SEL.

The subset of data used for the propagation modelling, therefore, included only recordings made from the Bruce or BSP hammer at the end stage of piling, at lift heights above 1.1 m. Since pile diameter was not a significant influence on the sound level here, the subset contained recordings from both pile sizes.

3.4. Propagation modelling

The measured pile-driving SEL decreased approximately logarithmically with distance (Fig. 5). The values obtained for the fitting parameters (Table 3) do not necessarily represent the physical properties in Urick (1983). In our case they are the simply the best fitting parameters to describe the combination of all the influences on transmission loss, not only geometric spreading and absorption in the water. It should be noted that while Eq. (2) could be fitted to pile-driving noise measurements in other scenarios, the fitted parameters apply only to the conditions in Lyttelton harbour, for the pile diameters and hammers described above.

Table 2
Parametric coefficients of terms in Eq. (3) fitted to pile-driving data using a GLM in R.

Parametric coefficients	Estimate	(95% confidence interval)	p-Value
Intercept	139.3	(138.2, 140.4)	$< 2 * 10^{-16}$
Energy (scaled), kJ	0.055	(0.036, 0.075)	$2.16 * 10^{-16}$
Stage: setting	−2.812	(−2.425, 1.180)	0.0191
Stage: start	4.996	(−10.790, −3.288)	0.0002
Pile driver: Bruce	−0.622	(−5.061, −0.564)	0.5029
Pile driver: Junttan	−7.039	(2.606, 7.386)	0.0007
Energy * Bruce	−0.002	(−0.038, 0.033)	0.8855
Energy * Junttan	0.116	(0.057, 0.174)	0.0004

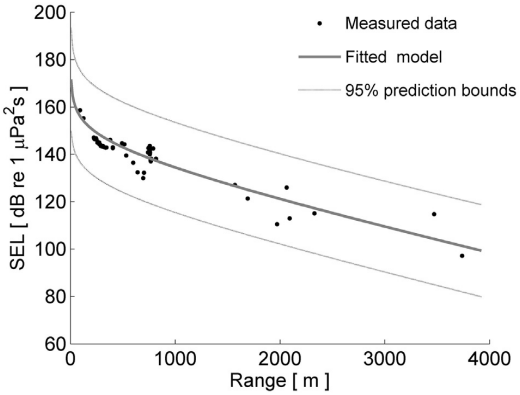

Fig. 5. Propagation model fitted with source level and the spreading and absorption loss coefficients as fitting parameters (adj. R^2 0.86).

Table 3
Fitted parameter values for propagation model (Eq. (2)) calculated using Matlab. Adjusted R^2 was 0.86.

Parameter	Predicted value (95% confidence bounds)
Source level	182 (167, 197) dB re 1 μPa²s
a	12.6 (6.65, 18.6) dB
b	0.0095 (0.0071, 0.0118) dBm^{-1}

3.5. Noise map

A strike's SPL_{0-p} appeared to increase linearly with SEL, with the fitted relationship:

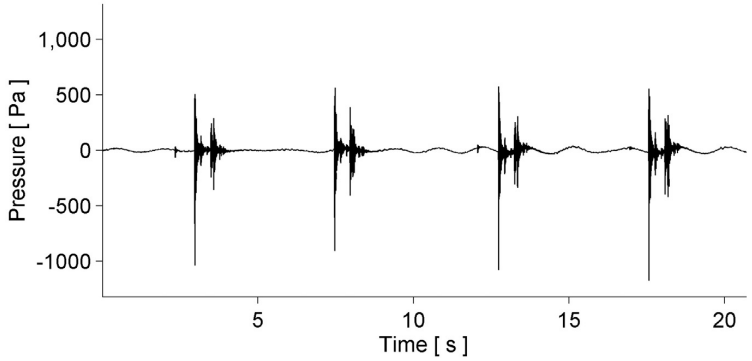

Fig. 4. Pressure waveform of BSP bouncing, end stage, lift height 1.5 m, on Jan. 27, 2015, frequency range 30 Hz–250 kHz, range to piling 103 m.

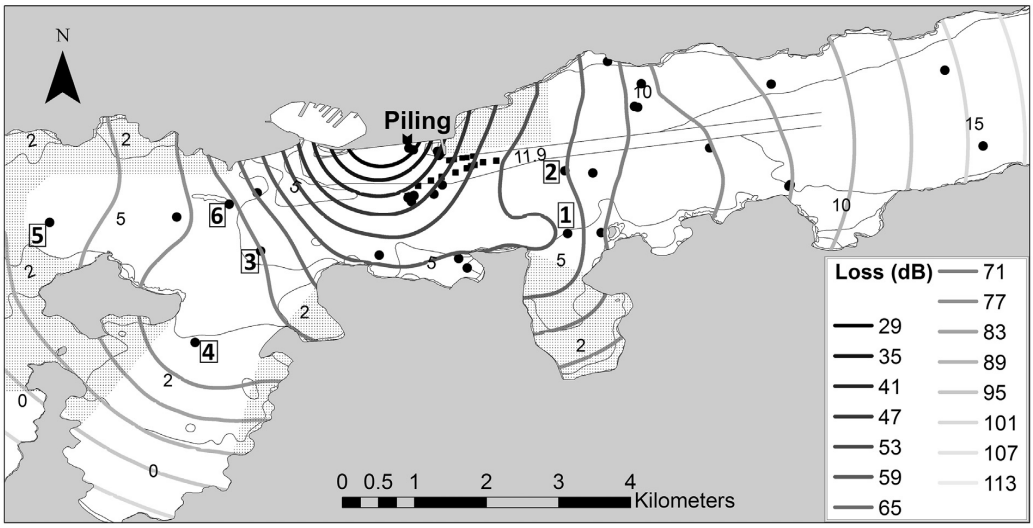

Fig. 6. Transmission loss contours in dB (thick, grayscale lines) are plotted over the harbour bathymetry (white fields numbered with maximum depth in m). Recording locations are indicated as black dots. The stippled areas indicate where the loss contours are likely unrealistic based on the fact that shielding will greatly increase the loss at these locations. Boxed numbers label specific recording locations for reference.

$$SPL_{0-p} = 0.95 \times SEL + 29.62, (R^2 = 0.95) \quad (4)$$

Using Eq. (4), a fitted source SEL of 182 dB re 1 μPa^{2}s corresponds to a source SPL_{0-p} of 202.4 dB re 1 μPa. This is effectively what the average source SPL_{0-p} of the Bruce or BSP driver would be, in the end stage of piling, if it behaved as a point source of sound. The difference between this and the average broadband RMS noise level (close to the port) is 202.4–119.4 = 83.0 dB. Modelled losses at grid points beyond where piling noise was measured to be indistinguishable from ambient noise were adjusted if necessary. If the loss at these points was < 83 dB, indicating underestimation of loss by the model, the loss value was increased to 83 dB.

The non-circular contours (Fig. 6) indicate that the soundscape is strongly influenced by factors other than range. The most notable feature is the lower transmission loss towards location 1 compared to those shielded by Sticking Point (the breakwater to the east of the piling, see Fig. 1), for example location 2. The other interesting pattern on the western side is the large spacing in contours between locations 3 and 4. A possible explanation for this relatively low loss with range could be the shallowness of the water in this area, leading to cylindrical rather than spherical spreading.

Piling noise is very broadband at close range (Fig. 7a). Further away, both piling and ambient noise levels decrease. The recording at (b) was shielded by Sticking Point, which appears to have blocked most of the higher frequencies (> 1 kHz) from propagating further (Fig. 7b). At location (c), almost 4 km away and in very shallow water, only the high frequencies persisted (Fig. 7c).

A breakwater (Sticking Point) present near the piling strongly influenced the propagation of the pile-driving sound (Fig. 8). SEL suddenly decreased as the drifting recording vessel passed Sticking Point (c. 526 m mark, Fig. 8), indicating a significant shielding effect.

3.6. Estimated zones of impact

3.6.1. TTS from a single pile-driving strike

Using a source level of 182 dB re 1 μPa^{2}s, our propagation data (Fig. 5) imply that an SEL of 164 dB (the level which induced TTS in a harbour porpoise after exposure to a single airgun pulse; Lucke et al., 2009) would occur in Lyttelton at a range of about 26 m from the pile-

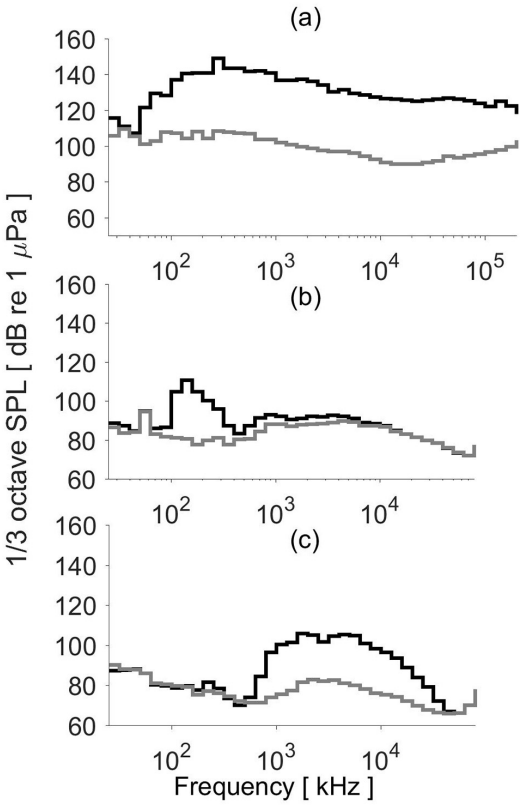

Fig. 7. Piling noise TOLs (black line) and ambient noise TOLs (grey line) measured at three locations around the harbour. (a): 100 m from piling, water depth 12 m; (b): at location 2 in Fig. 6, water depth 8 m, (c): at location 4, water depth 3 m.

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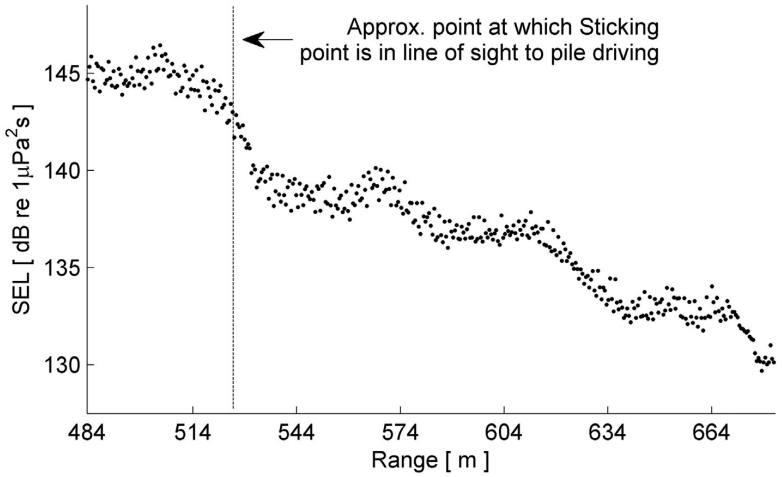

Fig. 8. SEL of each strike recorded while drifting past Sticking Point over a period of 11 min. Approximate range at which breakwater starts shielding pile-driving sound from the boat-based recording system is indicated by the vertical dotted line (526 m). Frequency range 30 Hz–96 kHz.

driving. Since this range is well within the near field of the pile-driving noise, it may not be reliably estimated. Because the hearing thresholds in that particular porpoise were considered to have been elevated (Lucke et al., 2009), this level should be considered a masked TTS. Hence, the range estimated at which TTS may occur in Hector's dolphin (with normal hearing thresholds) may be an underestimate.

3.6.2. TTS from 1 h of exposure

An SEL of 146 dB re 1 µPa^{2}s (the single-strike level of pile-driving noise which induced a TTS in a harbour porpoise after 1 h of cumulative exposure; Kastelein et al., 2015) would occur at a range of about 376 m from the pile-driving. Using the map of loss contours (Fig. 6) this would occur at the loss contour of 36 dB and cover an area of approximately 0.38 km^2 (Fig. 9). The mean time between strikes was 1.3 s in the present study, but longer intervals (up to 4.5 s) were observed, particularly at the higher hammer lift-height settings (producing generally louder pile-driving noise). Since cumulative sound exposure level depends on the individual strike's SEL and the number of exposures (Southall et al., 2007), longer inter-strike-interval would require a longer period of exposure before inducing the same TTS.

3.6.3. Behavioural change

A captive harbour porpoise changed its behaviour when pile-driving noise was replayed at an SEL of 133 dB re 1 µPa^{2}s (Kastelein et al., 2013a). In Lyttelton, this level would occur at a range of about 1120 m and at the loss contour of 49 dB (Fig. 9). Detection levels are, not surprisingly, much lower. A harbour porpoise could detect pile-driving noise in a quiet pool at an SEL of 75 dB re 1 µPa^{2}s (Kastelein et al., 2013b). In Lyttelton this would occur at the 107 dB loss contour, well beyond the loss of 83 dB required for the pile-driving noise to be at the level of the average ambient noise. For the 5% most quiet times (in terms of ambient noise) in Lyttelton the pile-driving noise would then

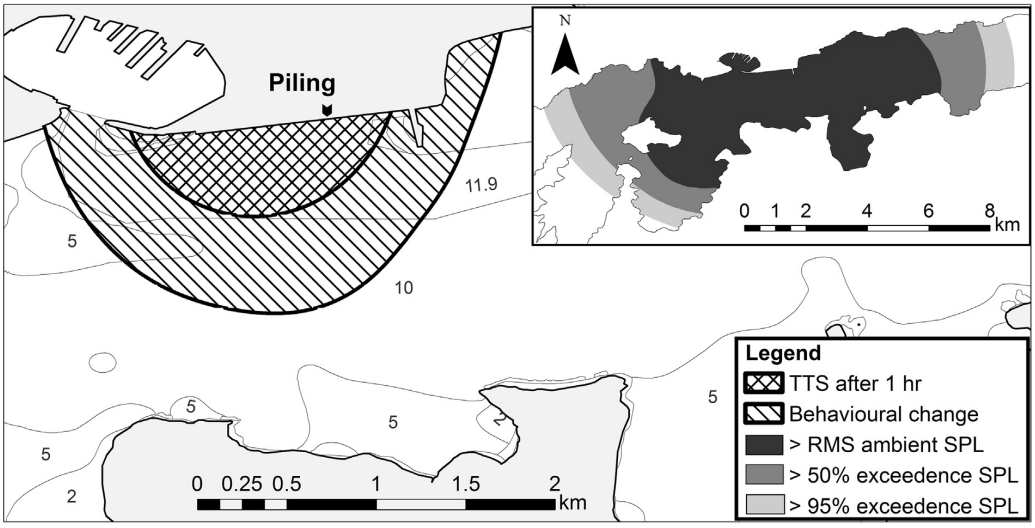

Fig. 9. Approximate zones in which pile-driving sound could impact Hector's dolphins. Inset: Increasingly lighter grey areas where pile-driving noise normally exceeds the RMS, 50% exceedence and 95% exceedence ambient noise levels, respectively.

be detected in an area up to 33 km^2 (see inset Fig. 9). However, for most of the time the ambient noise level is much higher, which will act to mask pile-driving noise and decrease the range over which pile-driving is detectable.

4. Discussion

Pile-driving introduced a large amount of noise into an already noisy harbour environment. Peak pressure levels were raised by over 1000 Pa (180 dB) (Figs. 2 & 4). At close range TOLs were raised by up to 45 dB across a wide frequency range (Fig. 7a), exceeding background levels 50% of the time over an area of up to 28 km^2.

There are surprisingly few peer-reviewed, published studies examining pile-driving in the context of wharf construction in harbours. An extensive set of measurements have been reported by the California department of transportation (Buehler et al., 2015), from many pile-driving projects, including a range of pile types and diameters. Most measurements were made in the near field and, therefore, are not directly comparable to our data from Lyttelton harbour (since measurements were only carried out in the far field). However, the SEL of 157 dB re 1 μPa^{2}s measured at 158 m, in water depth of 4 m, during bridge construction using 0.61 m diameter piles (no information on substrate or hammer energy), was similar to the modelled SEL of 153 dB re 1 μPa^{2}s at the same range in Lyttelton. The SELs at ranges of 260–340 m and 853–1530 m, in 0.9–9.1 m water depth, measured during wharf construction using 0.61 m diameter piles, were within 1 dB of the modelled levels in Lyttelton at these ranges. A more distant measurement at 2820–2922 m (SEL of 126 dB re 1 μPa^{2}s), was 15 dB higher than the modelled level in Lyttelton at this range, indicating that the transmission loss at this range was higher for Lyttelton. This is confirmed by the high absorption loss coefficient (Table 3), which is most significant at larger ranges.

Duncan et al. (2010) measured pile-driving noise in Port Phillip Bay, Australia, under very similar conditions to the pile-driving in Lyttelton. Pile type (diameter and material), hammer energy, and water depth were comparable to those in our study. The substrates in Duncan's study were silt layer on sand or sand on calcarenite, both layer types are much harder, with higher densities, than the mud/sand layer in Lyttelton. Comparing SELs at the same range from pile-driving shows that the levels measured in Lyttelton were lower by about 12 dB (Duncan et al., 2010). While the frequency content of pile-driving is relatively similar for most studies, the sound pressure levels recorded in this study are much lower than those of previous studies. Most studied much larger pile diameters, such as those used in offshore wind farms (for example Nedwell et al., 2007; Tougaard et al., 2009; Brandt et al., 2011), harder substrates (for example Nedwell et al., 2007; Robinson et al., 2007; Tougaard et al., 2009) and/or higher hammer energy (for example Lepper et al., 2009; Bailey et al., 2010; Brandt et al., 2011). Most studies were in much deeper water. Lyttelton Harbour is generally shallow; charted depths range from c. 13 m at the entrance to c. 5 m in front of the port, with an 11.9 m deep dredged channel allowing access for shipping. Our shallowest recordings were made in about 3 m of water. The shallowness of the harbour contributes to greater propagation loss for low frequencies.

The most comparable levels were recorded in the inner harbour of Fremantle, Australia (Paiva et al., 2015) where the SEL at 54 m was within 1 dB of our modelled level at this range. No information was available on hammer energy or pile diameter but since this harbour also experiences siltation (Paiva et al., 2015) the top layer of substrate is likely to be similar to the fluid mud layer in Lyttelton.

4.1. Propagation modelling

One of the more sophisticated attempts at modelling propagation of pile-driving noise in a harbour using freely available software (AcTUP v2.2L toolbox for Matlab; Collins & Porter, 2005; theory from Jensen et al., 2011), is by Duncan et al. (2010). This model considers spreading and absorption loss as well as influences of bathymetry and bottom layer properties. We attempted this modelling approach, and that of Marsh and Schulkin (1962), but the limited knowledge of Lyttelton's bottom layer properties and the model's high sensitivity to these inputs restricted the value of model outputs. Another approach, by Denes et al. (2016) used the parabolic equation method, but the model was validated at only two measurement locations and was likely inaccurate for ranges beyond those (> 1 km). Our approach was instead to develop a simple propagation model based on as much data as possible, referenced to measured pressure levels from multiple locations. The empirical data were weighted heavily in producing a contour map of losses (Fig. 6). The result is that the point recordings act to define the pressure levels, while the model interpolates between, and beyond them.

The geometric spreading coefficient of 12.6 was closer to cylindrical propagation (10) than to spherical propagation (20), most likely due to the shallow water depths in Lyttelton (3–13 m). Studies in deeper water show spreading losses of 20 (Bailey et al., 2010), 17–21 (Nedwell et al., 2007) and 16–29 (Blackwell, 2005). The absorption loss coefficient found in Lyttelton (0.0095 dBm^{-1}) is much higher than found in these studies, most likely due to a combination of higher absorptiveness of the soft bottom layers in Lyttelton and the shallower water depths in the harbour.

The noise map (Fig. 6) visualises how piling noise spread throughout the harbour. We think that this is an approach that should be used more. Further pile-driving is proposed in a planned expansion of the port of Lyttelton; this map provides useful information on how those sounds are likely to propagate. The contours, however, are approximations influenced by bottom layer properties, bathymetry and frequency content of the signal. Contour maps of underwater noise have been produced in previous studies (see for example (Cobo et al., 2007; Rossington et al., 2013) but to our knowledge none are based on the combination of modelled and empirical measurements. The map could be used for similar sources of anthropogenic sound near the wharf, so long as the source level is known, to estimate what sound levels would be received in different parts of the harbour. In particular, future studies of dolphin habitat use in Lyttelton Harbour may identify specific areas that are important (e.g. for foraging), in which the received noise level could be estimated. The accuracy of estimated levels will depend on how similar the frequency spectrum of the source is to the pile-driving noise used to develop the model.

4.2. Impact on Hector's dolphins

Hector's dolphins in Lyttelton harbour are routinely exposed to anthropogenic noise, particularly from small and large vessel traffic. Pile-driving noise had a much higher peak pressure, was impulsive, and was present for around 2 h (but up to 9 h) per day. It had the potential to impact Hector's dolphins in a variety of ways. If sufficiently close to the piling, Hector's dolphins could experience temporary hearing loss (Fig. 9), which could decrease their ability to forage via echolocation and detect environmental cues. It must be noted that the original recording of the pile-driving used in the playback in Kastelein et al. (2015) was made with a sampling frequency of 65 kHz therefore contained no frequencies above 32.5 kHz. Harbour porpoise hearing, however, reaches maximum sensitivity around 130 kHz (Kastelein et al., 2002) – frequencies that are certainly present in pile-driving strikes recorded at close range (e.g. Fig. 3; also see Dyndo et al., 2015 and Hermannsen et al., 2014 for impacts of low levels of high frequency noise on harbour porpoise). Also, Kastelein et al. (2015) replayed pile-driving sounds to a captive harbour porpoise at only one level (146 dB SEL re 1 μPa^{2}s), which was as loud as their equipment could produce, and found that this level caused TTS. It is possible that a lower level would have caused TTS also. It is important that 146 dB SEL re 1 μPa^{2}s is not to be regarded as the threshold at which TTS was induced.

The level at which TTS is induced also depends on the frequency of

the sound, with a lower threshold for higher frequency sounds, following the harbour porpoise audiogram (Tougaard et al., 2015). Furthermore, this TTS was measured in one captive harbour porpoise, which may have a lower hearing sensitivity than wild harbour porpoise. The level found to induce TTS in Kastelein et al. (2015), therefore, is likely to underestimate the level at which TTS would occur in response to actual (as opposed to recorded then played back) pile-driving noise on wild harbour porpoise.

Pile-driving noise is unlikely to mask echolocation clicks, but has much more masking potential for environmental cues (e.g., from prey and predators) as these are at a much lower frequency than echolocation clicks, and pile-driving noise has much more energy in these frequency ranges.

Although reporting the details is beyond the scope of this paper, we made visual and acoustic observations which are relevant to the question of how dolphins responded to pile-driving sounds. Of 15 boat surveys in Lyttelton Harbour during this study, Hector's dolphins were seen on 13. Seven sightings were made within 500 m of the piling location, three of which were within 3–7 min of piling activity. On 10 days our SoundTrap HF recorder was moored inside Sticking Point, approximately 370 m from the piling location. Hector's dolphin sonar clicks were clearly evident in recordings made on eight of those 10 days. On five days dolphin clicks were recorded simultaneously with pile-driving strikes. Our experience suggests that to be recorded at all, dolphins would have had to be within c.200 m of the recorder. Taken together, these observations indicate that pile-driving did not prevent at least some Hector's dolphins from using the nearby area (i.e. within some hundreds of meters of the pile-driving).

We also had three echolocation detectors (v.5 T-PODs) moored in the inner, middle and outer harbour. Statistical modelling of dolphin detections during pile-driving showed a significant decrease in the inner harbour, closest to the pile-driving activity, with a concomitant increase in detections in mid harbour (which is shielded by Sticking Point). This is consistent with dolphins moving away from the area closest to the piling operations into quieter areas (Leunissen, 2017). These data indicate that pile-driving acted to reduce the foraging area available to the dolphins. If displaced far enough out of the harbour, risk of being caught in fishing nets could be increased (Forney et al., 2017).

Because the pile drivers in this study were much smaller than those used in construction of offshore windfarms, our estimated areas of audibility (33 km^2) and behavioural change (1.5 km^2) are much smaller than those measured for harbour porpoise in relation to offshore windfarms (e.g. c.15,000 and 1400 km^2 respectively; Bailey et al., 2010). Hector's dolphin is an inshore species, with individuals having very small home ranges (Rayment et al., 2009). The pile-driving occurred within a confined harbour environment. Together these features increase the likelihood that this pile-driving operation may have had a significant impact on the local Hector's dolphins.

NOAA and NMFS (2016) have recently provided recommendations on permanent threshold shift (PTS) and TTS thresholds for cetaceans classified as having low, mid and high frequency hearing. These thresholds are based on frequency weighting noise according to the inverse audiogram of representative species in each frequency group (Finneran, 2015). Based on the worst case scenario in Lyttelton (i.e. max. single-strike source SEL of 192 dB re 1 μPa^2s, 2700 strikes per hour, 9 h of piling per day) the 24-hour cumulative PTS onset isopleth would occur for Hector's dolphins at c. 1500 m from piling, and for TTS at 2700 m (average 440 m and 1400 m, respectively, based on single-strike source SEL of 182 dB re 1 μPa^2s, 2700 strikes per hour, with 2 h of piling per day).

While the proposed thresholds represent the current best science, there are issues that need to be addressed. The thresholds of impulsive sound for the high-frequency cetacean group (including Cephalorhyncids) are heavily based on the Kastelein et al. (2015) study, about which we have expressed reservations above. Due to the scarcity of relevant data to address such a wide range of marine mammal species exposed to a variety of sound sources, the usual standards for statistical robustness, particularly avoiding pseudo replication, were not always met, potentially introducing bias (Wright, 2015; Tougaard et al., 2015). There are also insufficient data to model recovery after TTS and, therefore, determine the intervening time necessary to treat multiple exposures as separate events (Finneran, 2015). This deficiency is clearly relevant for sounds which occur in bouts, such as pile-driving. Lastly, Hector's dolphin hearing has never been tested. While it is likely to be similar to that of harbour porpoise, the uncertainty associated with this assumption is potentially significant, particularly when the choice of weighting function is critical in noise regulation (Tougaard and Dähne, 2017).

Given the endangered status of Hector's dolphin it is imperative that additional threats, including those from noise pollution, are minimised. Bubble curtains can significantly reduce the noise radiated into the water column (Lucke et al., 2011; Nehls et al., 2016; Tsouvalas and Metrikine, 2016b) particularly when confined (e.g Buehler et al., 2015). For Lyttelton Harbour, however, significant re-suspension of sediment could breach a condition of the Coastal Permit, and therefore make bubble curtains an unlikely noise-mitigation option for future construction work. Another strategy for reducing noise pollution could be to employ screw-piling technology, rather than impact pile-driving, which produces significantly less underwater noise (Saleem, 2011).

Declarations of interest

None.

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Impact of pile-driving on Hector's dolphin in Lyttelton Harbour, New Zealand

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ABSTRACT

Several dolphin species occur close inshore and in harbours, where underwater noise generated by pile-driving used in wharf construction may constitute an important impact. Such impacts are likely to be greatest on species such as the endangered Hector's dolphin (*Cephalorhynchus hectori*), which has small home ranges and uses this habitat type routinely. Using automated echolocation detectors in Lyttelton Harbour (New Zealand), we studied the distribution of Hector's dolphins using a gradient sampling design over 92 days within which pile-driving occurred on 46 days. During piling operations, dolphin positive minutes per day decreased at the detector closest to the piling but increased at the mid-harbour detector. Finer-grained analyses showed that close to the piling operation, detections decreased with increasing sound exposure level, that longer piling events were associated with longer reductions in detections, and that effects were long-lasting - detection rates took up to 83 h to return to pre-piling levels.

1. Introduction

The increase in anthropogenic noise in the ocean (e.g. McDonald et al., 2008) has resulted in growing interest in researching the impact of noise on marine mammals, in particular cetaceans. Since cetaceans rely on sound for foraging and sociality, it is important to know how the additional noise may affect them. Negative impacts on marine mammals have been observed from sources including airgun pulses used in seismic surveys (e.g. Romano et al., 2004; Lucke et al., 2009; Gray and van Waerebeek, 2011), shipping (Aguilar Soto et al., 2006; Castellote et al., 2012; Rolland et al., 2012) and sonars (e.g. Fernández et al., 2005; Filadelfo et al., 2009; Tyack et al., 2011). Pile-driving, another source of underwater noise pollution, is of special concern since the noise is loud, impulsive and broadband in frequency (Madsen et al., 2006). Effects on endemic, endangered species, especially those with small home ranges, are of particular interest in this context.

Harbour porpoise (*Phocoena phocoena*) has very similar acoustic behaviour (Dawson, 2018; Dawson and Thorpe, 1990; Villadsgaard et al., 2007) to Hector's dolphin, and is similar in size and ecology (Würsig et al., 2018). Harbour porpoises show strong avoidance reactions to pile-driving noise (Carstensen et al., 2006; Thompson et al., 2010; Tougaard et al., 2009; Brandt et al., 2011; Brandt et al., 2016). These studies used passive acoustic monitoring devices (T-PODs or C-PODs) at increasing distances from the piling to investigate changes in detection rates of echolocation clicks. Tougaard et al. (2009) and Brandt et al. (2011) found a marked decrease in porpoise clicks over a radius of at least 20 km from the piling. At close range (2.6 km from the source), this response lasted up to 72 h after piling ceased (Brandt et al., 2011). Aerial surveys confirmed that porpoises actually left the area rather than becoming silent (Dähne et al., 2013). Piling noise also affected echolocation rate, however, as a sudden decrease in click rate was observed following the onset of piling (Brandt et al., 2011).

Broadly similar responses have also been observed in Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in Fremantle Harbour, Australia. Video recordings made in a harbour channel showed significantly fewer visual detections during pile-driving activity for wharf construction (Paiva et al., 2015). This study could not, however, determine whether decreased detections were due to decreased use of that habitat. Alternative explanations include that masking of communication signals may have led to reduced surface socialising, that detection of prey by echolocation may have been impeded, and/or that the effect of pile-driving may have been indirect (e.g. on prey abundance or their availability).

Hector's dolphin (*Cephalorhynchus hectori*), is an endangered delphinid found only in New Zealand. This species uses high frequency click trains for echolocation and communication. These clicks are about 140 ms in duration and most are centred at a frequency of 125 kHz (Dawson and Thorpe, 1990). Hector's dolphin signals are low-level

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Item 4

Attachment F

compared to those recorded from other cetaceans, with an estimated peak-to-peak source level of 161–187 dB re 1 μPa @ 1 m (Kyhn et al., 2009). For harbour porpoise this is 178–205 dB re 1 μPa @ 1 m (Villadsgaard et al., 2007). There are no data on the hearing sensitivity of Hector's dolphin.

Hector's dolphin have one of the smallest documented home ranges of any dolphin species (Rayment et al., 2009a) and favours inshore waters, frequently entering harbours (Dawson et al., 2013). The principal threat to the species, incidental catch in gillnets and trawls, resulted in the establishment of the Banks Peninsula Marine Mammal Sanctuary in 1988, and 20 years later, extensive further closures to gillnetting (Slooten and Dawson, 2010).

Construction work for the development of Port Lyttelton, in anticipation of a growing increase in container cargo, was combined with earthquake repair work. This work included 15 months of pile-driving, and more is scheduled for 2019. Hector's dolphins are routinely present in Lyttelton Harbour (Brough et al., 2014, in press; Leunissen and Dawson, 2018). Pile-driving could be an additional impact on Hector's dolphin and provides the context for this study. Underwater recordings made in Lyttelton Harbour at close range to the piling (up to 370 m) show broadband, impulsive strikes with high peak-to-peak SPLs. Maximum calculated source sound exposure level (SEL) was 192 dB re 1μPa^{2}s @ 1 m (zero-to-peak sound pressure level ($SPL_{0\text{-}p}$) of 213 dB re 1 μPa @ 1 m: Leunissen and Dawson, 2018). All three drivers produced a similar distribution of energy across the frequency range, the highest energy was around 200–300 Hz. While most energy was between 50 Hz-10 kHz, there was some energy to at least 100 kHz (Leunissen and Dawson, 2018).

Since Hector's dolphins have small home ranges, and the pile-driving in Lyttelton occurred within a confined harbour environment, there is a high chance that this operation had a significant impact on the local Hector's dolphins. In a previous paper we provided measurements of the pile-driving sounds and their propagation within this harbour environment (Leunissen and Dawson, 2018). In this study we attempt to measure impact on the dolphins' distribution within Lyttelton Harbour. In particular, does the detection rate change after a pile-driving event? If there is an effect, how long does this last following the pile-driving event?

2. Methods

2.1. Field techniques

Pile-driving was used extensively in the reconstruction of one of the main wharves (Cashin Quay 2) in Lyttelton Harbour, New Zealand (43.6033° S, 172.7227° E) (Fig. 1). Piles were driven within an area 77 m long (along the wharf) and 24 m wide (see 'Pile-driving' in Fig. 1). This area contained 90 pile locations, of which 57 were driven during our study (between December 19th, 2014 and March 25th, 2015). Three different pile drivers were used with hammer weights of nine, ten and 14 t, with a maximum blow energy of 206 kJ. The hollow steel piles had diameters of 0.61 or 0.71 m, and were driven an average of 66 m into the seabed (HEB construction, pers. comm. 2015). A "soft start" using the hammer on its lowest energy setting for the first 2 min, was standard practice (i.e. required by the pile-driver manufacturers).

Echolocation detectors (v.5 T-PODs, numbers 755, 775 & 776, Chelonia Ltd) were moored in Lyttelton Harbour from December 19th, 2014 to March 25th, 2015, 2 m from the seabed, at distances of 1300, 2000, and 6150 m respectively from the piling. This deployment follows a gradient sampling design (Thompson et al., 2010; Brandt et al., 2011) and enables detection of temporal effects with distance. The sites were chosen to represent inner, mid and outer harbour sites (Fig. 1) while considering the safety of our equipment for long term deployment in a busy harbour. The inner T-POD at 1300 m was, therefore, at the closest practical distance to the pile-driving. The inner and mid T-PODs were moored near existing harbour markers. The outer T-POD was moored in a bay well clear of shipping traffic, with a buoy at the surface (see Table 1 for properties of the sites where T-PODs were moored).

T-PODs were serviced (data downloaded, batteries replaced, fouling removed) on 7 January 2015 (re-deployed on the same day) and 27 February 2015 (re-deployed on 5 March 2015 due to unsuitable weather conditions). The same T-PODs were used at their respective sites for the entire monitoring period, except for the outer site. The outer T-POD became detached from its mooring between 7 January and 27 February, and was not recovered. This T-POD was replaced with a new device (v.4 No. 484, Chelonia Ltd). The aim of acoustic monitoring was to detect changes in acoustic activity in relation to pile-driving noise. Sensitivities of the T-POD versions used in the current study (v. 4 and 5) are similar and much more standardised than previous versions (Dähne et al., 2006; Verfuß et al., 2008). Hence, any differences in detection rates are likely negligible (see also Dawson et al., 2013).

In all T-POD deployments, five scans were optimised for detection of Hector's dolphins (target filter frequency = 130 kHz; reference frequency = 92 kHz; bandwidth = 4; noise adaptation = + +; sensitivity = 10; scan limit = 240). One scan was set at a lower frequency to discriminate between Hector's dolphins and other delphinids (target filter frequency = 50 kHz; reference frequency = 70 kHz; sensitivity = 6). The same settings were used as in Dawson et al. (2013) studying Hector's dolphin habitat use and Rayment et al. (2011) detecting Maui's dolphin (*Cephalorynchus hectori maui*) clicks. Other studies using T-PODs employed a similar strategy to discriminate between detections of harbour porpoises and bottlenose dolphins (e.g. Philpott et al., 2007; Bailey et al., 2010). The detection radius of T-PODs detecting Hector's dolphins is 198–239 m (Rayment et al., 2009b).

Pile-driving noise levels were recorded continuously throughout the study via a DSG recorder (Loggerhead Instruments; HTI-96 min hydrophone, max. Frequency response 2–30 kHz) moored in Diamond Harbour (see Fig. 1). This recorder was set to sample at 2500 Hz to allow an extended recording period. While this sample rate could not capture the full spectrum of piling noise (i.e., only up to 1250 Hz), the recordings allowed incorporation of relative intensity of pile-driving noise into the statistical analysis of echolocation detections.

Noise levels were measured and modelled throughout the harbour (see Leunissen and Dawson, 2018 for more detail). The sound levels at each T-POD location are summarised in Table 1.

2.2. Analyses

TPOD data were processed using the manufacturer's software (T-POD.exe v8.24). This software classifies clicks according to the likelihood they were of cetacean origin. The categories CET HI and CET LO (combined as 'Cet All') reliably represent Hector's dolphin detections (Rayment et al., 2009b), and are used here. Using only 'Cet All' detections, however, results in a conservative account of habitat use as many genuine trains are classified as DOUBTFUL (Rayment et al., 2009b; see also Thomsen et al., 2005, for a similar result from harbour porpoise).

Click data were exported as detection positive minutes (DPM) per hour - the number of minutes per hour in which dolphin clicks were detected, and DPM per day – the number of minutes per day in which dolphin clicks were detected. DPM (measured over a given time period) is the recommended metric for studying habitat use and behaviour (Chelonia Ltd. 2007), has been used in other studies assessing impacts of pile-driving (Brandt et al., 2011, 2016; Degraer et al., 2012), and has the advantage of reducing the effect of variation in sensitivity among T-PODs (Dähne et al., 2006). The DPM per hour measure allowed tracking of the post pile-driving echolocation activity on a fine temporal scale.

Mean SEL was used to account for pile-driving strike intensity. It was generally not possible to calculate the SEL for every strike within an hour, due to variation in ambient noise (such as water flow noise or passing boats). Therefore, a representative sample of ten pile strikes was used to calculate the mean pile strike SEL for each hour. The

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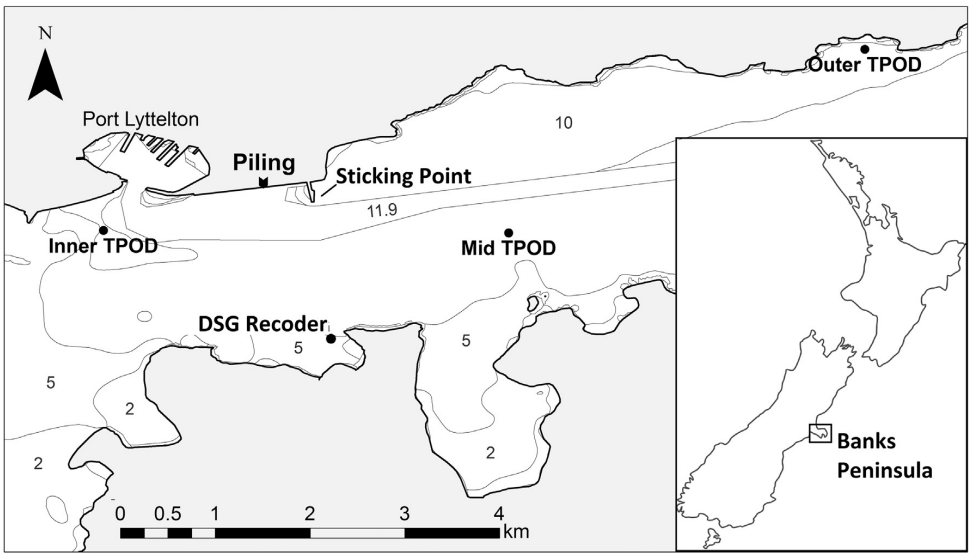

Fig. 1. Locations of T-POD monitors, DSG recorder and pile-driving in Lyttelton Harbour. Numbers within gray contour lines indicate depth (m). Inset: Map of New Zealand.

Table 1
Site properties for each T-POD location. Substrate information obtained from Chart NZ 6321 (www.linz.govt.nz).

Site	Range to piling (m)	Range to nearest shore (m)	Substrate	Water depth (m)	SEL (mean, max; dB re 1μPa^{2}s)	SPL_{0p} (mean; dB re 1μPa)
Inner	1300	330	Mud/Shell	4	127, 137	158
Mid	2000	890	Sand/Mud/Shell	8	114, 124	145
Outer	6150	125	Mud	7	90, 100	121

sample was chosen (through visual inspection of the hour's waveform in Audacity) to avoid strikes masked by ambient noise, and such that the peak pressure in the strikes' waveforms were at midrange of the peak pressures of all strikes within the hour. Peak pressure was proportional to SEL (Leunissen and Dawson, 2018). SEL per day was calculated as the mean across all hours which contained pile-driving. To quantify how long any effect lasted following a pile-driving event (where a new event was defined when the time between consecutive strikes, from one pile driver, exceeded 1 min), the variable "time-since-piling" was included. The duration of previous pile-driving events was also included. For each hour this was calculated as the total piling-positive-minutes (PPM) within previous consecutive hours containing pile-driving, up to the current hour. The duration of piling per day was calculated as total PPM across all hours for that day. Hourly wind data were provided by Metservice (www.metservice.com). This variable was relevant because in shallow water sound does not propagate as far at high wind speeds due to decreased reflection at the roughly textured water surface (Norton and Novarini, 1996). Increasing aeration of the water also reduces propagation (Mallock, 1910). This could lead to lower click detection rates at higher wind speeds (e.g. Brandt et al., 2016). Time of day and time since high tide were included in our models as they have been shown to influence Hector's dolphin distribution in Akaroa Harbour, on the south side of Banks Peninsula (Dawson et al., 2013).

2.3. Statistical analyses

Statistical analyses were carried out using the software package R (v 3.2.4, The R Foundation for Statistical Computing, 2016). The effect of pile-driving noise on dolphin detections was investigated using an information theoretic approach (Anderson et al., 2000; Burnham and Anderson, 2002), by comparing a suite of competing explanatory models. The two response variables were DPM per hour and DPM per day. Response variables were not normally distributed. Visual comparison of fitted Gaussian, Poisson and negative binomial distributions, and Q-Q plots indicated that the negative binomial distribution provided the closest fit to both response variables.

Explanatory variables consisted of piling-related, time-related and environmental variables (Tables 2 and 3). Collinearity among explanatory variables was assessed using variance inflation factors (VIFs). A cut-off value of three (Zuur et al., 2011), was not exceeded, indicating that collinearity was not significant.

A 17 day hiatus in pile-driving over the Christmas-New Year period was much longer than any other break in piling activity (max. 90 h). The DPM per hour dataset was restricted to include data for which time-since-piling did not exceed 150 h. This limit is more than twice as long as the longest duration of impact observed in harbour porpoise studies (72 h; Brandt et al., 2011).

The effect of explanatory variables on response variables was investigated using Generalised Additive Models (GAMs; Hastie and Tibshirani, 1990) with a negative binomial response (using the package *mgcv* in R). GAMs fit a sum of smooth functions for each covariate, and are particularly useful for modelling the non-linear relationships between cetacean distribution and environmental variables (Ferguson et al., 2005; Torres et al., 2008; Embling 2009). Since the model is additive, the effect of each covariate is considered in addition to the effects of the other covariates (Hastie and Tibshirani, 1990). The choice of basis dimension for smoothing terms was not restricted and left to be chosen during the modelling process for best fit.

Explanatory variables were expected to have a different effect on the response variable based on T-POD location. Therefore, a factor

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Table 2
List of explanatory variables used in the models of DPM per day.

Variable (abbreviation)	Type	Description
Piling related variables		
Sound Exposure Level (SEL)	Continuous	Mean sound exposure level (dB re 1 μPa^{2}s) for each day as measured at the Diamond Harbour DSG
Piling positive minutes (PPM)	Continuous	Total number of minutes that contained pile-driving noise each day
Time related variables		
Previous DPM (DPMt-1)	Continuous	DPM measured during previous day.
Environmental variables		
Wind speed (Wspd)	Continuous	Measured in knots at 9 am each day
Wind direction (Wdir)	Continuous, cyclic	Measured in degrees at 9 am each day
T-POD position (TPOD)	Factor, 3 levels	Inner (1), mid (2) or outer (3) harbour position

interaction term (using the tensor product interaction function *ti* with the 'by = TPOD' argument), which fitted a separate smoothing function for each of the three T-POD locations, was also tested (as well as testing a smoothing function *s* for each variable across all T-POD locations combined). Models never contained both the smoothing function of the variable and the factor interaction term as this would include the same variable twice. All smoothed functions were fitted using the default spline (cubic regression spline for *ti* and thin-plate regression spline for *s*), except for the circular variables (tide, time of day and wind direction). These variables were fitted with a cyclic cubic regression spline.

Response variables were temporally auto-correlated (tested using the auto-correlation function *acf* in the R package *stats*). One method to account for correlation is to use a correlation structure in a Generalised Additive Mixed Model (GAMM). For our data, this approach (using a corAR1 structure) produced marginal reductions in temporal auto-correlation, and produced models for which normality was not satisfied (verified via Q-Q plots). Instead, we introduced an explanatory variable with the value of the response at a previous point in time (in this case DPM of the previous hour or day; Tables 2 and 3), an approach used by Brandt et al. (2016) in their T-POD study of pile-driving effects on harbour porpoise. This considerably reduced the effect of temporal autocorrelation in the resulting models (see Appendix A).

A suite of GAMs was constructed and their performances compared via AICc. Model selection was conducted using forward step-wise selection (see Zuur et al., 2009). The Akaike weight was also calculated for each model, and can be interpreted as the approximate likelihood that the model is the best in the set (Anderson et al., 2000). The index of relative importance (IRI) was used to rank the importance of each variable (Burnham and Anderson, 2002). While model averaging can be useful for linear regression models, averaging structural parameters in some non-linear models is not recommended (Burnham and Anderson, 2002). Also, the coefficients for the categorical variable (T-POD) were very similar across all top models. Hence, we have not presented any model averaged results.

An interaction between time-since-piling (TSP) and duration-of-piling (Dur) was included in the modelling of DPM per hour. This was done to investigate if piling events of longer duration increased the length of time that detection rates were affected after piling. A contour plot was used to illustrate the effect of this interaction. This required all other explanatory variables to be fixed. SEL and DPMt-1 were fixed at their respective mean values, and Hour, Tide and Wdir were fixed at values at which DPM per hour at the inner harbour was predicted to be high by the models (i.e. when dolphins were likely to be present in the inner harbour).

Relationships were considered statistically significant at alpha = 0.05. Model validity was verified using diagnostic plots (Q-Q plots and histograms to check normality, residuals vs linear predictor to check heterogeneity, and response vs fitted values to check model fit, using randomised quantile residuals to account for the negative binomial distribution).

3. Results

This study consisted of 92 days of T-POD monitoring at the inner and mid sites, and 41 days at the outer site (Table 4), yielding a combined total of 5256 T-POD hours. During this period pile-driving occurred on 46 days, with a mean of 125.5 mins of piling per day (SE = 16.7 mins). This average excluded the 17-day break over

Table 3
List of explanatory variables used in the models of DPM per hour.

Variable (abbreviation)	Type	Description
Piling related variables		
Sound Exposure Level (SEL)	Continuous	Mean sound exposure level (dB re 1 μPa^{2}s) of a representative sample of 10 strikes per hour as measured at the Diamond Harbour DSG
Time since piling (TSP)	Continuous	Equals '0' during hours of piling, otherwise equals the minutes since the previous piling event.
Piling duration (Dur)	Continuous	Duration of the previous piling event in minutes.
Time related variables		
Hour of day (Hour)	Continuous, cyclic	Equals '0' for the hour starting at 00:00 am, to '23' for the hour starting at 11:00 pm
Previous DPM (DPMt-1)	Continuous	DPM measured in the preceding hour.
Environmental variables		
Wind speed (Wspd)	Continuous	Averaged over the 10 min directly preceding each hour, measured in knots
Wind direction (Wdir)	Continuous, cyclic	Averaged over the 10 min directly preceding each hour, measured in degrees
T-POD position (TPOD)	Factor, 3 levels	Inner (1), mid (2) or outer (3) harbour position
Tide (tide)	Continuous, cyclic	Hours since last high tide

Table 4
T-POD deployment and detections. 'Detection positive days' is the number of days on which at least one dolphin click was detected. DPM = detection positive minutes; SE = standard error.

T-POD	Days deployed	Detection positive days	Mean DPM per day (SE)
Inner	92	82	12.83 (1.52)
Mid	92	91	29.47 (1.97)
Outer	41	41	55.27 (6.40)

Christmas-New Year during which no pile-driving occurred. The outer T-POD, while in place, had consistently more detections of Hector's dolphins than the other two (Table 4).

3.1. DPM per day

The model which included the piling-related variable PPM was the top model, and had a higher Akaike weight than those that did not (Table 5). The effect of many of the variables differed by location (Table 6).

An increase in PPM per day led to a decrease in DPM per day at the inner and outer T-PODs, and an increase in DPM at the mid T-POD (Fig. 2). The variable SEL was not present in the top models.

DPM per day decreased with increasing wind speed at the inner and mid T-POD (Fig. 2). At the inner T-POD, increased detections were seen during westerly winds, and decreased detections during easterly winds (Fig. 2).

3.2. DPM per hour

The six highest rated models, by Akaike weight, all contained three piling-related variables (TSP, SEL and Dur), the 7th and lowest rated model contained two piling-related variables. Relationships among variables were more complex in the DPM per hour dataset, for which top models included all variables tested, as well as the interaction between time-since-piling and duration-of-piling (Tables 7 and 8).

The lowest detection rate at the inner T-POD was seen within 2000 mins (33 h) after piling (Fig. 3). After this point the rate steadily increased and levelled off around 5000 mins (83 h). DPM per hour decreased with increasing SEL at all T-POD locations (Fig. 3). An increase in duration of pile-driving led to a decrease in detection rate, up to a duration of about 150 mins (Fig. 4). The interaction between time-since-piling (TSP) and duration-of-piling (Dur), at the inner T-POD, showed decreasing detection rates within the first 2000 mins (33 h) of piling (Fig. 5). Detection rates returned to the level of the previous hour (set at 1.1 DPMs) after 3000–3500 min (50–58 h) (Fig. 5). The first maximum following the minimum occurred at 5000 min. Therefore, this time most likely represents the time to recovery, see Brandt et al. (2011). There were more subtle effects with duration. For short duration events (< 100 min) the lowest DPM per hour was seen directly after piling, and was lower than that of the previous hour (Fig. 5). For longer duration events, however, the lowest DPM was seen around 2000 mins (33 h) after piling, as shown by the 0.4 contour (Fig. 5). Beyond 5000 mins after piling, DPM per hour decreased with time.

At the inner T-POD, detection rates were highest around 5–6 am and the lowest around 11–12 pm, with another peak in detections at 5–6 pm (Fig. 3). At the mid T-POD the highest rate was seen around 4–5 pm, and the lowest around 5–6 am (Fig. 3). At the inner T-POD, highest detection rates were seen around 100 mins after high tide (Fig. 3). At the mid T-POD, detection rates were highest around low tide, and at the outer T-POD around high tide (Fig. 3). Wind direction had the overall effect of increased DPM per hour during northerly winds and decreased during southerly winds (Fig. 4). Detection rates tended to decrease with increasing wind speed (Fig. 4).

Table 6
Index of relative importance (IRI), estimated degrees of freedom (edf) and significance (*p*-value) for the parametric (first 3 rows) and smoothed terms in the top model in the DPM per day dataset. Bold terms are significant at the 5% level. *The first three rows of 'edf' are coefficient estimates for the parametric terms.

Term	IRI	edf	p-value
Intercept	**1**	**2.71***	**< 2e-16**
TPOD2	**1**	**0.57***	**5.86e-4**
TPOD3	**1**	**1.07***	**1.32e-6**
ti(DPMt-1):TPOD1	**1**	**2.56**	**0.001**
ti(DPMt-1):TPOD2	**1**	**1.00**	**0.008**
ti(DPMt-1):TPOD3	1	1.00	0.174
ti(Wspd):TPOD1	**1**	**1.00**	**0.006**
ti(Wspd):TPOD2	**1**	**1.00**	**0.012**
ti(Wspd):TPOD3	1	1.00	0.446
ti(Wdir):TPOD1	**0.9**	**1.78**	**0.006**
ti(Wdir):TPOD2	0.9	0.00	0.387
ti(Wdir):TPOD3	0.9	1.17	0.059
ti(PPM):TPOD1	0.49	1.00	0.062
ti(PPM):TPOD2	0.49	1.00	0.104
ti(PPM):TPOD3	0.49	1.00	0.486

4. Discussion

4.1. Pile-driving and the effect on dolphin detections

Multi-model inference revealed that the top models contained at least one piling-related variable, indicating that pile-driving influenced detection rates of Hector's dolphins in Lyttelton Harbour. Considering that several studies of harbour porpoise have shown that animal density is correlated to the number of acoustic detections (Marques et al., 2009; Sveegaard et al., 2011; Kyhn et al., 2012; Dähne et al., 2013), we propose that this is the most parsimonious explanation for differences in detection rates of Hector's dolphins also. DPM per day decreased at the inner T-POD, as piling (PPM) increased, while it increased at the mid-harbour T-POD. The mid harbour location is further from the piling activity, and is partially shielded by Sticking Point (Fig. 1). Average broadband sound levels were 14 dB lower at the mid-harbour T-POD (Table 1, see Leunissen and Dawson, 2018 for more detail). Taken together, these data suggest that dolphins displaced from the inner harbour moved towards the mid harbour area, increasing the chance they were detected by the mid T-POD. This effect was also observed visually in a study of impact of pile-driving from offshore wind farm construction on harbour porpoise (Dähne et al., 2013). The lack of strong trends for piling related variables at the outer T-POD indicates this detector was outside the zone of impact and, thus, provides an outer boundary.

Table 5
Results of model selection for GAMs with DPM per day as the response variable. Only models within 6 AICc points of the top model are shown. Rank is based on AICc, 'Wt' is the Akaike weight of the model, '% DE' is the percentage deviance explained by the model, R^2 is the adjusted r-squared value, and the 'Model' column shows the model structure. Terms enclosed by 's()' are smoothed variables, and by 'ti()' are smoothed seperately for each T-POD location.

Rank	Model	df	AICc	ΔAICc	Wt	% DE	R^2
1	T-POD + ti(DPMt-1) + ti(Wspd) + ti(Wdir) + ti(PPM)	18.9	1746.92	0	0.49	44.2	0.48
2	T-POD + ti(DPMt-1) + ti(Wspd) + ti(Wdir)	15.6	1747.25	0.33	0.41	42.2	0.48
3	T-POD + ti(DPMt-1) + ti(Wspd)	12	1750.06	3.13	0.1	39.3	0.443

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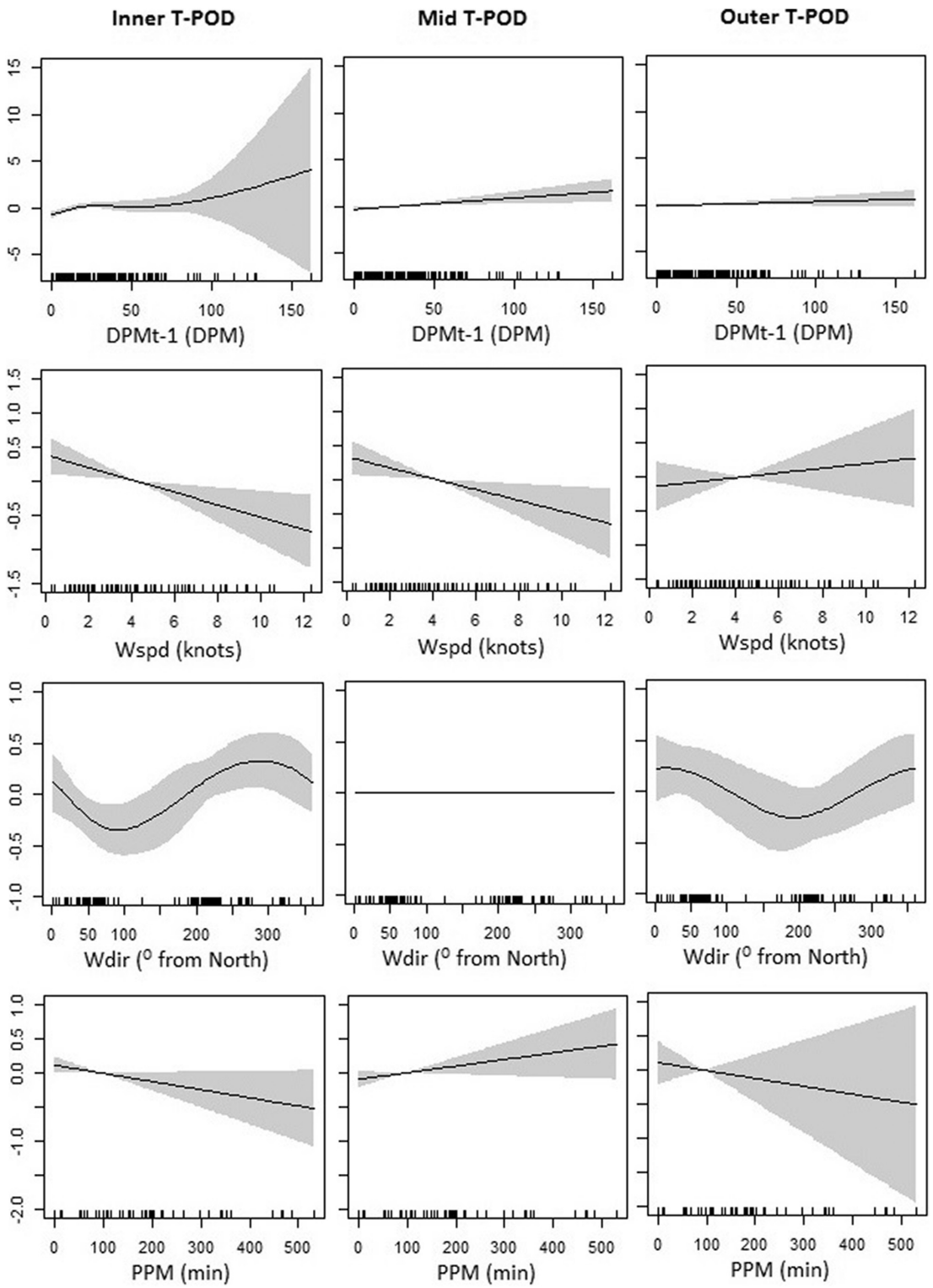

Fig. 2. The predicted smoothing functions for each explanatory variable, from the highest ranked model in which it appears, and its effect on DPM per day (y-axis) with shaded 95% confidence intervals. The ticks along the bottom edge of the plot indicate the values found in the measured data for that variable.

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Table 7
Results of model selection for GAMs with DPM per hour as the response variable. Only models within 6 AICc points of the top model are shown. Rank is based on AICc, 'Wt' is the Akaike weight of the model, '% DE' is the percentage deviance explained by the model, R^2 is the adjusted r-squared value, and the 'Model' column shows the model structure. Terms enclosed by 's()' are smoothed variables, and by 'ti()' are smoothed seperately for each T-POD location, except the term 'ti (TSP,Dur)' which is an interaction between the 2 variables.

Rank	Model	df	AICc	Δ	Wt	% DE	R^2 (adj.)
1	ti(DPMt-1) + TPOD + ti(Hour) + ti(TSP) + ti(SEL) + ti(tide) + ti(TSP,Dur) + ti(Wdir) + s(Dur)	46.4	10,491.1	0	0.46	19.3	0.152
2	ti(DPMt-1) + TPOD + ti(Hour) + ti(TSP) + ti(SEL) + ti(tide) + ti(TSP,Dur) + ti(Wdir)	43.05	10,492.2	1.1	0.27	19.1	0.152
3	ti(DPMt-1) + TPOD + ti(Hour) + ti(TSP) + ti(SEL) + ti(tide) + ti(TSP,Dur) + ti(Dur)	41.66	10,494.6	3.5	0.08	19.1	0.148
4	ti(DPMt-1) + TPOD + ti(Hour) + ti(TSP) + ti(SEL) + ti(tide) + ti(TSP,Dur) + ti(Wspd)	43.99	10,494.8	3.7	0.07	18.9	0.148
5	ti(DPMt-1) + TPOD + ti(Hour) + ti(TSP) + ti(SEL) + ti(tide) + ti(TSP,Dur)	40.8	10,495.6	4.5	0.05	18.8	0.148
6	ti(DPMt-1) + TPOD + ti(Hour) + ti(TSP) + ti(SEL) + ti(tide) + ti(Wdir) + s(Dur)	42.75	10,496.1	5.0	0.04	18.9	0.158
7	ti(DPMt-1) + TPOD + ti(Hour) + ti(TSP) + ti(SEL) + ti(tide) + ti(Wdir)	39.54	10,496.4	5.3	0.03	18.7	0.157

Table 8
Index of relative importance (IRI), estimated degrees of freedom (edf) and significance (p-value) of each term in the top model (except for s(Wspd) - values are from 4th best model) for the parametric (first 3 rows) and smoothed terms in the DPM per hour dataset. Bold terms are significant at the 5% level. *The first three rows of 'edf' are coefficient estimates for the parametric terms.

Term	IRI	edf	p-value
Intercept	**1**	**−0.84***	**< 2e-16**
TPOD2	**1**	**0.97***	**< 2e-16**
TPOD3	**1**	**1.28***	**< 2e-16**
ti(DPMt-1):TPOD1	**1**	**3.01**	**< 2e-16**
ti(DPMt-1):TPOD2	**1**	**2.31**	**9.74e-08**
ti(DPMt-1):TPOD3	**1**	**2.26**	**1.54e-04**
ti(TSP):TPOD1	**1**	**3.57**	**2.58e-05**
ti(TSP):TPOD2	1	1.00	0.132
ti(TSP):TPOD3	1	1.75	0.355
ti(Hour):TPOD1	**1**	**2.82**	**8.18e-05**
ti(Hour):TPOD2	**1**	**1.98**	**0.001**
ti(Hour):TPOD3	1	0.00	0.643
ti(SEL):TPOD1	**1**	**2.48**	**0.034**
ti(SEL):TPOD2	1	1.00	0.129
ti(SEL):TPOD3	1	1.46	0.098
ti(tide):TPOD1	**1**	**1.66**	**0.019**
ti(tide):TPOD2	1	0.96	0.157
ti(tide):TPOD3	**1**	**1.86**	**0.005**
ti(TSP,Dur)	**0.93**	**3.04**	**0.045**
s(Wdir)	**0.8**	**1.72**	**0.013**
s(Dur)	0.57	2.96	0.185
s(Wspd)	0.08	1.00	0.057

This is reinforced by the low noise contours at this location in Leunissen and Dawson (2018).

The greater temporal resolution of the DPM per hour response variable supported a more nuanced analysis, indicating that time-since-piling, piling SEL and the interaction of time-since-piling and duration were significant influences. Here also, responses were often location specific. DPM per hour at the inner harbour T-POD decreased significantly with increasing SEL (Fig. 3) indicating that it was not only the presence of pile-driving but also its intensity that led to avoidance reactions. This is probably why studies assessing the impact of windfarm construction on harbour porpoise see avoidance reactions at much larger distances (around 20 km; Tougaard et al., 2009; Brandt et al., 2011; Dähne et al., 2013). Pile-driving for windfarms involves much larger piles (around 2.4–4 m diameter, compared to 0.61–0.71 m in Lyttelton) and correspondingly heavier pile drivers, leading to much higher sound source levels (Fricke and Rolfes, 2015). Also, the harder substrate found in these offshore locations (sand/gravel, compared to the fluid mud layer in Lyttelton) allows the sound to propagate further (due to increased reflection from the bottom surface; Jensen et al., 2011). This effect on propagation leads to an increase in range at which the sound can be heard.

4.2. Duration of impact

Analysis of DPM per hour suggested that the decreasing trend in detection rate following a pile-driving event lasted around 33 h. Detection rate restored to the level of the hour prior to exposure after 83 h. This gradual increase in detections after 33 h probably reflected the gradual return of dolphins to the inner harbour following a pile-driving event. Levelling-off of the trend in detection rate with time-since-piling (as in Brandt et al., 2011) indicates that the previous piling event no longer has an effect on detection rate. This was observed in the current study at 83 h. The modelled decline in DPM (see Figs. 3 and 5) after that point was not well supported by data (only during the Christmas/New year break did time-since-piling exceed 90 h). The maximum duration of effect on detections (83 h) is comparable to, though slightly longer than, the longest duration of effect estimated for the impact of pile-driving on harbour porpoise (72 h; Brandt et al., 2011). It is interesting that the lowest detection rate did not occur immediately after pile-driving, but rather 33 h later. This seems counterintuitive and is not observed in other studies (e.g. Tougaard et al., 2009; Brandt et al., 2011), but could have been driven by a need to stay in the area for foraging opportunities, for example. Another reason for this delayed minimum could be due to lower SEL in this study. Louder sounds are more likely to result in an immediate impact, while quieter sounds could be tolerated for longer before a threshold is reached.

DPM per hour decreased with duration of the previous pile-driving event up to a duration of 150 mins, although the effect was not strong. There was however an important interaction between time-since-piling and duration of the previous piling event. For long duration piling events, the decrease in DPM per hour persisted for longer after piling had finished.

4.3. Influence of other factors

T-POD location was the most significant influence on detection rate of Hector's dolphins in Lyttelton Harbour (Table 8). Similar fine-scale variation in spatial distribution of Hector's dolphin has previously been revealed by other acoustic (e.g. Dawson et al., 2013), and visual surveys (e.g. Brough et al., 2018). Decreased hourly detections at the inner T-POD between 7 am and 4 pm could be due to disturbance by higher levels of vessel traffic near the wharf and construction activity during working hours (e.g. increased swimming speed in killer whales with increased boat traffic, following a diurnal pattern (Kruse, 1998)). Another explanation could be diel movements of prey (as observed with harbour porpoise; Todd et al., 2009). The changes in detections in response to time of day are in addition to the changes following pile-driving events (accounted for by the model structure). Since we were unable to acquire true control data, however, it cannot be concluded that Hector's dolphin detections would follow the same daily trend outside the monitoring period, with no construction activities taking place. Diurnal variation in Hector's dolphin habitat use has previously been observed in Porpoise Bay (Bejder and Dawson, 2001) and Akaroa

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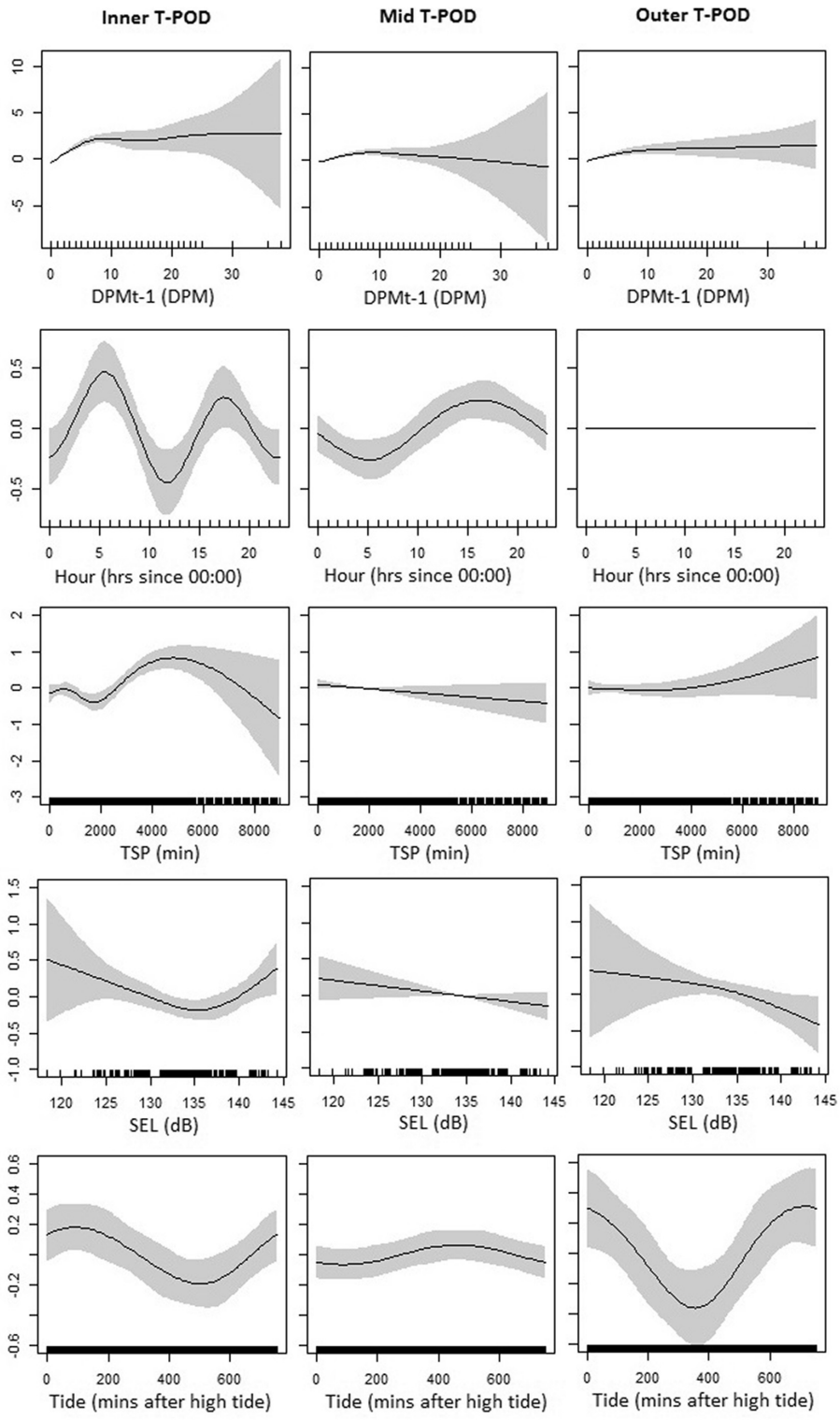

Fig. 3. The predicted smoothing functions for each explanatory variable and its effect on DPM per hour (y-axis) with shaded 95% confidence intervals. The ticks along the bottom edge of the plot indicate the values found in the measured data for that variable.

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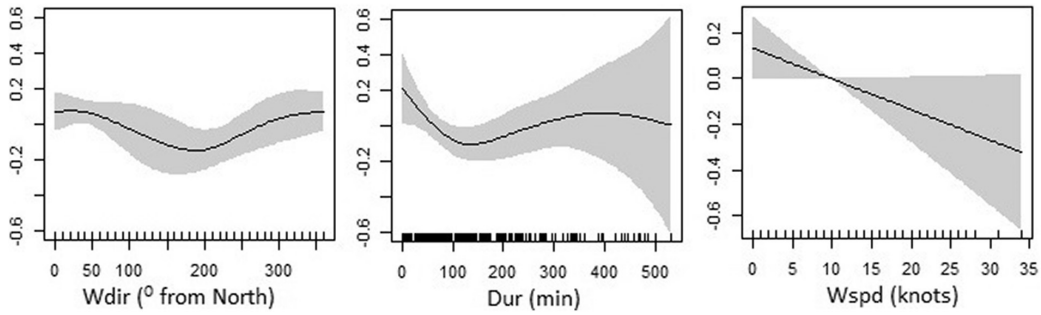

Fig. 4. The predicted smoothing functions for the explanatory variable and its effect on DPM per hour at all T-POD locations (y-axis) with shaded 95% confidence intervals. The ticks along the bottom edge of the plot indicate the values found in the measured data for that variable.

Harbour (Dawson et al., 2013), but does not follow the same trend as observed in this study.

State of the tide also had a significant effect on Hector's dolphin distribution in nearby Akaroa Harbour (Dawson et al., 2013). Furthermore, detection rates of bottlenose dolphins on the coast of Scotland (Mendes et al., 2002), and harbour porpoise in the Bay of Fundy (Johnston et al., 2005) were correlated with tidal state. A possible driver for the variation in dolphin distribution is the tidally mediated movement of prey species. For example, yellow-eyed mullet (*Aldrichetta forsteri*), identified as a prey species from Hector's dolphin stomach contents (Miller et al., 2012), was most often caught at night time low tides in Manukau Harbour, northern New Zealand (Morrison et al., 2002).

At least at the inner and middle T-POD locations, more dolphin detections were made at lower wind speeds. This was possibly due to higher attenuation of click sounds during high wind speeds in shallow water, caused by the increased amount of air bubbles in the water and less reflection at the ruffled water surface (Norton and Novarini, 1996). In contrast, Brandt et al. (2016) observed the opposite effect of wind on detections of harbour porpoise. This effect was determined to be due to the increased propagation of piling noise at lower wind speeds, leading to lower detection rates. In addition, more noise clicks were recorded at higher wind speeds due to increased levels of ambient noise giving false-positive detections (Brandt et al., 2016).

4.4. Temporary threshold shift (TTS) in hearing

This study showed that pile-driving noise clearly influenced Hector's dolphin distribution. Another important impact from the noise is increased risk of hearing damage, particularly close to the piling activity. Leunissen and Dawson (2018) calculated zones of potential impact in Lyttelton Harbour based on hearing studies of harbour porpoise (Kastelein et al., 2013a; Kastelein et al., 2013b; Kastelein et al., 2015). These zones depend on the length of time they spend near the pile-driving. While these zones did not cover very large areas, Hector's dolphins may tolerate noise at levels which could induce TTS if there was a sufficient reward for doing so. Hector's dolphins have been observed inside the zones where they are at risk of TTS. We visually observed dolphins (near our close-range sound recorder moored about 370 m from the piling activity) and, thus, have many recordings of their clicks (up to 10 consecutive dolphin positive minutes) during pile-driving events. Masking of environmental sounds is highly likely in the inner harbour. The spatial extent of these impacts into the outer harbour was heavily reduced due to the shielding effect of the breakwater at Sticking Point (Leunissen and Dawson, 2018).

The sensitivity of Hector's dolphin hearing has not yet been tested, so the TTS calculations by Leunissen and Dawson (2018) assumed that it is similar to that of harbour porpoise. Two lines of evidence suggest that Hector's dolphin hearing might be significantly more sensitive. First, the source level of Hector's dolphin echolocation clicks is much lower than that of harbour porpoises (Kyhn et al., 2009), implying that to serve the same function the receiver system should be more sensitive. Second, we detected behavioural change in Hector's dolphins at SELs lower than those which have been observed to modify behaviour of harbour porpoise (Tougaard et al., 2009; Bailey et al., 2010; Brandt et al., 2011; Dähne et al., 2013; Kastelein et al., 2013b).

In summary, pile-driving noise was associated with a decrease in detection rate of Hectors' dolphins at the inner T-POD, with an increase

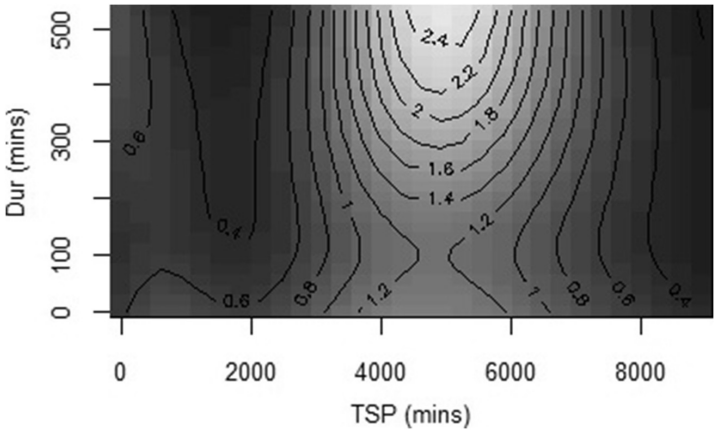

Fig. 5. Interaction between time-since-piling (TSP) and Duration-of-piling (Dur) calculated in the top model, with contours showing the predicted DPM per hour at the inner TPOD when the other variables are fixed as follows: "Hour" = 16 (4 pm), "Wdir" = 50° from North, "tide" = 100 mins after high tide, "SEL" = 134 dB, "DPMt-1" = 1.1 mins.

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in detections per day seen at the mid T-POD. The most parsimonious explanation is that this was driven by dolphins moving from the inner harbour to the mid harbour when pile-driving was underway. Reduced density of dolphins near the inner T-POD was also implied by decreasing detection rates following a bout of piling, restoring to pre-piling levels after 50–83 h. Intensity of piling also affected detection rate, with fewer detections in the inner harbour on days with longer duration piling activity, and fewer detections per hour after longer and louder piling events. Pile-driving has also been shown to introduce a risk of TTS (Leunissen and Dawson, 2018).

We have demonstrated that pile-driving had an effect on Hector's dolphins's use of Lyttelton Harbour. While the population level effect is uncertain, the extra energy expenditure from area abandonment and reduced foraging opportunities are potentially very important in the context of the endangered status of this species, and in addition to the other threats it faces. It is essential that future research strives to quantify the population level impacts. In the meantime, society should take a precautionary approach to such impacts, taking whatever means possible to reduce the likelihood of detrimental change.

There are options to mitigate the noise-related effects of pile-driving. For example, bubble curtains can significantly reduce the noise radiated into the water column (Lucke et al., 2011; Nehls et al., 2016; Tsouvalas and Metrikine, 2016) particularly when confined (e.g. Buehler et al., 2015). For Lyttelton Harbour, however, significant re-suspension of sediment could breach a condition of the Coastal Permit, and therefore makes bubble curtains an unlikely noise-mitigation option for future construction work. A strategy for reducing noise pollution could be to employ screw-piling technology, rather than impact pile-driving, which produces significantly less underwater noise (Saleem, 2011). Since Hector's dolphins are generally found closer inshore during the summer (Rayment et al., 2010; Brough et al., 2014, 2018), restricting piling to winter time would also likely reduce its impact.

Declarations of interest

None.

Acknowledgements

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Appendix A

Temporal autocorrelation

Two methods were used to reduce temporal auto-correlation in both datasets, tested using the *acf* function in R. The use of the DPMt-1 variable in the models (Tables 2 and 3) was much more effective in reducing temporal auto-correlation in model residuals than using a corAR1 correlation structure, in both datasets (Figs. A.1 and A.2).

DPM per hour

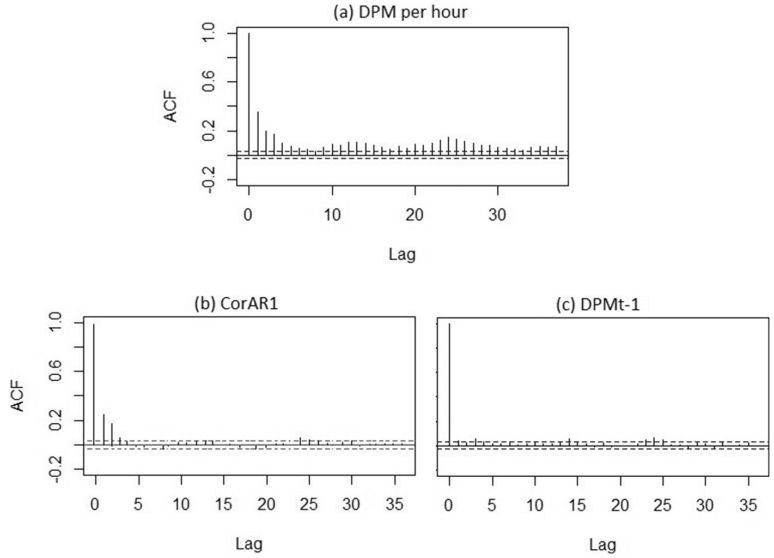

Fig. A.1. (a): Temporal autocorrelation of the DPM per hour variable; (b): Temporal autocorrelation of the residuals of the top model, with the corAR1 correlation structure, of DPM per hour; (c): Temporal autocorrelation of the residuals of the top model, with the DPMt-1 variable, of DPM per hour. Horizontal dotted lines indicate the 95% confidence interval of white noise of this series.

DPM per day

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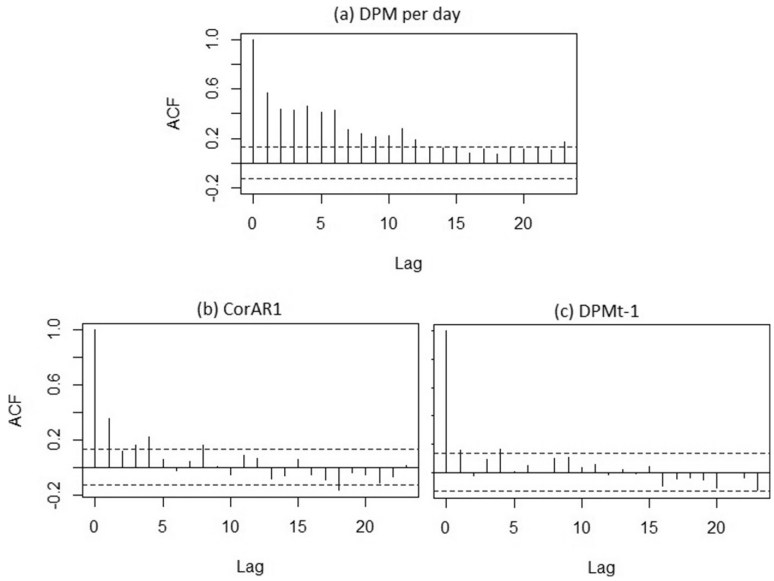

Fig. A.2. (a): Temporal autocorrelation of the DPM per day variable; (b): Temporal autocorrelation of the residuals of the top model, with the corAR1 correlation structure, of DPM per day; (c): Temporal autocorrelation of the residuals of the top model, with the DPMt-1 variable, of DPM per day. Horizontal dotted lines indicate the 95% confidence interval of white noise of this series.

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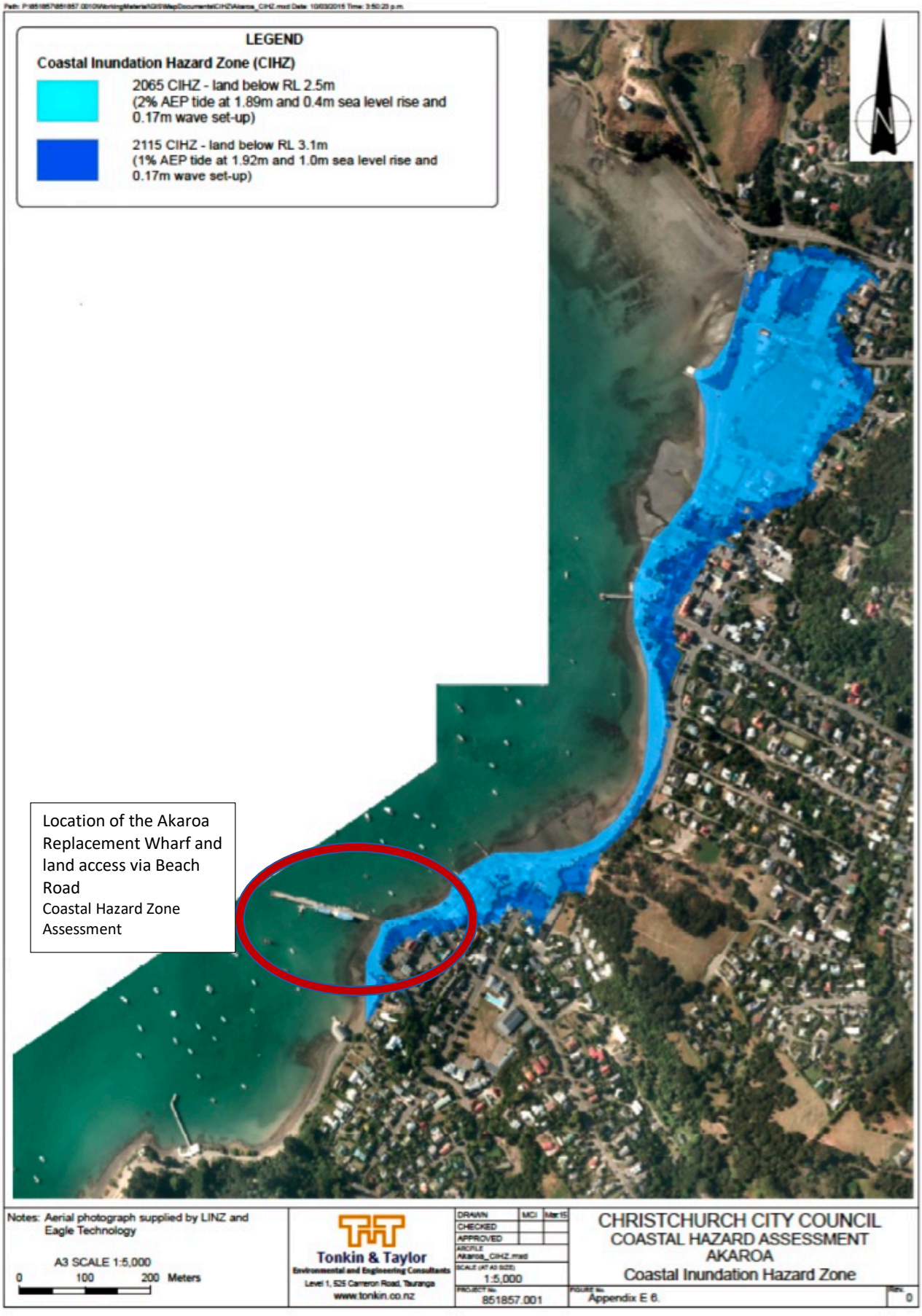


Submission #44698

Attachment 2, Victoria Andrews, Akaroa Wharf Replacement Submission

Examples of waterfront design features

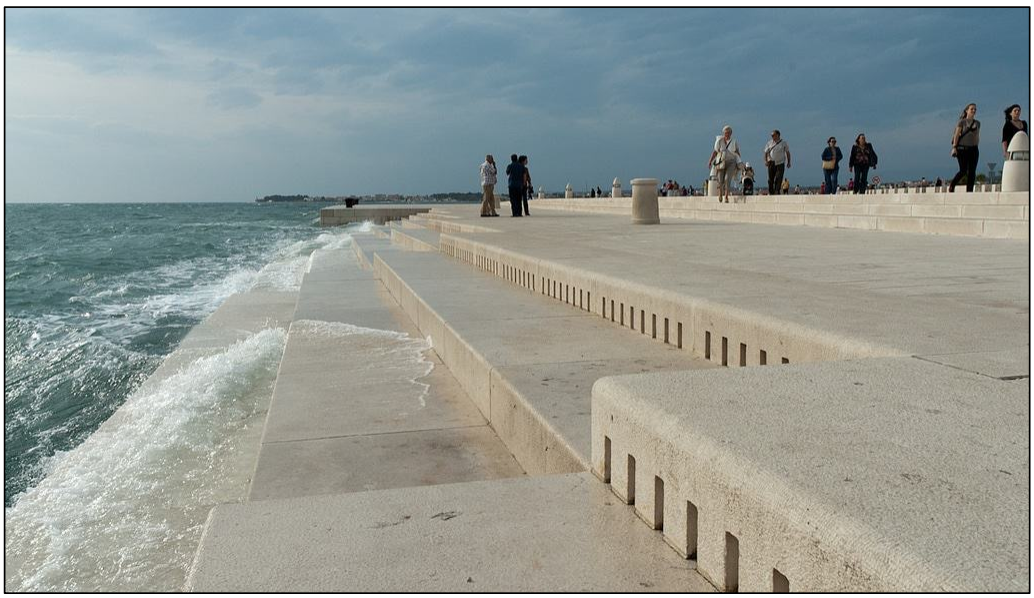
Please note that recreational use is kept separate from commercial operators

Oslo, Norway, Opera House with steps down to the water

Singapore

Submission #44698

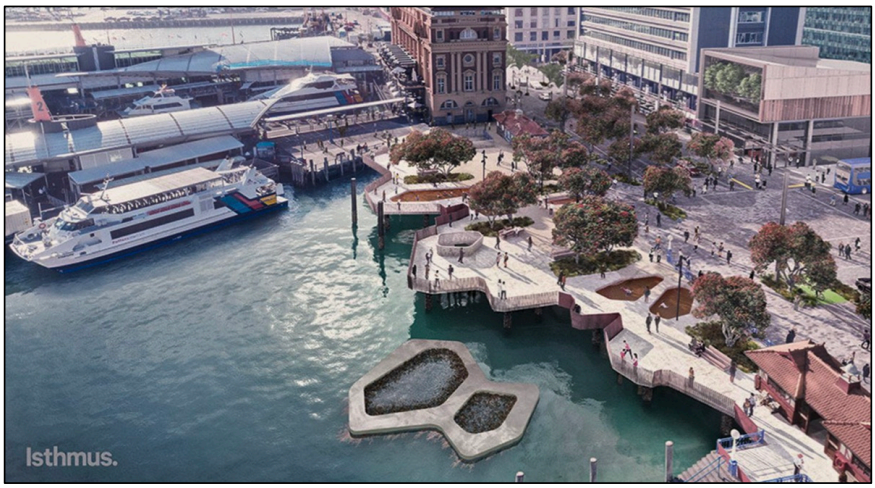
Niederhafen River Project



Sea Organ, Zadar

Submission #44698

Oriental Bay, Wellington, Isthmus



Above and below: Isthmus, Auckland Ferry Terminal & waterfront redevelopment with steps
*Note that commercial operators are kept separate from the public and recreational users