PETONE WHARF FUTURE OPTIONS

PREPARED FOR HUTT CITY COUNCIL (HCC)

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Calibre Consulting Ltd

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TASK	NAME	SIGNATURE
Project Manager	Tom Arthur	
Prepared by	Tom Arthur	
Reviewed by	Bevan White & Peter Olivier	
Approved for Issue by	Tom Arthur	

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1 EXECUTIVE SUMMARY

This report summarises options for the future of Petone Wharf for consideration by the community committee of Hutt City Council (HCC) and the Petone Community board. The options are based on the conservation report written by Studio Pacific Architects with input from planning consultant Align and HCC.

The 393m long wharf at Petone is a traditional hardwood structure and is around 115 years old. The wharf has been found to be in poor condition and has been closed to the public since January 2021 when moderate earthquakes caused the failure of several piles and severe slumping in the wharf approach. The wharf was repaired however a detailed inspection later in 2021 found the condition of the structure at the end of the wharf to be poor. HCC resolved that the wharf should remain closed until the outer end of the wharf is repaired or removed.

HCC have allocated $21M in the long term plan for rebuilding Petone Wharf and met with Heritage New Zealand and Greater Wellington Regional Council in July 2021 to discuss the design and planning process. It was agreed a conservation report would be written and that this would be used to produce options for the rebuilt wharf.

Following completion of the conservation report, six options were proposed, there are summarised below. Cost estimates are being prepared by quantity surveyors at AECOM and will be added in a subsequent revision of this report.

Ref	Description
Option 1	Full Heritage: Same extent and form, salvaged materials where practical and new hardwood
Option 2	Trimmed Heritage: Shortened wharf using same form, salvaged materials where practical and new hardwood
Option 3	Semi-Heritage: Shortened wharf using same form. Mixture of traditional and modern materials
Option 4	Heritage beach and modern end: Limited area of wharf at beach restored using original fabric. Outer wharf uses same form with mixture of traditional and modern materials
Option 5	Demolition: Removal of wharf with piles cut at seabed and no replacement structure
Option 6	Demolition and replacement with modern wharf.

Table 1: Summary of options and cost estimates

Following feedback from project stakeholders the preferred option will be selected by HCC and developed. The consenting is expected to be complete in February 2023 and construction to begin winter 2023.

2 INTRODUCTION

2.1 Background

Petone Wharf was built in 1907 and was previously owned by the former Wellington Harbour Board before being vested to HCC in 1989.

Detailed condition surveys of Petone Wharf have been completed on a five-yearly cycle since the early 1990's to assess on-going damage and deterioration. After each detailed survey, repair and maintenance works have been completed, the last detailed inspection recommended the wharf remains closed due to the condition of the structure. Due an increasing rate of pile failure, monthly walkover inspections are being carried out to monitor the structure.

The overall condition of the wharf has deteriorated to the point where a large proportion of the structure is in poor condition and a rebuild is necessary.

2.2 Description of Current Wharf

Petone Wharf is a simple linear wharf, 393m long with a deck area of approximately 2,500 m². The approach is 283 m long x 4.6 m wide and the wharf head is 110 m long x 10.1 m wide.

Three 1907 construction drawings have been retrieved from Wellington City Council archives along with the original construction specification documents. These documents describe in detail the materials used for the wharf including the species of Australian hardwoods used for each component.

The wharf is a traditional cross-braced timber trestle on timber piles with the original piles being of Ironbark or Jarrah, and the pile caps, walers, braces, beams and fenders being of mixed Australian hardwoods. The decking on the wharf head is reinforced concrete, whilst on the approach, a concrete topping and wearing surface overlies the original hardwood decking.

Newspaper reports from shortly after the wharf was completed discuss severe slumping to the wharf head that was addressed by adding more piles driven deeper into the seabed. There are two rows of piles beneath the wharf head which are not shown on the original drawings and are located off-grid. It is believed these are the piles added around 1910 to address the slumping issues discussed in the newspaper reports.

Many of the capping beams on the wharf head are up to 500mm below the underside of the stringers with packing between which differs from the construction drawings. This difference to the design was most likely to address localised slumping shortly after construction of the wharf.

The most significant modification since construction is the installation of a concrete deck which was completed in the early 1960's. The timber decking to the wharf head was removed at this time. We have the contract specification for this work but no drawings. The specification document mentions that 48 No defective hardwood timbers were to be replaced but we have no records actual number replaced which is likely to be higher.

The 1960's specification mentions replacement of a pair of capping beams. It is possible more were replaced to address deterioration at the top of the piles that may not have been apparent until the deck was removed.

The handrails along the approach have been replaced and the stairs have been removed, including supporting piles to the landing area (cart refuge) at gridline 25.

The wharf head is higher than the approach and the last four bays of the approach between gridlines 44 and 48 ramp upwards to meet the wharf head.

The boat steps and landing at the beach end of the wharf head were replaced in 2013 by a steel access jetty and ladder supported by 5 new piles. The jetty straddles the approach and wharf head and was damaged during the Kaikoura earthquake.

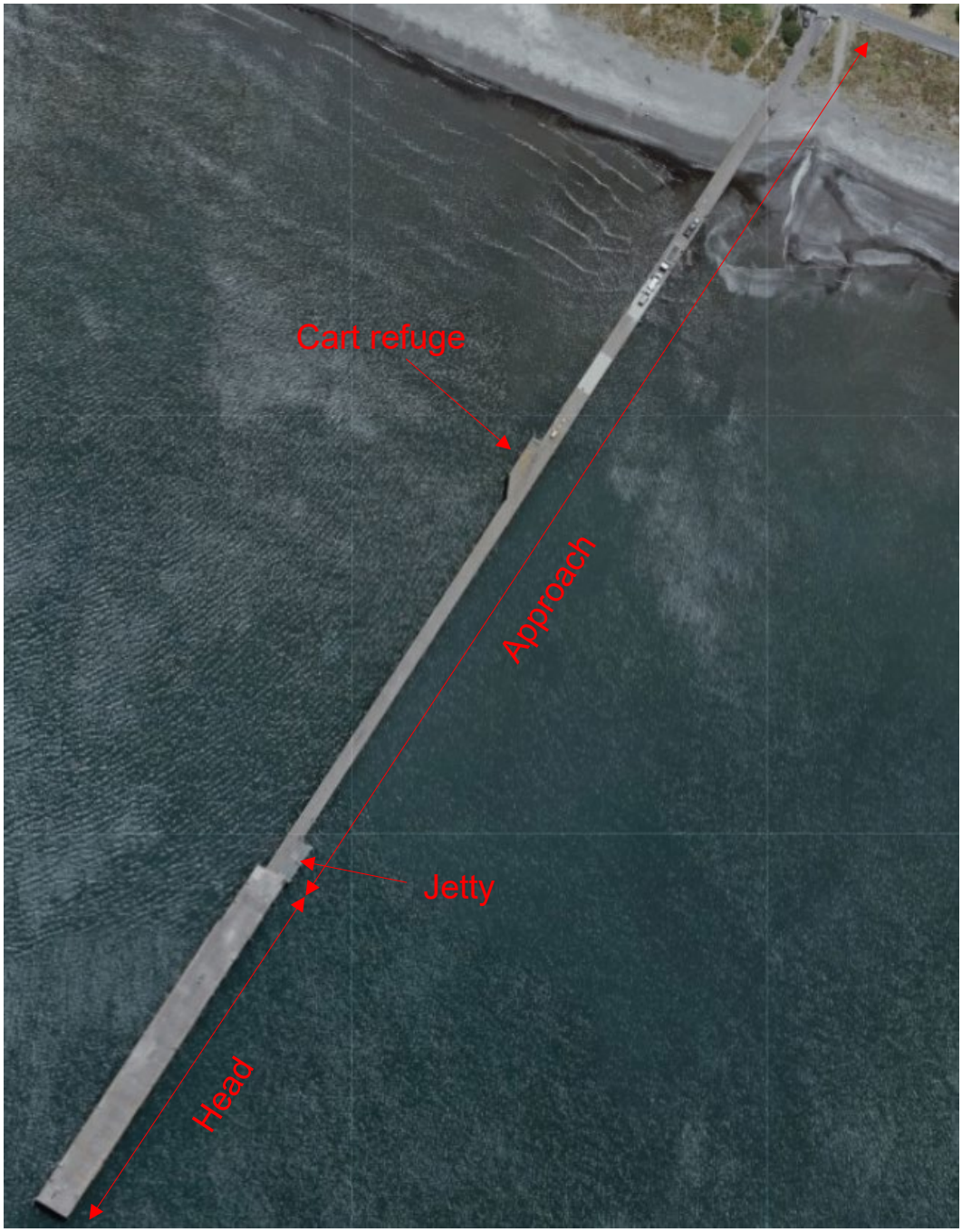


Figure 1: Aerial image of Petone Wharf circa 2021 (Source: LINZ Data Service)

2.3 Condition of Wharf

The last detailed inspection was completed in 2021 comprising a visual inspection from a boat at both high and low tides and a dive survey of the piles. The Calibre HCC Wharf Condition Report dated 2021-11-04 prepared by Calibre recommended the wharf was closed until the structure was repaired or replaced.

The condition of the wharf generally deteriorates with distance from the beach. Many timber members show signs of deterioration, with capping beams and corbels having extensive decay at the end of the wharf.

The inspection in 2021 indicated that the condition of the piles had declined since 2018 when the previous dive survey was completed.

During a sequence of moderate earthquakes in late 2020, nine piles failed around the cart refuge and were repaired in February – March 2021. The failed piles were found to have severe damage due to Teredo worm and it is likely that other piles on the wharf will have similar deterioration. The 2021 dive inspection noted the piles on the wharf head to be in poor condition while the piles located along the western edge and outer half of the wharf head are generally in poor or very poor condition.

Figure 2 Dip in wharf deck over grid 28, and a length of the removed pile from this location showing severe deterioration from teredo worm. Worm damage to a pile on wharf head

The outer stringers are showing widespread degradation, many of the beams along the western side of the wharf have lost structural integrity, four on the wharf head were replaced in 2018. The inner beams are generally in much better condition and with the exception of some areas of the wharf head where there is decay due to rainwater leaking through construction joints.

A very large proportion of the edge beams on the approach require replacement and there is vegetation growing on many of these beams which retains moisture and accelerates decay.

The steel access platform (jetty) is in moderate condition with deformation of steel beams and rust on most of the members. The structure is vulnerable to earthquakes as it straddles the wharf head and approach which move differently during an earthquake. The jetty was damaged during the Kaikoura earthquake with some beams remaining twisted.

The deck on the wharf head is not level. Newspaper stories from shortly after the wharf was built describe significant and uneven slumping of up to 18” (457 mm). It is not clear to what extent the wharf was levelled at the time and it is likely subsequent pile failures will have caused further movement. In 2019, survey marks were installed over each pile and these are routinely surveyed for vertical movement. The most recent survey indicated minor vertical movement around pile 63F. The dive survey confirmed the two closest piles are at the point of failure and the pile cap has failed. The difference between the highest and lowest point on the wharf head is around 250 mm.

The concrete deck appears to be in reasonable condition in areas which have been removed for pile repairs, the concrete and reinforcement were observed to be sound. The construction joints are letting rainwater through which has accelerated decay of the timber below.

2.4 Re-build vs. Repair

There are two approaches for the renewal of Petone Wharf, rebuild and repair. A rebuild would remove each part of the wharf down to the piles and then reinstate reusing materials where practical. A repair would involve individually replacing the elements that are in poor condition.

Form a heritage perspective, a repair is preferable so that as much of the original fabric as possible remains in place. The repair would require temporary propping to the decking whilst lower elements are repaired or replaced. At the exposed outer end of the wharf the water is deep and the wharf condition is particularly poor. Propping here would be expensive and take far longer than a rebuild approach.

A rebuild option removing each component allows for the most thorough inspection of the structure. This is important as much of the worst deterioration occurs at the interface between structural elements such as the upper face of stringer beams and piles where connected to bracing and cap beams. This has been observed at Petone Wharf where sections of deck were removed for repairs. If the wharf is repaired it would not be possible to inspect all these areas.

The proportion of the wharf structure that is in good enough condition to be retained is expected to be small, greatly limiting the heritage benefit of repairing over rebuilding.

3 DESIGN CONSIDERATIONS

A meeting was held in July 2021 at Petone Wharf with Heritage New Zealand, Greater Wellington Regional Council, HCC, Calibre and Align to discuss the wharf rebuild.

The poor condition of much of the wharf was highlighted with the majority of the structure needing replacement, it was agreed that a conservation report would be written and that this would be used to inform decision making on the renewal of the wharf.

The conservation report was completed by heritage architects at Studio Pacific with input from the local historian, Peter Cooke. The options presented in this report have been prepared with input from heritage architects at Studio Pacific, HCC, Calibre and Align. The options are presented to inform decision making on the future of the wharf.

3.1 Wharf usage

3.1.1 Historic

Petone wharf was built for coastal shipping and initially used for the export of meat and timber products. The wharf replaced the earlier wharf that was built for exports from the Gear Meat Co. The wharf has not been used for shipping for many years and prior to closure was not used regularly by recreational boat users. The history of the wharf is discussed in more detail in the conservation report.

The East by West ferry service tried a commuter service however this proved unpopular and there are no plans to reinstate this service. A tourist service operating on weekends and public holidays was also operated by East by West but this has also ceased, without the ferry service using the wharf the provision of a jetty at the wharf head is less important.

3.1.2 Future

The primary use of the wharf will continue to be for walkers and fishers.

The wharf will not be used for the berthing of large vessels, so a bathymetry survey is not recommended. For some options, a new jetty structure will be built for smaller vessels.

3.2 Size of Wharf

Petone Wharf is a substantial structure around 393 m long and the cost for rebuilding and maintaining a structure of this size is significant. The current and future use of the wharf could be reduced based on current and expected usage though it is recognised that changing the size and length of the wharf will impact the character and heritage value of the structure.

Removal of the outer part of the wharf is being considered to reduce both the rebuild and maintenance costs for the wharf.

The outer wharf is in very poor condition and it is expected that repairing this area will be more expensive than the rest of the structure. It is likely to be at least 2 years before this area of the wharf is rebuilt and the condition of the structure will continue to deteriorate during this time.

Visual simulations completed by Align show the removal of the outer 61 m of the wharf, these simulations show the structure from several viewpoints and give an idea of the visual impact. The visual simulation from Honiana Te Puni Reserve car park is shown in Figure 3 below.

Figure 3: Visual simulation showing current and shortened length (Source: Align)

3.3 Wharf Deck Height

Petone Wharf was designed for the berthing of large vessels with the 1907 construction drawings show the deck to be an average of 10’ (3.05 m) above the high-water level. Sea level rise due to climate change is not expected to be near 3 m during the life of the wharf so it is proposed to keep the deck at the same elevation.

We are aware a study on future sea level rise has been completed for HCC, the proposed deck height will be confirmed once this report has been made available.

Figure 4: Extract from construction drawings showing deck to be 10’ (3.05 m) above high water level

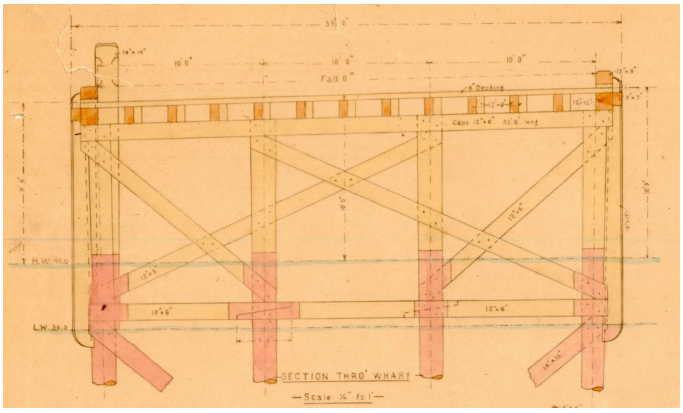


Figure 5: Ramping of final bents on approach

The wharf has a slight ramp at the end of the approach which is not shown on the construction drawings. Options would include either retaining the ramp or building the wharf head at the same level as the approach.

3.4 Wharf Entrance

The entrance to the current wharf is approximately 11m wide which is around triple the typical width of the approach. It is proposed that the wider opening is retained for the rebuild options as this is considered to be a key aspect of the connection between the wharf and the shore.

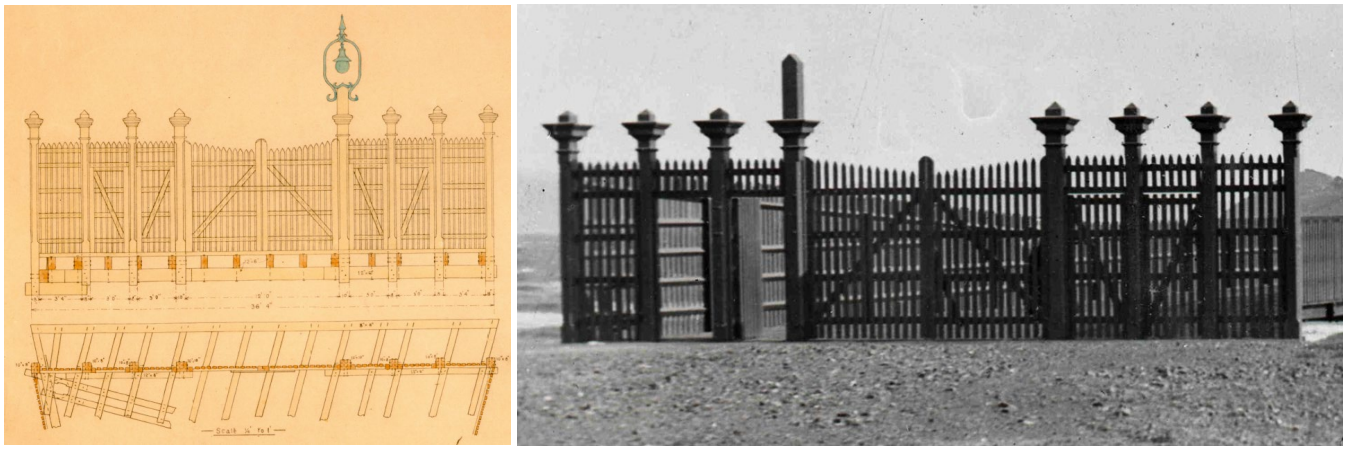


Figure 6: Extract from construction drawings showing original wharf entrance, with photograph taken shortly after construction alongside.

Since construction the wharf has had timber columns and gates across the entrance to the wharf. Several timber columns were removed in December 2021 as they were deemed to be unsafe after severe hollowing was found immediately below ground level. The columns were not believed to be original as the posts lack the chamfer detailing visible on the construction drawings and photographs of the entrance taken shortly after completion.

Picket style fencing and gates are proposed which are in keeping with the original wharf. The developed concept design will include details of the gates for feedback from stakeholder groups.

The 1907 construction drawings show the timber wharf structure extending beyond the gates into what is now the Great Harbour Way / Te Aranui o Pōneke shared path. It is unclear the extent that the timber structure remains which could mean the work site extends 2-3 m beyond the current gate location. It is proposed that the new retaining wall / abutment is located below the gates which will be in the same location as the existing ones.

3.5 Construction Materials

A diagram showing typical wharf components is available in Appendix B - Typical Wharf Components.

3.5.1 Timber Materials

Procuring hardwood timber in the volume needed for this project represents a programme risk. 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 destruction of the rainforest. A careful balance must be found between minimising the environmental impact of sourcing hardwood timber and the heritage impact of using modern materials.

There are Australian suppliers who are confident they can supply sustainably managed hardwood timber similar to that used for the original wharf.

The existing wharf timber was protected by copper sheeting in the tidal zone, however using this material for the new structure would be expensive and time consuming. Timber treatments would be a more economical way of prolonging the life of the timber.

3.5.2 Retaining / re-use of timber from Petone and other wharves

The majority of the timber on Petone Wharf is in poor-moderate condition and would not be expected to last 50 years before needing replacement.

The use of recycled timber from other wharves is being investigated with a large volume of hardwood possibly available following removal from a wharf in the South Island. Using this recycled material would reduce the environmental impact of replacing the wharf but would require careful inspection and assessment of the materials for suitability and durability.

Most of the stringer beams (joists) require replacement. These are typically 6.1 m long so it is expected that some can be used for shorter structural elements such as bracing, walers or capping beams. The re-use of stringer / capping beams for decking is also possible as the beams are 150 mm wide which is greater than the existing decking beams.

3.5.3 Stringers

The outer stringer beams are in very poor condition and the inner beams are in moderate – poor condition. Decay has been found to the top of the beams where the deck has been removed for repairs. The ends of the beams typically have splitting meaning little of the existing stringer beams are suitable for reuse, it is expected that beams can be repurposed as shorter bracing members.

Figure 7: Exposed decking and stringer beams on Petone Wharf, note severe splits to exposed upper face of stringers.

The stringer beams (joists) are typically 300 mm deep x 150 wide and 6m long, replacement with similar Australian hardwood or concrete is preferred for the new wharf.

Treated softwood timber is significantly weaker than the existing hardwood so cannot be substituted like for like. Engineered timbers such as glulam and LVL are not suitable for an aggressive marine environment.

Pre-cast concrete can be used for stringer beams. As the majority of the beams are only visible from directly below the wharf, the visual impact of substituting timber for concrete would be reduced.

3.5.4 Decking

The use of timber for the deck is consistent with the original wharf construction and is the preferred option for Heritage New Zealand. This can be slippery if wet, so the safety of this surface would need to be considered. The heritage value of using timber decking would be reduced if a non-slip surface is added above.

There is hardwood decking present on the approach below the concrete decking. The condition of the exposed outer ends of the timber decking are poor but the majority of the material is in good condition. Reuse of the hardwood decking would require removal of the asphalt topping and careful cutting of fixings to the stringers below.

Concrete was installed on the current wharf around 60 years ago so a new concrete deck would be consistent with the recent structure. A design life of up to 100 years can be achieved by providing sufficient cover to steel reinforcement and specifying an appropriate concrete mix design. The length of the wharf would make poured in situ concrete challenging as this would need to be pumped from the shore or from a barge. Poured in situ concrete could increase the time taken to rebuild the wharf due to waiting for the concrete to cure over a large number of pours.

The use of an impermeable concrete deck will limit deterioration from rainwater but makes maintenance more difficult as the structural members below would be more difficult to access from above.

A composite deck could be used, with decking available in light weight and panels which can be installed and removed easily. The use of composite decking has a greater heritage impact than using timber or concrete as the existing wharf originally had timber decking which was replaced / covered by concrete decking.

3.5.5 Fixings

The fixings were specified in 1906 to be Muntz (brass) metal bolts and many of these fixings appear to be in place but are typically heavily corroded at the surface. It is proposed that stainless steel fixings are used for the rebuilt wharf for compliance with design standards.

3.5.6 Piles

Hardwood timber is prone to marine borer such as Toredo worm which can reduce the life of the structure in the inter-tidal zone. Petone wharf has significant Toredo worm damage to the piles (Figs. 8 & 9). 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 (Fig 10) or Denso wrap is also effective at reducing worm damage. Although visually intrusive, these treatments can be hidden behind timber fenders.

Figure 8: Marine borer damage to a section of pile removed from Petone wharf

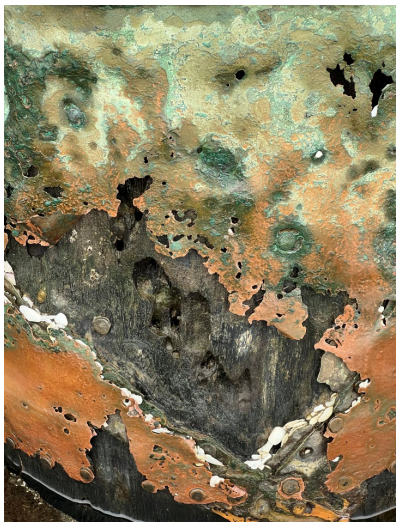


Figure 9: Failed copper sheathing and worm damage

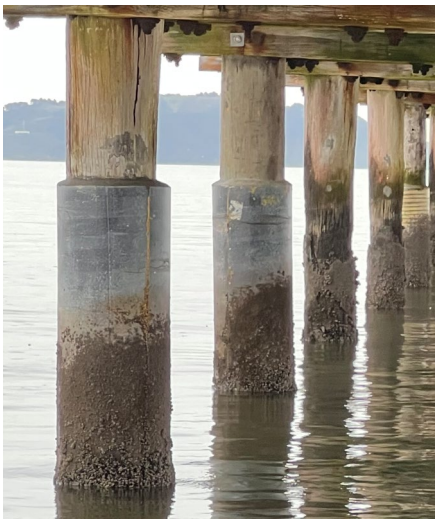
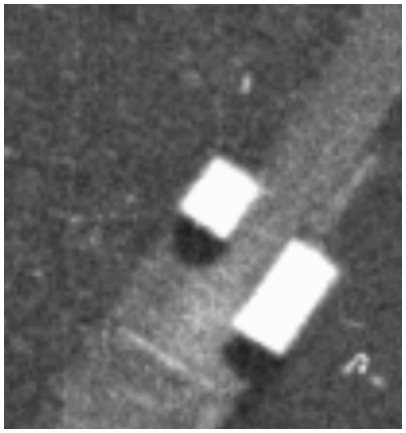


Figure 10: Piles with FRP jackets at Petone Wharf

The timber piles generally have deteriorated in the inter-tidal zone with some also having damage at the seabed. It is proposed that for piles in very poor condition the deteriorated section is removed and a new timber pile is connected to the existing pile. Moderate damage can be mitigated with an FRP jacket around the affected area. Both options retain some of the original pile fabric and importantly the pile location is unchanged allowing the footprint / silhouette of the wharf to remain similar.

3.6 Provision of Building on wharf

There have always been buildings on the wharf since the original construction there have always been buildings on the wharf until 2017 when the most recent hut was removed due to damage sustained in the Kaikoura earthquake. The original wharf construction drawings show a small timber frame structure on the northwest corner of the wharf head with various building added and removed since. (Fig 11). The original building was a similar size to the most recent building with windows and the roof spanning east-west.



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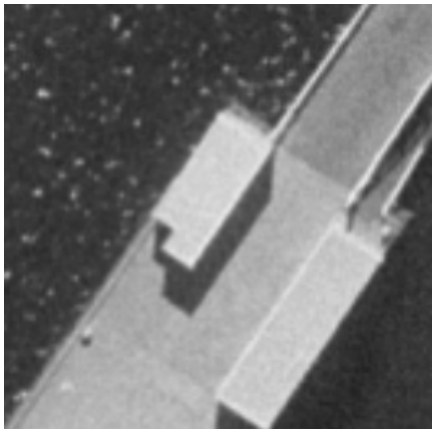


1977

1995

Figure 11: Aerial images showing various buildings on wharf (source HCC historic imagery)

The most recent hut was built around 1990 and was a small weatherboard structure with a corrugated steel roof. The walls, roof trusses and floor from the hut are in poor condition and stored. The roofing steel was severely corroded so was discarded.

The small building on the wharf head is an important feature of the wharf and it is intended that a building is included in the wharf rebuild.

3.7 Heritage

The heritage of the structure is considered in detail in the **Align Petone** Wharf Conservation written by StudioPacific Architects.

3.8 Consultation

The area around the wharf entrance is also known to have been used by Māori so consultation with iwi on both the wharf design and construction methodology will be undertaken to allow protocols, concerns, input and feedback to be considered.

Petone Wharf is a structure that is of great significant to the community of Petone and has been the defining feature of the shoreline for over 100 years. It is intended that the options in this report are shared with the Petone Community Board and their feedback will be considered in the selection and development of the rebuild Options.

Stakeholder	Organisation	First name	Last name	Position
Taranaki Whānui ki te Upoko o te Ika (Port Nicholson Block Settlement) Trust	Iwi (PSGE)	Lee	Hunter	Chief Executive
		Kirsty	Tamanui	Business Services & Operations Manager
		Holden	Hohaia	Chairperson
Wellington Tenths Trust	Iwi	Anaru	Smiler	Chairperson
Palmerston North Māori Reserve Trust	Iwi	Liz	Mellish	Chairperson
Hīkoikoi Management Ltd.	Iwi	Mike	Helleur	Chief Executive
		Vicki	Hollywell	Operations Manager
		Richard	Te One	Relationships Liaison Officer
Te Tatau o te Pō Marae	Marae (Iwi)	Lee	Hunter	Manager
		John	Warren	Chairperson
Petone Community Board		Pam	Hanna	Chairperson
Heritage New Zealand		Christine	Barnett	HNZPT Archaeologist
		Dean	Raymond	Area Manager / Planner

Table 2: Summary of cultural stakeholders

4 COST ESTIMATES

This section is a place holder for a summary of the cost estimates which will be prepared by AECOM

Option		Rebuild Cost	Maintenance Cost
1.	Full Heritage		
2.	Trimmed Heritage		
3.	Semi-Heritage		
4.	Heritage beach, modern end		
5.	Demolition (no rebuild)		$ 0
6.	Modern rebuild after demolition of existing	Not costed	Not costed

Table 3: Cost Estimate Summary

5 SUSTAINABILITY

Minimising the environmental impact of the project is an important aspect of the design. A high level embodied carbon estimate was completed, focusing on the product and construction stages (A1-5). These emissions can be calculated most accurately and are those which will be emitted in the short term.

5.1 Assessment Methodology

A carbon emissions assessment has been performed for options 1 – 4 & 6. The Structural Carbon Tool developed by the Institute of Structural Engineers (IStructE) was used for this assessment. The assessment calculates the embodied carbon ($kgCO_2e$) and provides an understanding of the differences between the options and aims to identify opportunities for material reduction.

The carbon factors adopted for these calculations are based on average regional carbon factors which are derived from recent Calibre project experience and industry best practise. These calculations are based on the material quantity estimates for the structural elements of each rebuild option and assumptions around the extent of materials from the current wharf that can be recycled.

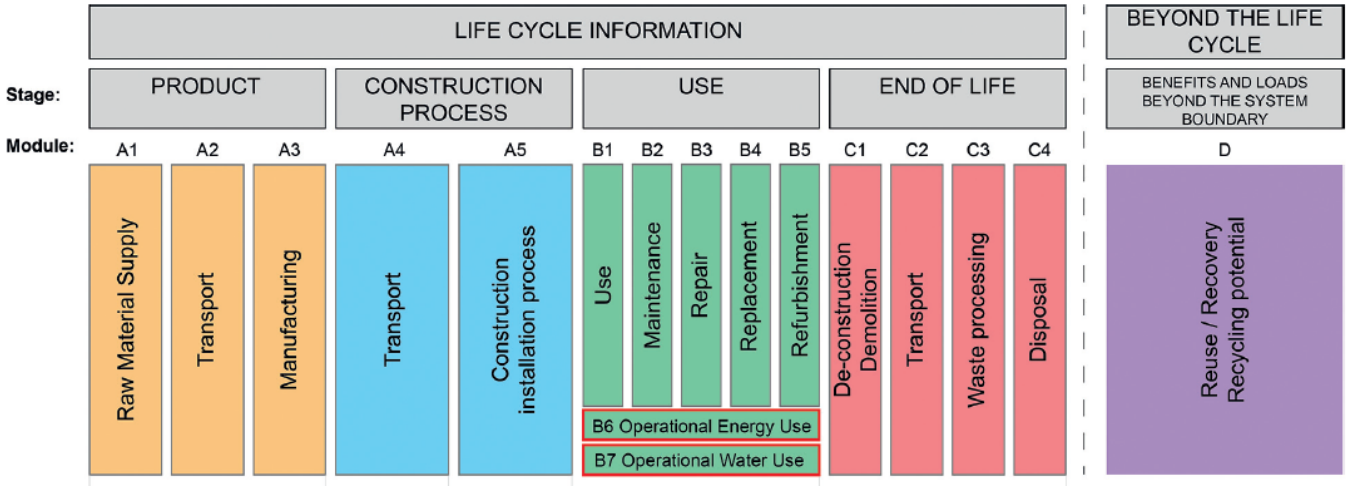


Figure 12: BS EN 15978 Life Cycle stages for a typical building project

The carbon factors are split by lifecycle module and are a function of several aspects such as the procurement process, transport of materials and wastage, and are based on New Zealand specific carbon factors.

Embodied carbon ($kgCO_2e$) = material quantity (m^3) x carbon factor ($kgCO_2e/m^3$)

The product and construction stages cover the process of procurement of the raw material until the practical completion of the project. The effect of carbon sequestration, i.e., the removal of carbon dioxide from the atmosphere via photosynthesis is not included, although this is an added benefit of using timber which essentially traps carbon absorbed from the atmosphere during the trees' lifespan in a structure for a significant period of time.

The embodied carbon for the Use and End of Life stages are difficult to quantify. For a wharf the embodied carbon from Module B, Use is considered to be small relative to the earlier stages and it will be similar for all rebuild options.

Module D corresponds to the benefits beyond the system boundary, such as recycling of materials. At present timber materials from the wharves are being used for landscaping however the re-use of material at the end of the wharf's life is difficult to quantify.

5.2 Assessment Outcome

The graph below shows the estimated embodied carbon in the re-build options. Options 2-4 are similar and are less than Option 1 due to the reduction in materials being used with the outer 60 m of the wharf not being rebuilt.

A concept for a modern rebuild, Option 6 has not been developed. The estimate for this option is based on similar material volumes as Options 2-4 but using concrete instead of timber.

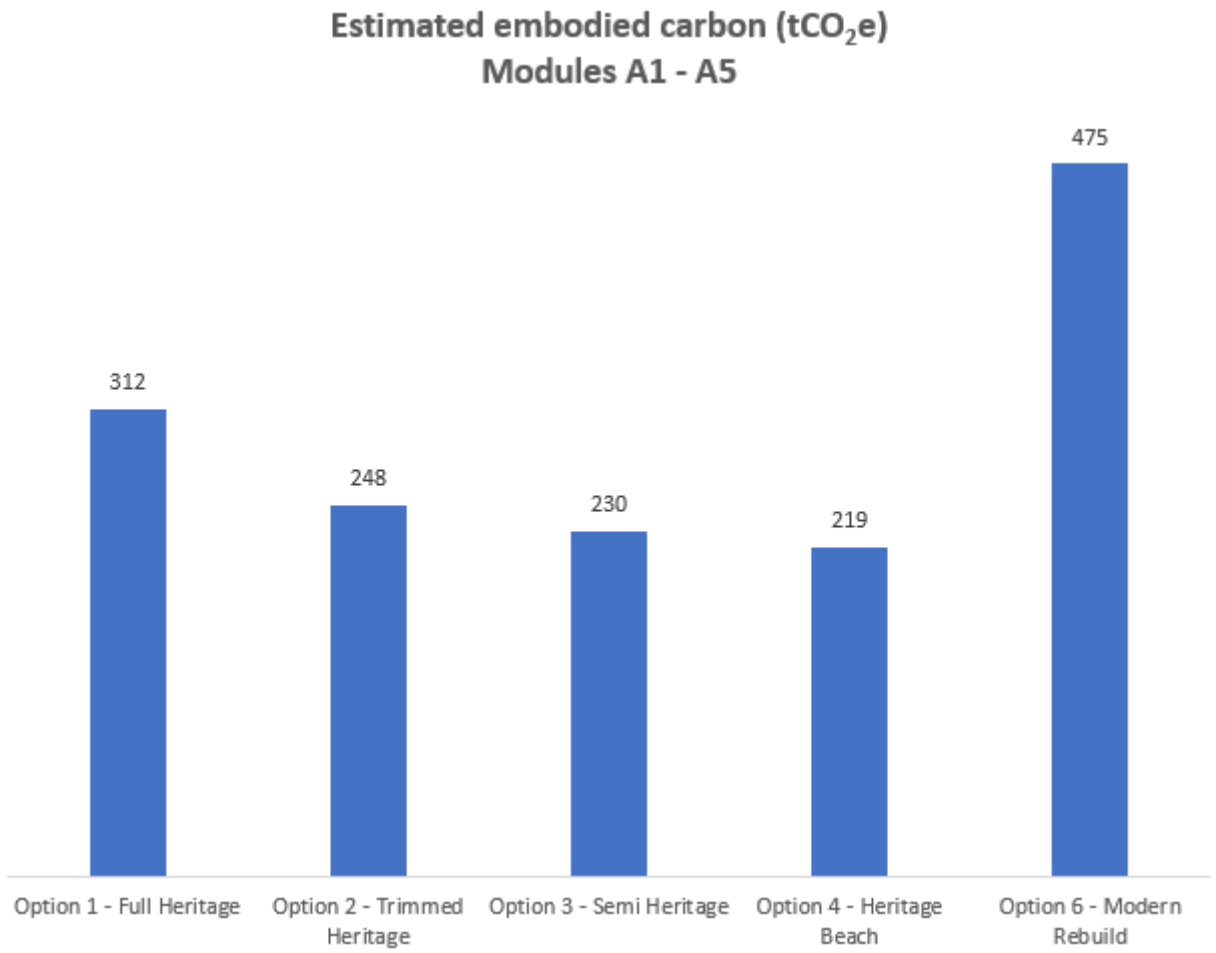


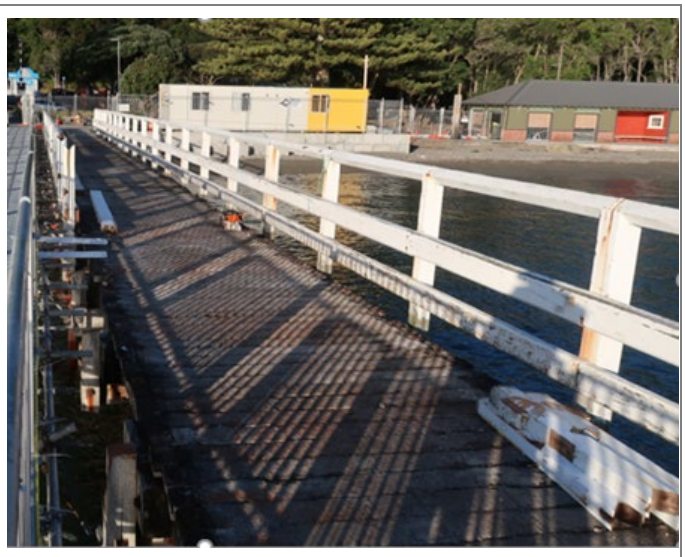
Figure 13: Estimated embodied carbon for options 1 – 4 & 6

6 CONSTRUCTION

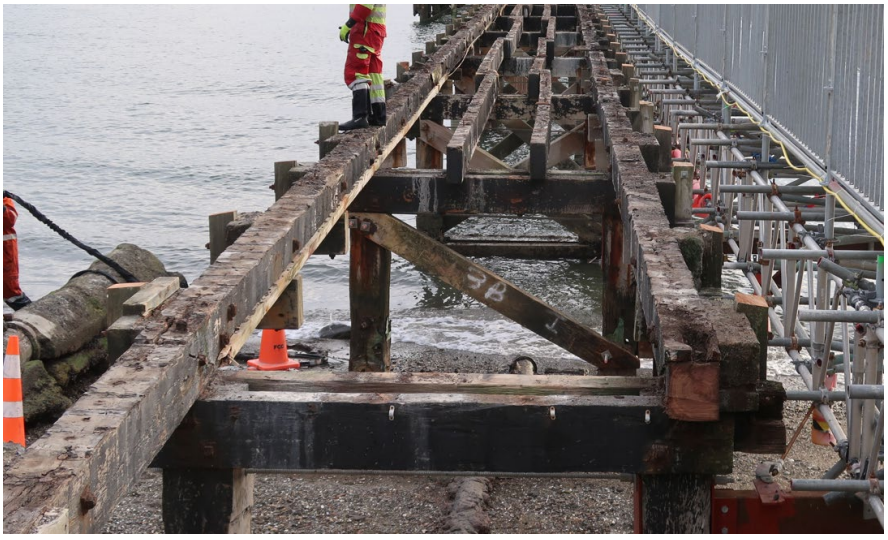
The wharf rebuild is not expected to start until at least mid-2023, this is based on the programme in the Align Petone Wharf Consenting Strategy dated 2021-09-16 provided by Align which has the design and consent finalised in March 2023.

6.1 Proposed Construction Methodology

Below we have summarised the steps anticipated for rebuilding Petone Wharf, with photographs of these activities from the refurbishment of the wharves at Days Bay and Rona Bay. All the rebuild options could use a variation of this methodology.



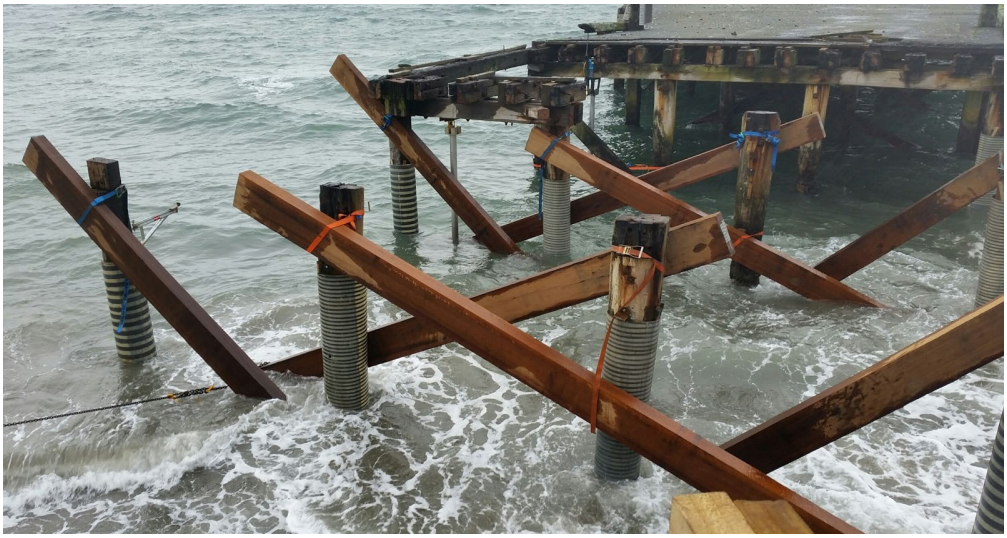
1. Removal of handrail and decking, starting from outer end of wharf working towards shore using light weight plant / barrows.



2. Starting from the shore end using a crane on the beach, the stringers and capping beams are inspected and removed from bent if replacement required

3. Bracing & walers inspected and removed if in poor condition

4. Piles repaired or replaced



5. Bracing & walers replaced if needed

6. New capping beam and stringer beams installed

7. Temporary decking installed for construction traffic (crane) which will move to onto the repaired area of wharf

8. Process repeats for next wharf section, moving crane onto refurbished area of wharf.

9. New decking installed once heavy construction traffic (crane) is not working in the area

10. Handrails installed, this can be done at end of works to avoid damage from construction traffic

6.2 Site Layout

A draft site layout has been created for consenting purposes, this shows how pedestrian and construction traffic and activities will be managed. The drawing is in Appendix A.

6.3 Aquifer

A Tonkin & Taylor Geotechnical Desktop Study of HCC Wharf Foundations dated 2017-10-09 report summarised the risk to the Waiwhetu aquifer from construction activity at Petone Wharf. The report noted the risk to be low, however since the report was written we have found newspaper articles stating piles were driven further than was shown on the construction drawings. Tonkin & Taylor have been asked to update their guidance based on our current understanding of the pile embedment.

6.4 Environmental Impact

Specialist input will be obtained to summarise the impact of flora and fauna around the wharf, the scope of the input is defined in the Align Petone Wharf Refurbishment - Request for Specialist Input dated 2022-03-19, prepared by Align.

6.5 Level of Service During Construction

Petone wharf has been closed since early 2021 due to the poor condition of the outer wharf. A partial reopening would significantly disrupt construction activities so HCC have decided the wharf is to remain closed until the rebuild is complete.

6.6 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 and other acceptable controls. Some key health and safety considerations for this project include:

- Conflict between construction and pedestrian traffic at wharf entrance
- Safe delivery / collection of materials from wharf laydown area
- Reinstatement of stairs to cart refuge may encourage jumping at shallow water depth
- Safe demolition / renewal of outer wharf which is very poor condition
- Identify construction hazards and maintain the project risk register.
- Falls and drowning
- Public safety at night

7 OPTIONS

Following completion of the conservation report a meeting was held with HCC, Calibre, Studio Pacific and Align. Six options were proposed for the future of the wharf. The options are summarised below.

Option 1. Full Heritage: Same extent and form, salvaged materials where practical and new hardwood

Option 2. Trimmed Heritage: Shortened wharf using same form, salvaged materials where practical and new hardwood

Option 3. Semi-Heritage: Shortened wharf using same form. Mixture of traditional and modern materials

Option 4. Heritage beach and shortened modern end: Limited area of wharf at beach restored using original fabric. Outer wharf uses same form with mixture of traditional and modern materials

Option 5. Demolition: Removal of wharf with piles cut at seabed and no replacement structure

Option 6. Demolition and replacement with modern wharf.

These options are summarised in more detail in Table 4 below, which describes the form, extent of the original wharf that will be retained, uses and cost. Visual simulations have been completed by Align showing the impact of removing the outer end of the wharf from various viewpoints around the wharf.

	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6
	Full heritage	**Trimmed Heritage**	**Semi Heritage**	**Heritage Beach, modern end.**	**Demolition, no rebuild**	**Modern rebuild after demo**
	Same extent and form, salvaged materials, new hardwood.	*Lesser extent, same form, salvaged materials, new hardwood.*	*Lesser extent, same form, less reuse of salvaged materials, new non-hardwood timber.*	*Beach end reuses original fabric, and original design. Harbour end uses same form, but with some differences.*		*New design to suit new uses. Likely repositioned to be adjacent to old site, not in same location.*
DESIGN						
Shorten wharf	No	Yes	Yes	Yes	N/A	Yes
Bay design, member sizes, member arrangement	Same pile setout and basic construction.	Same pile setout and basic construction.	Same pile setout and basic construction.	Same pile setout and basic construction. New portion could have changes to accommodate new uses.	N/A	New design to suit current uses
Gates	Full recreation using as much original fabric as possible.	Full recreation using as much original fabric as possible.	Recreate original in new material.	Recreate original in new material.	N/A	New gates or no gates
Handrail	Similar to original design, recycled material.	Similar to original design, recycled material.	Recycled or new material per original design	Recycled material similar to original design and modern variation.	N/A	New design to suit current uses
Shed	Design similar to original.	Design similar to original.	Same scale and general form, but useable. New fabric	Harbour end to new design to suit current and new uses. New fabric.	N/A	New design to suit current uses
Cart passing area	Included	Included	None (cut piles down)	None (cut piles down)	N/A	None
Ferry Jetty	Included	Included	Included	Included	N/A	New design to suit current uses
Fendering	Included	Included	Excluded	Excluded	N/A	New design to suit current uses
FABRIC						
Decking	Use salvaged decking timber from Petone Wharf, and additional recycled hardwood from elsewhere.	Use salvaged decking timber from Petone Wharf, and additional recycled hardwood from elsewhere.	Use new hardwood timber or new other timber	Composite plastic/salvaged decking timber from Petone Wharf (limited extent).	N/A	Concrete
Joists	Use salvaged joists from Petone Wharf (minimal), and recycled hardwood from elsewhere.	Use salvaged joists from Petone Wharf (minimal), and recycled hardwood from elsewhere.	Use new hardwood timber or new other timber	Use recycled timber from Petone Wharf, and additional new timber*.	N/A	Concrete
Capping Beams	Use all available salvaged beams from Petone Wharf (very few), and additional recycled / new hardwood	Use all available salvaged beams from Petone Wharf (very few), and additional recycled / new hardwood	Use new hardwood timber or new other timber	Use recycled timber from Petone Wharf, and additional new timber*.	N/A	Concrete
Bracing	Use all available recycled timber from Petone Wharf, and additional recycled hardwood from elsewhere.	Use all available recycled timber from Petone Wharf, and additional recycled hardwood from elsewhere.	Use new hardwood timber or new other timber	Use recycled timber from Petone Wharf, and additional new timber*.	N/A	Concrete
Piles	Existing piles will be repaired (minor or major repair). Virtually all will have the FRP jacket.	Existing piles will be repaired (minor or major repair). Virtually all will have the FRP jacket.	Existing piles will be repaired (minor or major repair). Virtually all will have the FRP jacket.	Existing piles will be repaired. Virtually all will have the FRP jacket.	N/A	Concrete
Fixings	All new	All new	All new	All new	N/A	All new
HERITAGE						
Amount of original fabric	Small	Smaller	Smallest	Smallest	None	None
Design authenticity	Highest	High	Some	High at beach, then low.	None	None
USES						
Uses	Current uses	Current uses	Better fishing, small shop.	Could allow for more uses - shop, swimming, better fishing, sitting.	None	Could allow for more uses - shop, swimming, better fishing, sitting.
SUSTAINABILITY						
Estimated embodied carbon (tCO_2e)	429	354	342	345	N/A	959
COST						
Capital	Highest (likely prohibitive)	High	Moderate - High	Cost related to any increases in uses.	Least	TBC
Maintenance	Largest	Large	Large	Moderate	None	Least

Table 4: Draft Options for Wharf Renewal

8 REFERENCES

1. Wharf Construction Drawings and contract documents
2. Wharf refurbishment (1960's) contract documents
3. Calibre HCC Wharf Condition Report dated 2021-11-04
4. Align Petone Wharf Conservation Plan dated 2022-02-23
5. GK Shaw Petone Wharf Outer Wharf Structure (Dive inspection) Report dated 2021-04
6. Newspaper clippings from 1908-1910 describing slumping https://paperspast.natlib.govt.nz/
7. Tonkin & Taylor Geotechnical Desktop Study of HCC Wharf Foundations dated 2017-10-09
8. Sea level rise report (to be added in future report revision)
9. Align Petone Wharf Consenting Strategy dated 2021-09-16
10. Align Visual Simulations Petone Wharf dated 2022-02-04
11. Align Petone Wharf Refurbishment - Request for Specialist Input dated 2022-03-19
12. AECOM Petone Wharf Quantitative risk assessment, dated 2021-05-18
13. Institution of Structural Engineers. How to calculate embodied carbon (2nd edition) dated 2022-03

9 LIMITATIONS AND DISCLAIMERS

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

Calibre has relied on and referenced certain reports and information prepared by third parties, including HCC, 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.

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

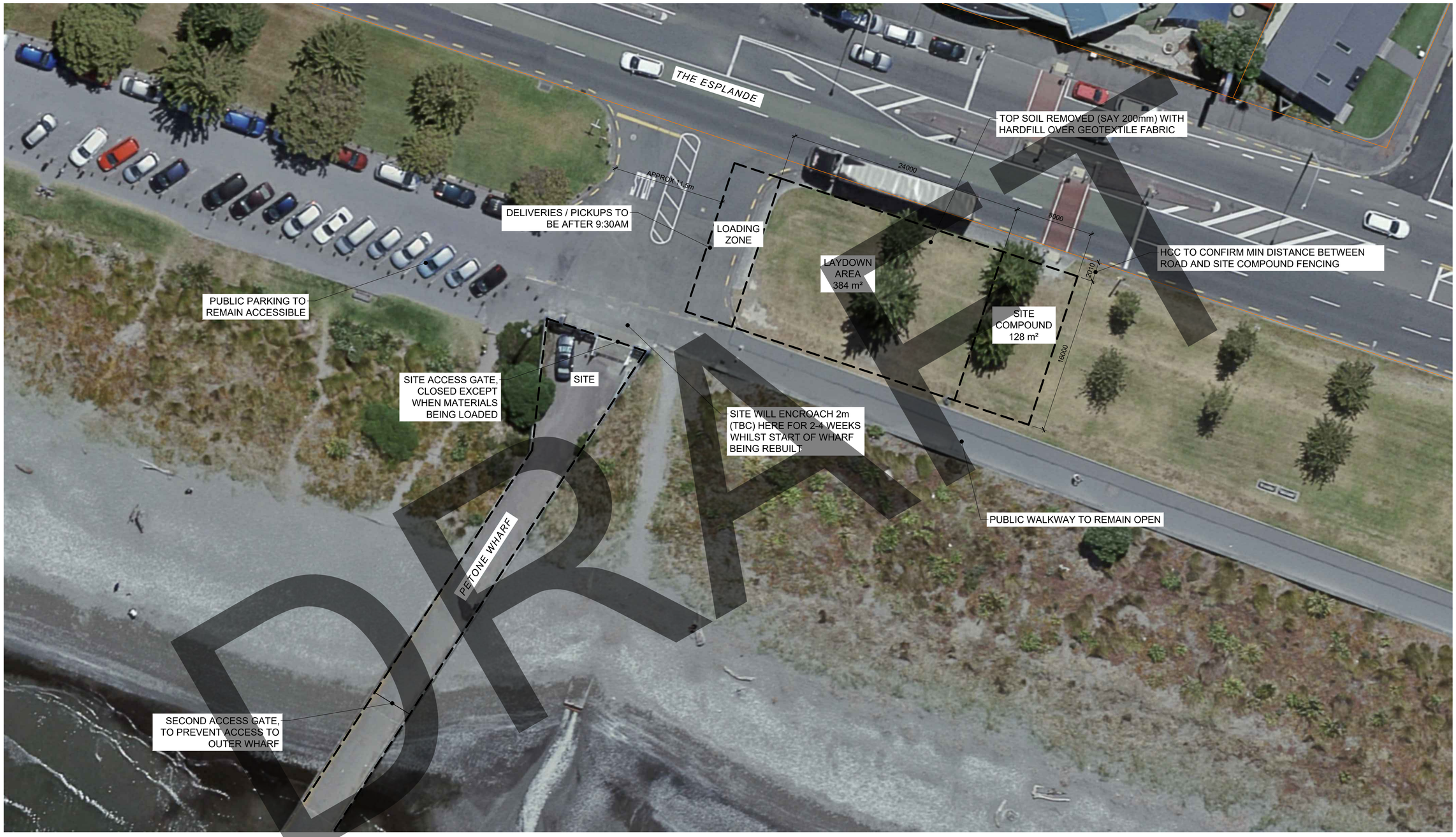
- The accuracy, completeness or relevancy of the contents of this report;
- The reliance on the contents of this report by any party other than the HCC and use of this report for any purpose other than facilitating discussions and consultation to consider options for remediating the wharf.
- These limitations 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.

In accepting delivery of, and in using this report, HCC 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.

Appendix A - Wharf Rebuild Drawings

Drawing List

709066 – P - S141 – Site Plan / Layout
709066 – P – S460 – Concept Drawing Option 1 – Full Heritage
709066 – P – S461 – Concept Drawing Option 2 – Trimmed Heritage
709066 – P – S462 – Concept Drawing Option 3 – Semi Heritage
709066 – P – S463 – Concept Drawing Option 4 – Heritage Beach, modern end



SITE PLAN AT WHARF ENTRANCE

1:200 @ A1
1:400 @ A3

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Revision	App	Date
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- -	-	-
- -	-	-
- -	-	-

Surveyed	-	-
Designed	TA	10/21
Drawn	DM	10/21
Reviewed	-	-
Approved	TA	10/21

Client: HUTT CITY TE AWA KAIRANGI

Project Title: Hutt City Council
Wharf Repairs & Maintenance

Sheet Title: PETONE WHARF
SITE PLAN / LAYOUT

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

calibre

Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
709066.004	S141	0

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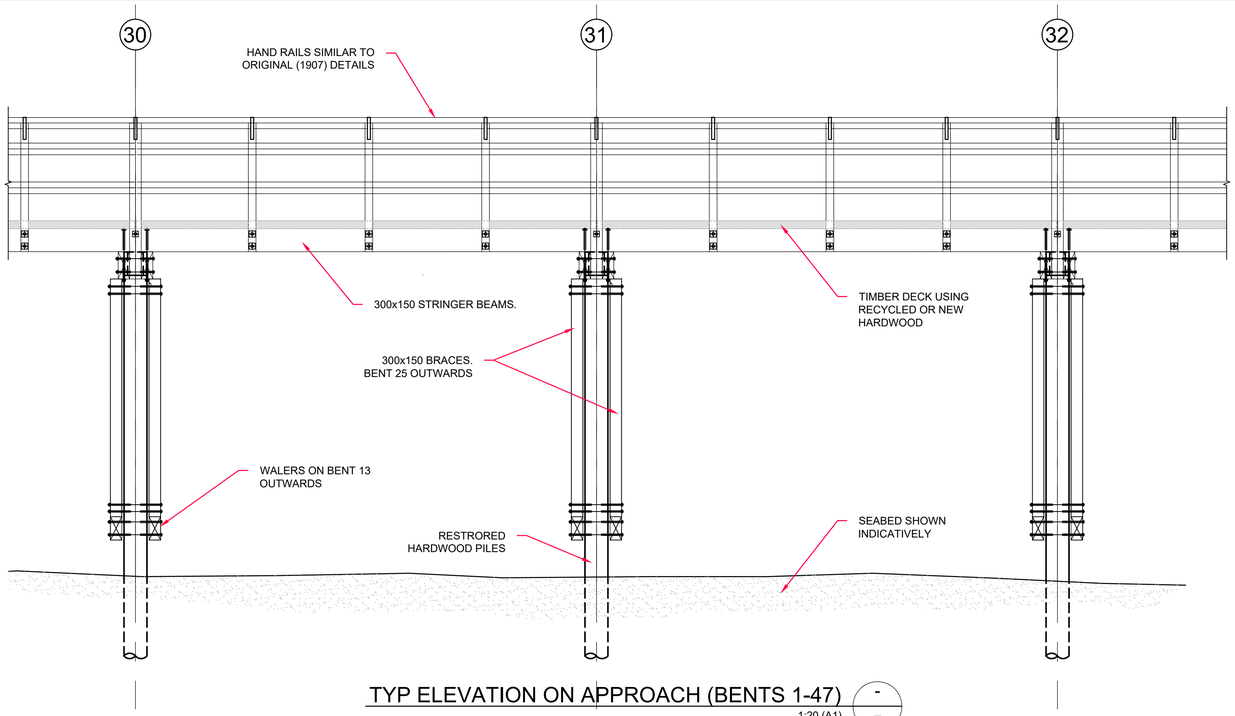

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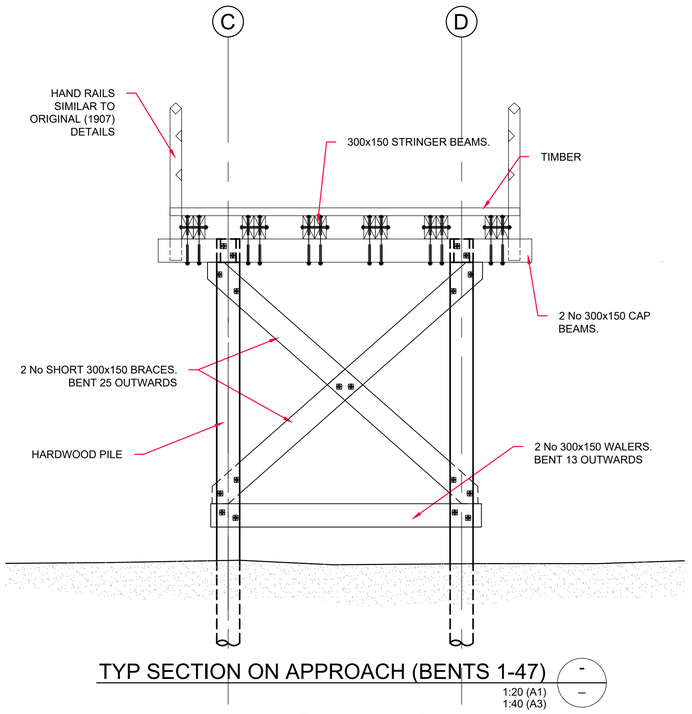

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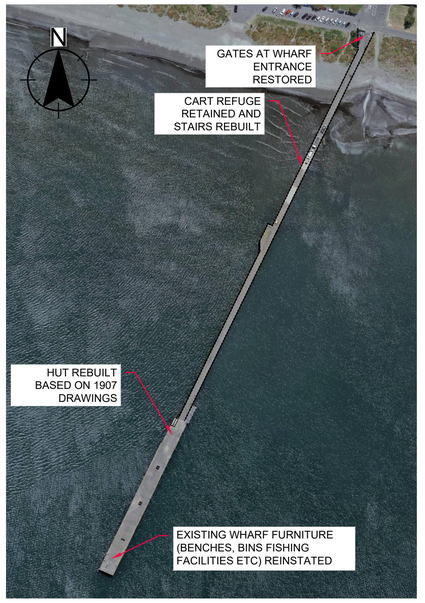

LAYOUT VIEW

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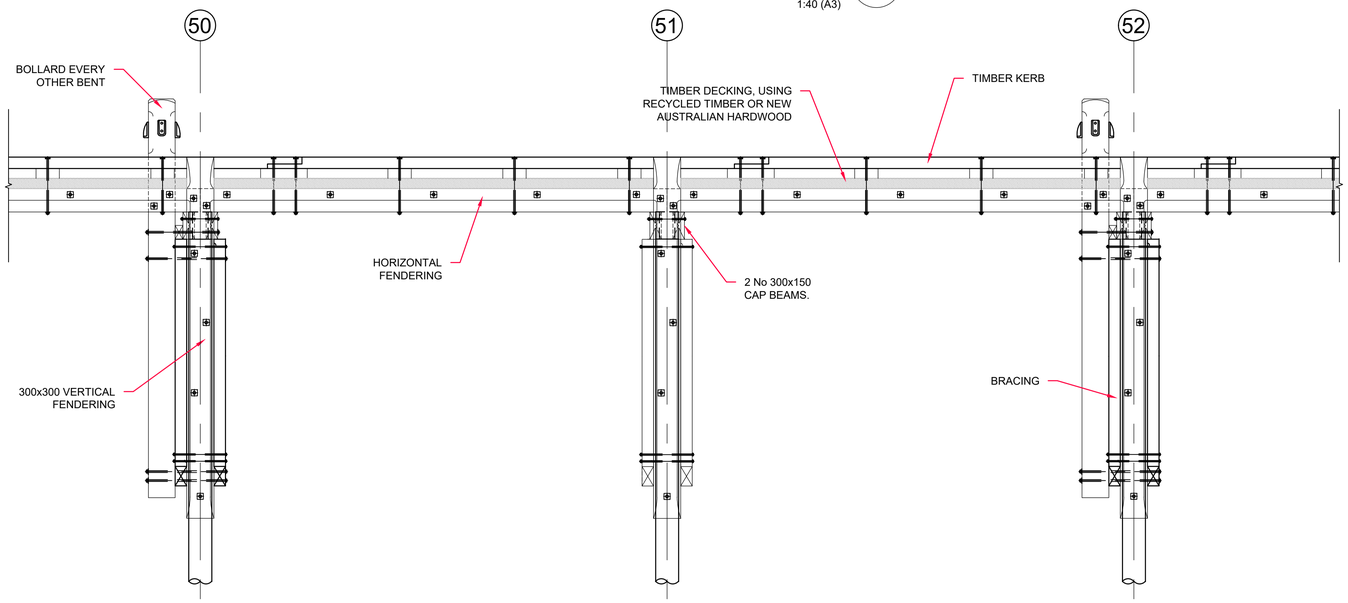

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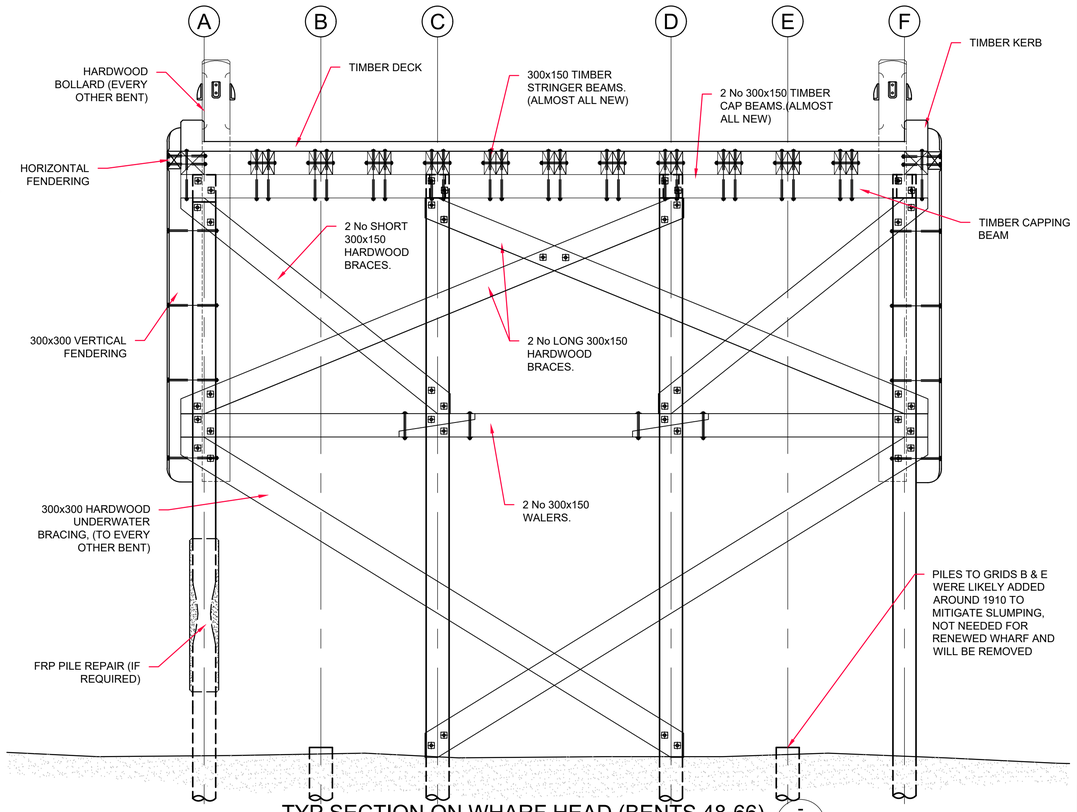

TYP SECTION ON WHARF HEAD (BENTS 48-66)

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NOTES:

1. BUILDING TO BE RESTORED AT WHARF HEAD, USING CONSTRUCTION DETAILS SIMILAR TO ORIGINAL 1907 DRAWINGS
2. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. THE RE-USE OF TIMBER WILL BE DONE WHERE PRACTICAL
4. AUSTRALIAN HARDWOOD TIMBER TO BE USED

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Revision	App	Date
- -	-	-

Surveyed	-	-
Designed	TA	03/22
Drawn	TA	03/22
Reviewed	-	-
Approved	-	-

Client: HUTT CITY TE AWA KAIRANGI

Project Title: Hutt City Council
Petone Wharf Renewal

Sheet Title: PETONE WHARF CONCEPTS
OPTION 1
'FULL' HERITAGE

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Kordia House
109-125 Willis Street
Wellington 6011
+64 4 384 2029
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
709066-P	S460	0

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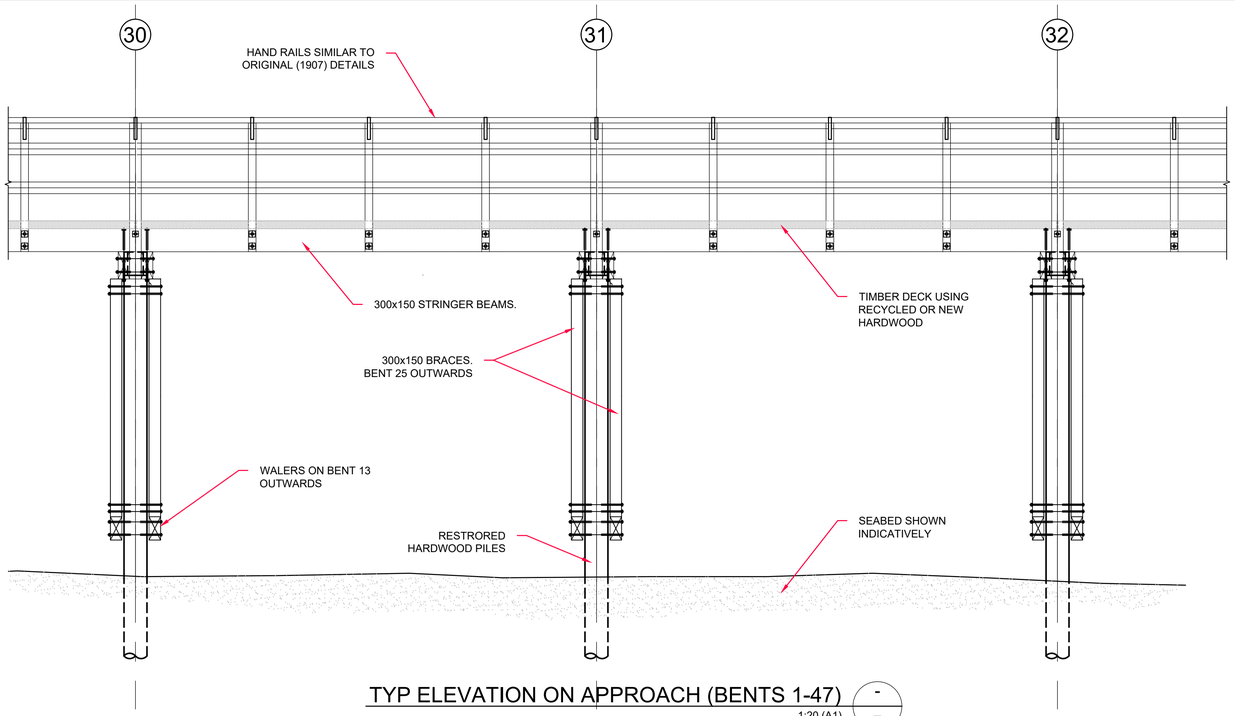

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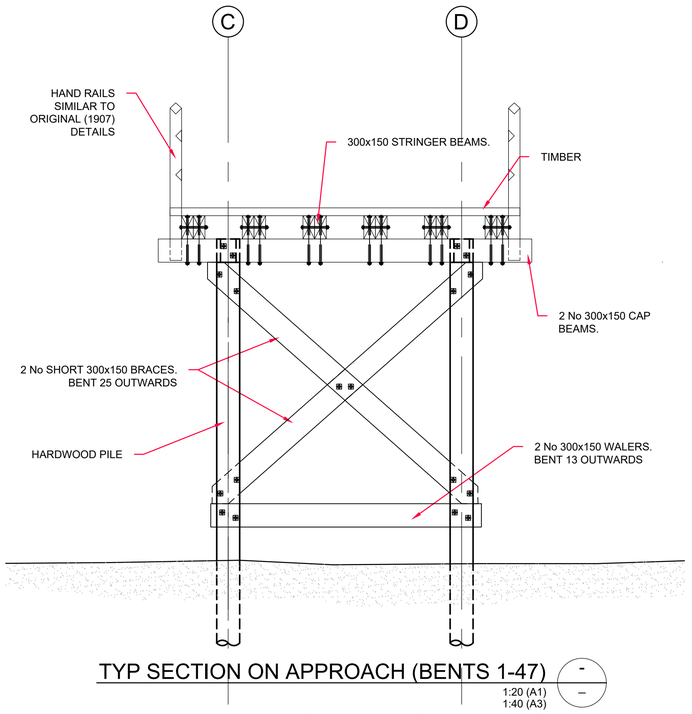

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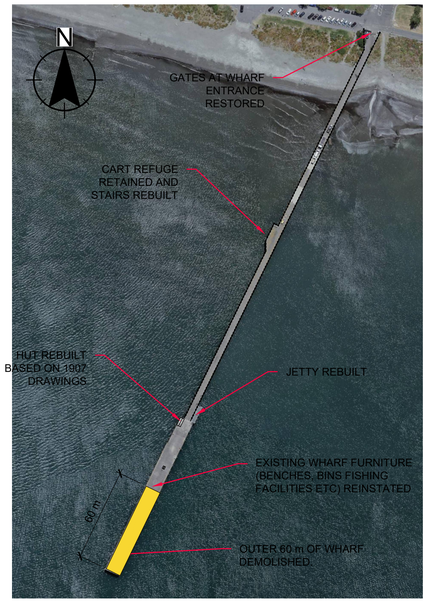

LAYOUT VIEW

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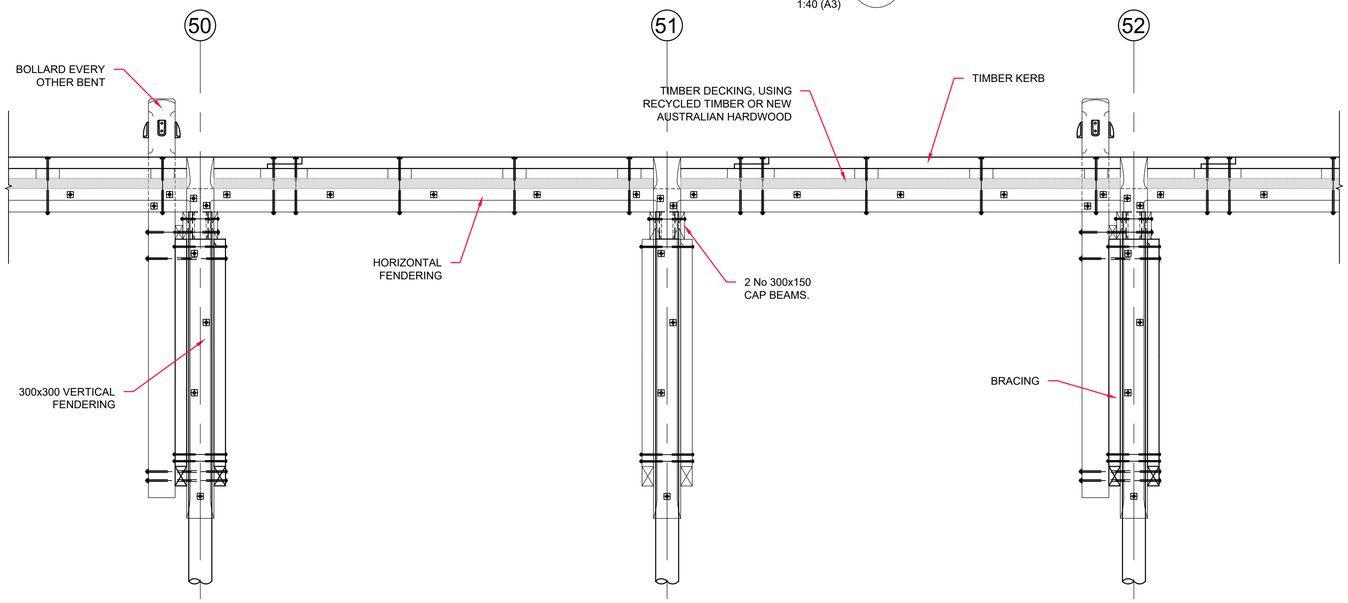

TYP ELEVATION ON WHARF HEAD (BENTS 48-56)

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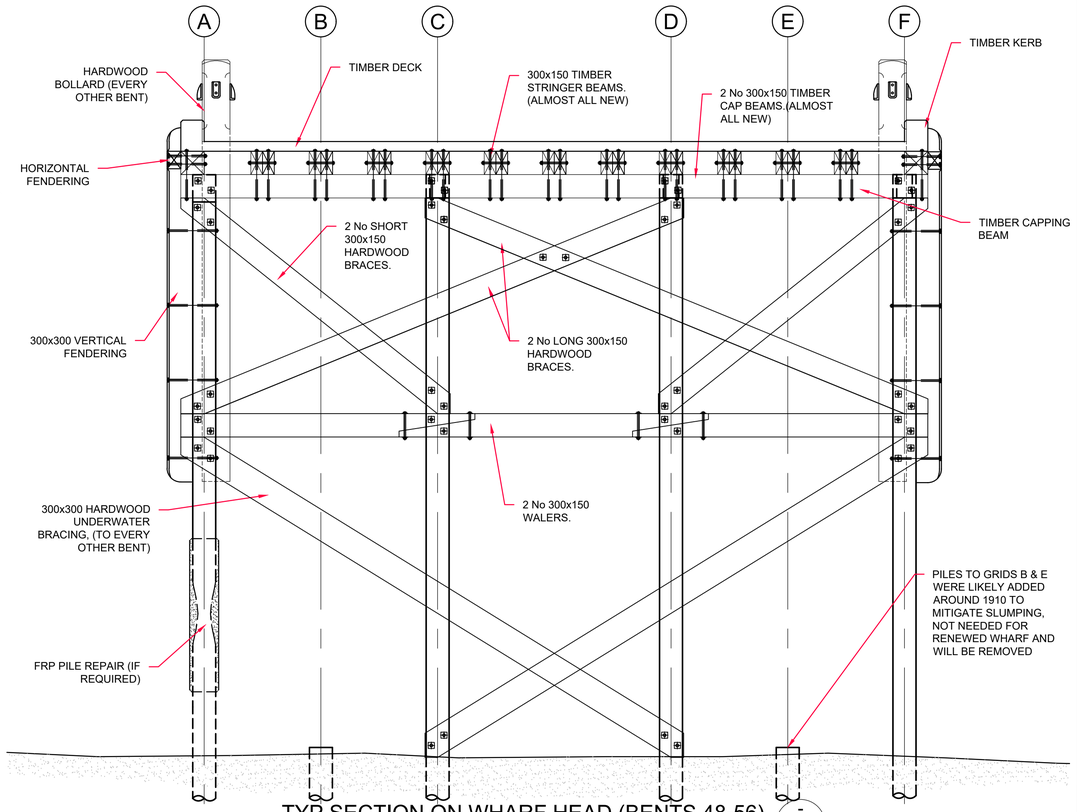

TYP SECTION ON WHARF HEAD (BENTS 48-56)

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NOTES:

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Revision	App	Date
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Designed	TA	03/22
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Approved	-	-

Client: HUTT CITY TE AWA KAIRANGI

Project Title: Hutt City Council
Petone Wharf Renewal

Sheet Title: PETONE WHARF CONCEPTS
OPTION 2
TRIMMED HERITAGE

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109-125 Willis Street
Wellington 6011
+64 4 384 2029
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
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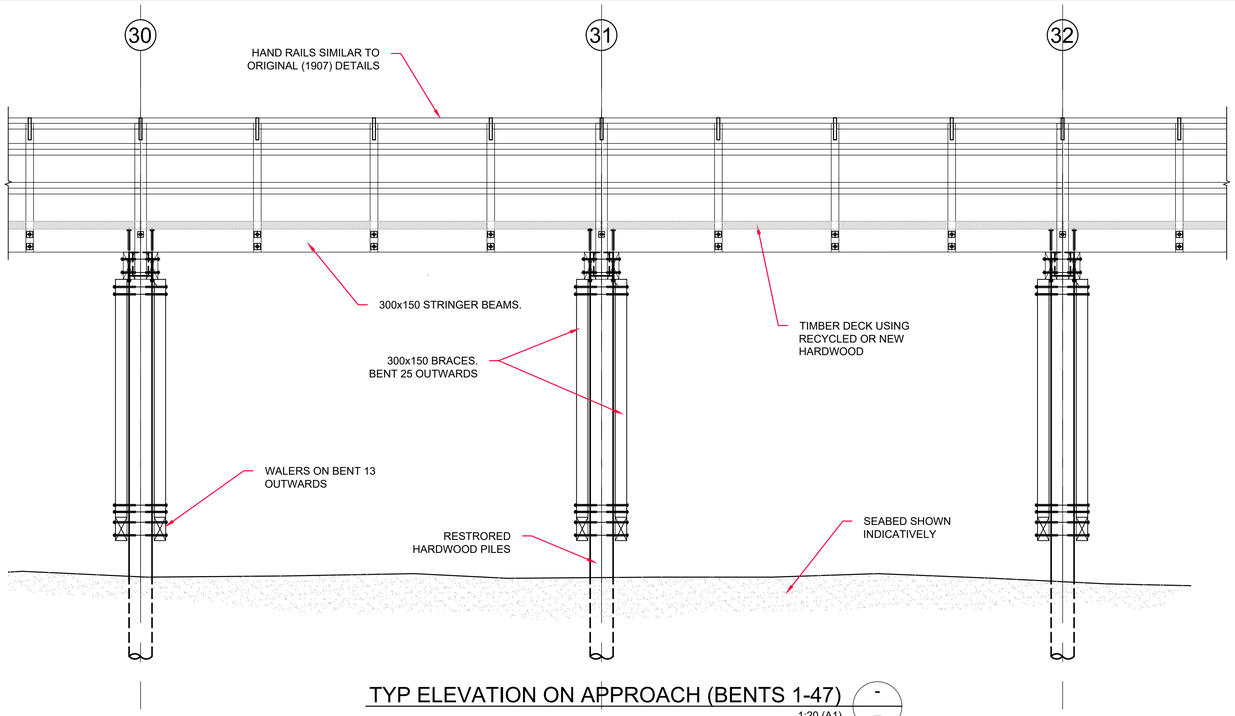

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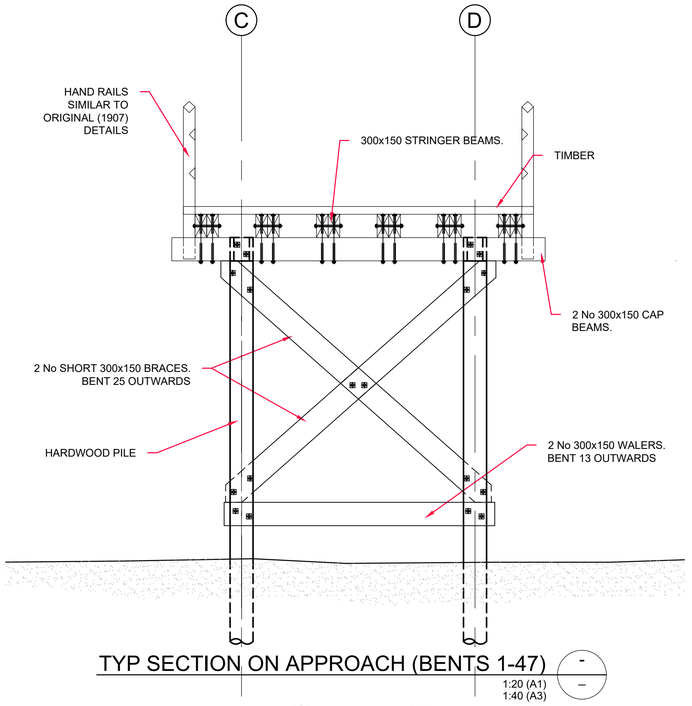

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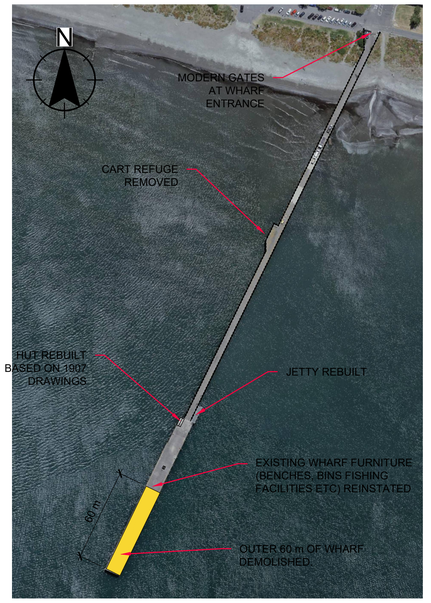

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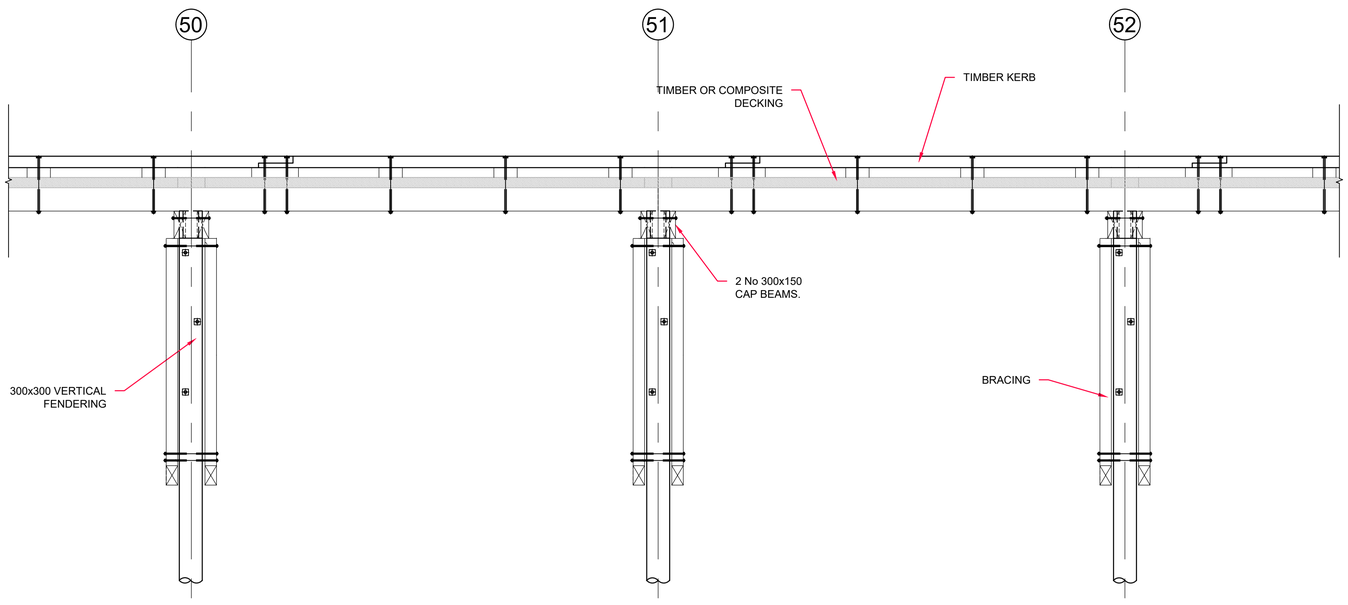

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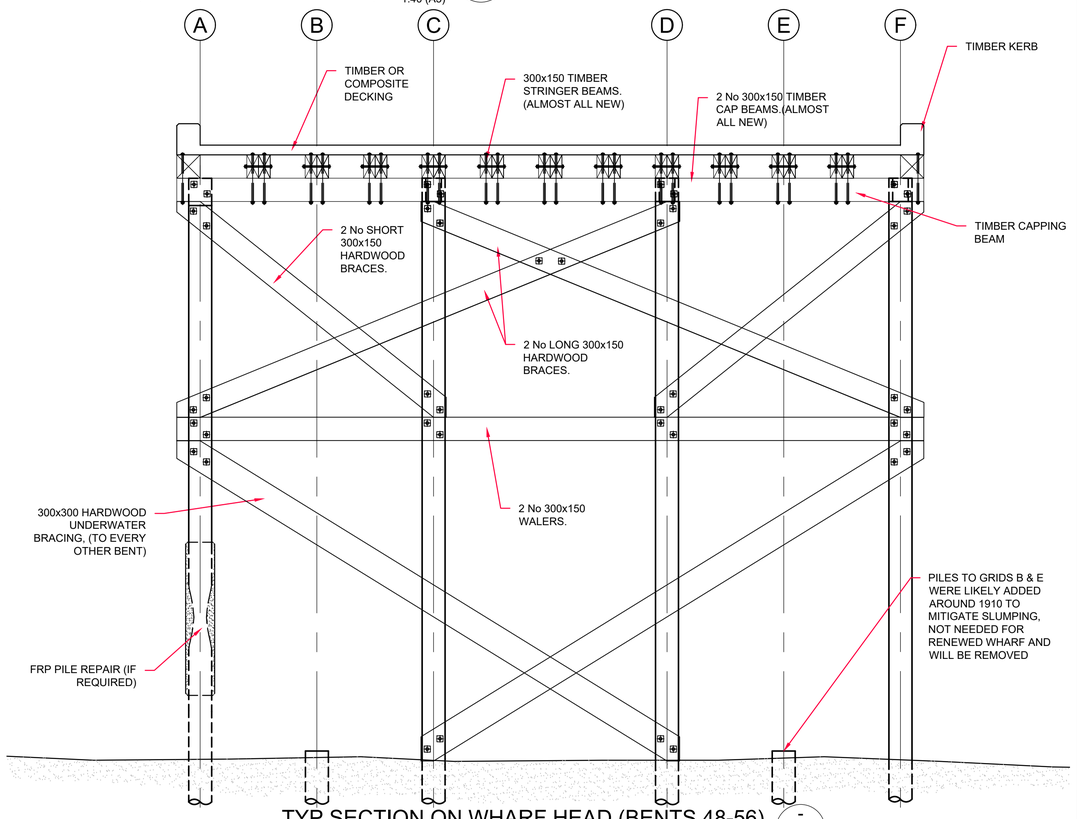

TYP SECTION ON WHARF HEAD (BENTS 48-56)

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NOTES:

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Designed	TA	03/22
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Approved	-	-

Client: HUTT CITY TE AWA KAIRANGI

Project Title: Hutt City Council
Petone Wharf Renewal

Sheet Title: PETONE WHARF CONCEPTS
OPTION 3
SEMI - HERITAGE

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109-125 Willis Street
Wellington 6011
+64 4 384 2029
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709066-P	S462	0

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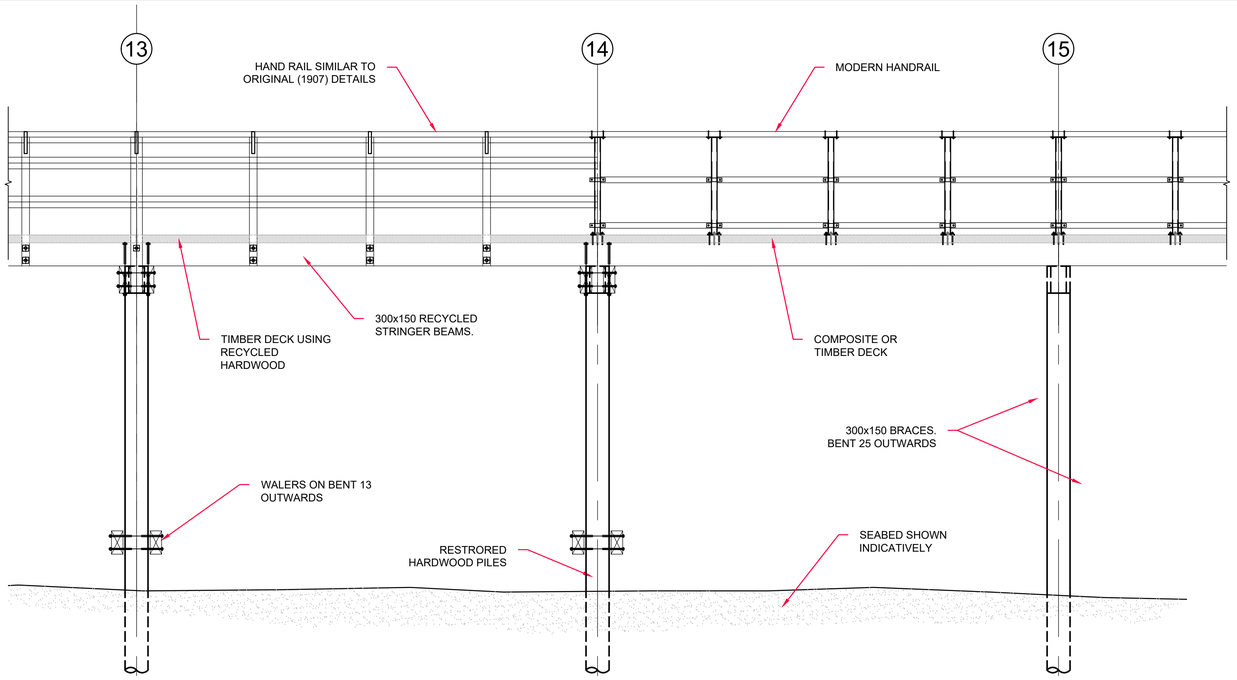

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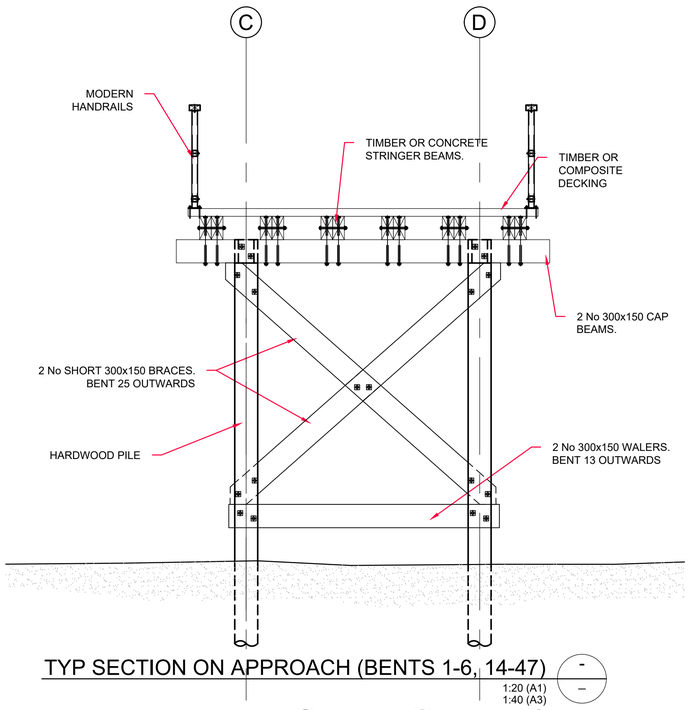

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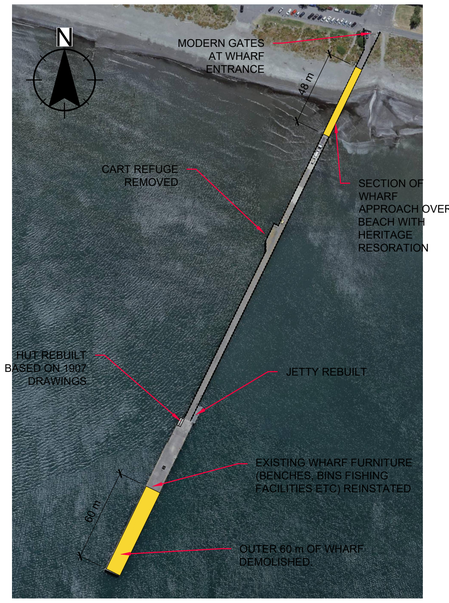

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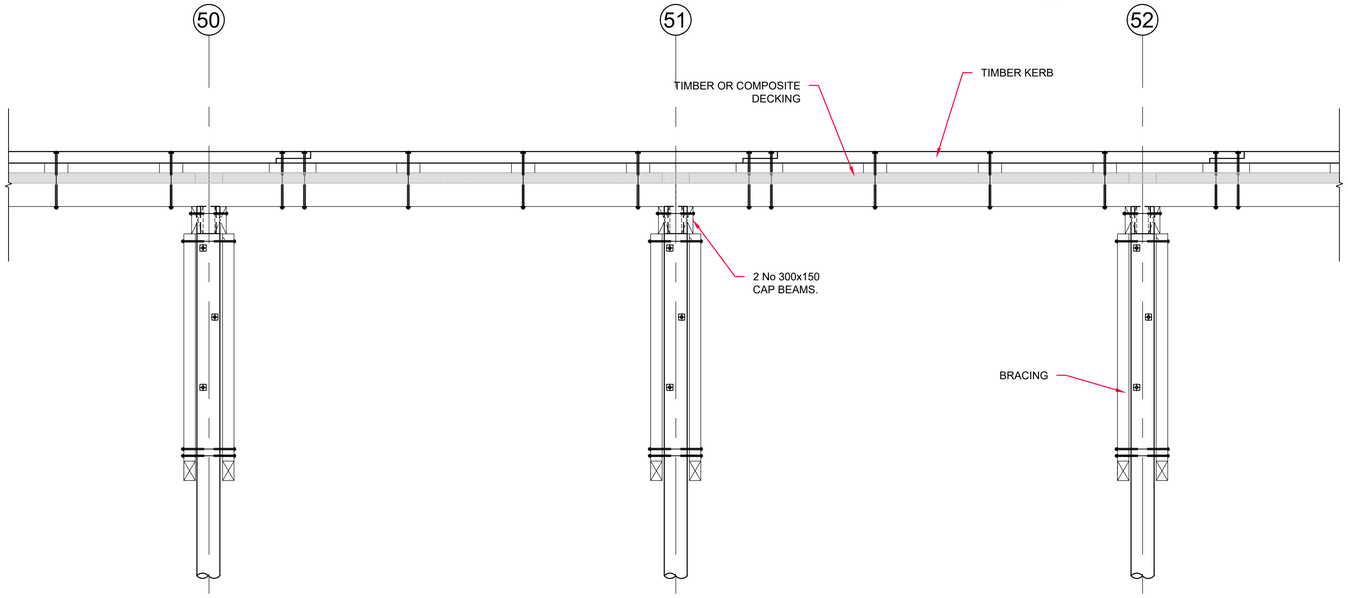

TYP ELEVATION ON WHARF HEAD (BENTS 48-56)

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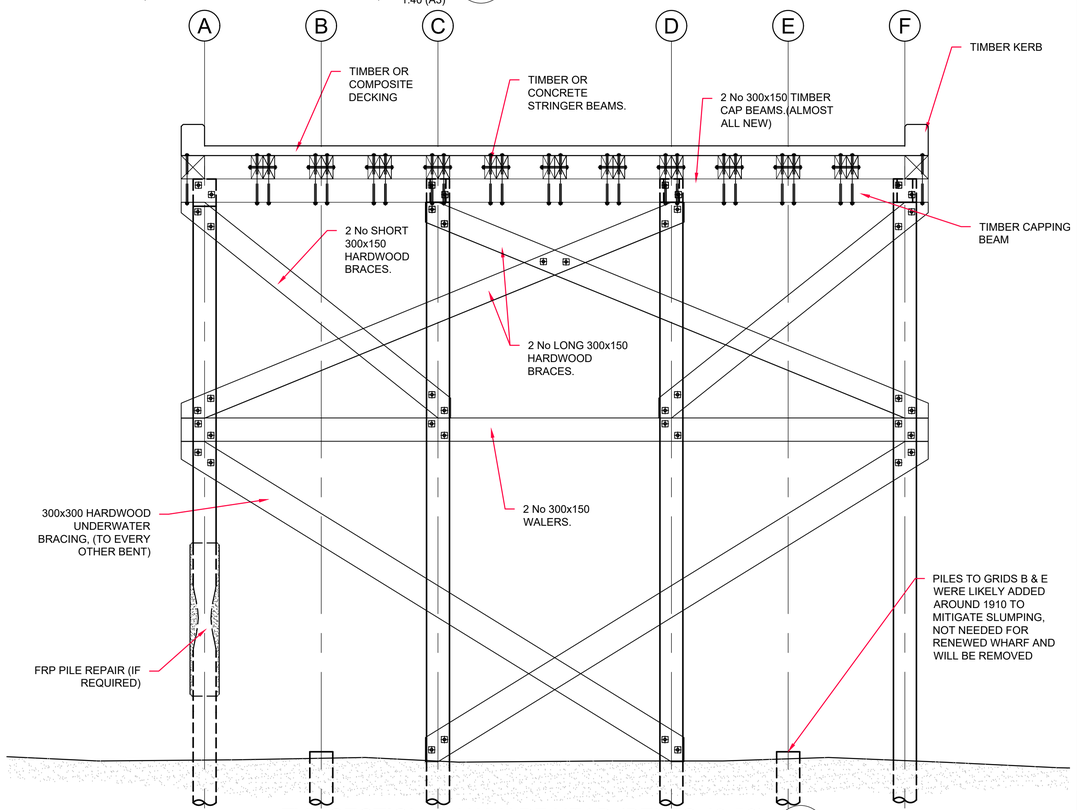

TYP SECTION ON WHARF HEAD (BENTS 48-56)

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NOTES:

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- -	-	-

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Designed	TA	03/22
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Reviewed	-	-
Approved	-	-

Client: HUTT CITY TE AWA KAIRANGI

Project Title: Hutt City Council
Petone Wharf Renewal

Sheet Title: PETONE WHARF CONCEPTS
OPTION 4
HERITAGE BEACH, MODERN END

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Kordia House
109-125 Willis Street
Wellington 6011
+64 4 384 2029
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Project No	Sheet	Revision
709066-P	S463	0

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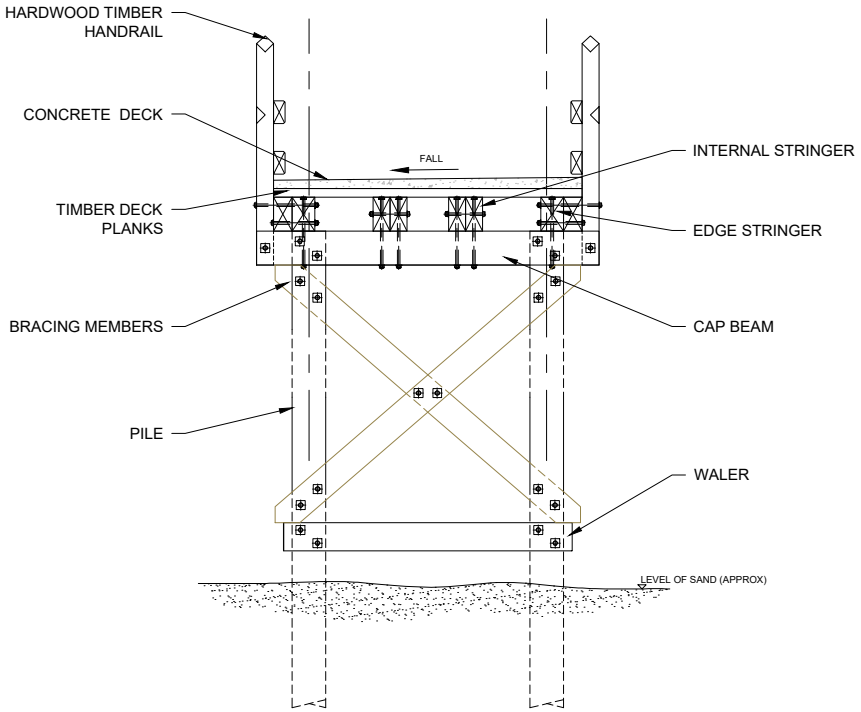
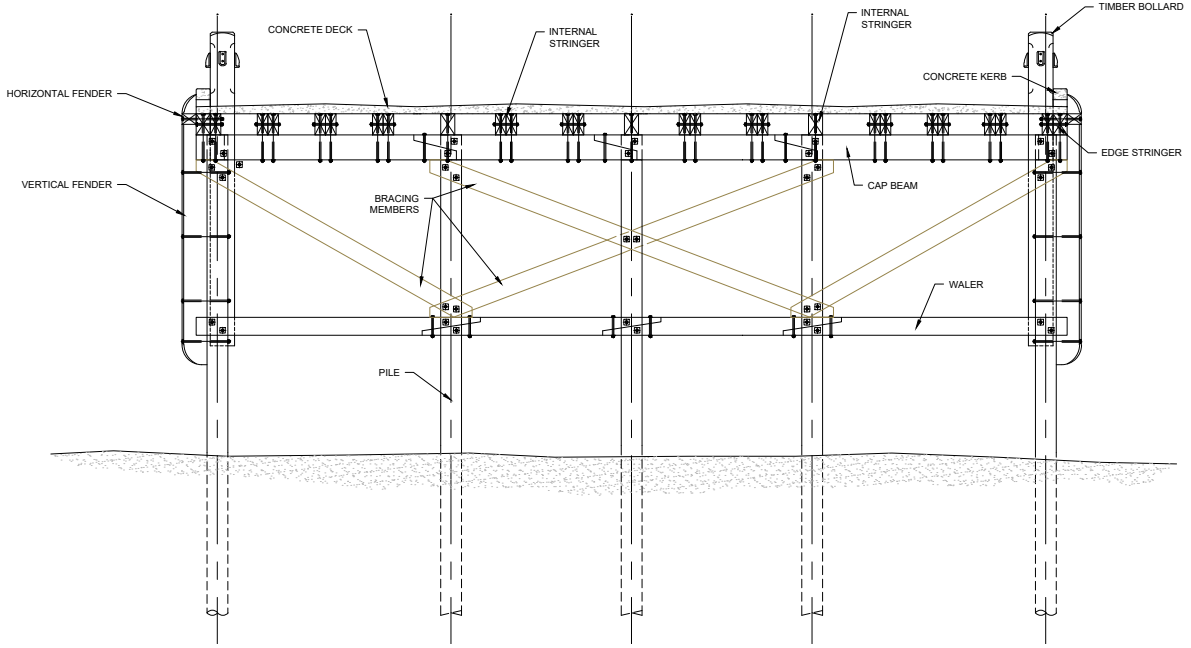
Appendix B - Typical Wharf Components



TYPICAL SECTION OF WHARF APPROACH



TYPICAL SECTION OF EXISTING WHARF HEAD

Revision	App	Date

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

Client: HUTT CITY TE AWA KAIRANGI

Project Title: Hutt City Council
Wharf Repairs & Maintenance

Sheet Title: TYPICAL WHARF COMPONENTS

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

Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
709066	-	-

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CONTACT US

CALIBRE CONSULTING LTD

Level 13, Kordia House, 109-125 Willis Street
Wellington 6011
PO Box 6643, Wellington 6141
+64 4 384 2029

WWW.CALIBREGROUP.COM