

Project Number: 1-14129.02

Kaipara Moana

KDC Marine Asset Condition Assessments

21 April 2020

CONFIDENTIAL





Contact Details

Dewi Todd-Jones

WSP
Mansfield Terrace Service Lane
125A Bank Street
PO Box 553
Whangarei 0140
+64 9 430 1700
+64 21 884 281
dewi.todd-jones@wsp.com

Document Details:

Date: April 2020
Reference: 1-14129.02
Status: Final

Prepared by

Clayton Brown
Senior Civil Engineer

Reviewed by

Iain MacDonald
Senior Civil Engineer (Ports & Marine)

Approved for release by

Dewi Todd-Jones
Work Group Manager: Bridges, Civils and
Structures



Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
1	15/03/20	CDB	DTJ	DTJ	Draft
2	03/04/20	CDB	IDM	DTJ	Draft
3	21/04/20	CDB	IDM	DTJ	Final

Revision Details

Revision	Details
1	Draft Issue
2	Draft Issue - Pouto Point options and feasibility assessment added
3	Final Issue - Amendments to site notations



Contents

Limitations.....	1
1 Introduction	2
1.1 Background.....	2
1.2 Methodology.....	2
1.3 Assumptions.....	3
2 Condition Assessments and Recommendations	4
2.1 Pouto Point.....	4
2.2 Kelly's Bay.....	24
3 Cost Estimates.....	30
4 Recommendations.....	30
5 References.....	30

Appendices

- Appendix 1 Pouto Point Site Photographs
- Appendix 2 Kelly's Bay Site Photographs

Figures

Figure 1: Asset Assessments Area Overview.....	2
Figure 2: Pouto Peninsula.....	5
Figure 3: Pouto Point General Site Arrangement.....	5
Figure 4: Pouto Point Circa 1936 (looking South).....	10
Figure 5: Historic Ferry Operations.....	11
Figure 6: Site 1: Pouto Point.....	12
Figure 7: Site 2: Marine Hall Reserve.....	12
Figure 8: Site 3: End of Signal Station Road.....	13
Figure 9: Extract from Chart NZ 4265 Kaipara Harbour showing Pouto Point (LINZ, 2018).....	16
Figure 10: Kelly Bay General Site Arrangement.....	24
Figure 11: Extract from Chart NZ 4265 Kaipara Harbour showing Kellys Bay (LINZ, 2018).....	26
Figure 12: Kelly's Bay Proposed layout.....	27

Tables

Table 1-1: Structural Asset Condition Rating.....	3
Table 2-1 : Site suitability and facility details – 1) Pouto Point Road existing access.....	7
Table 2-2 : Site suitability and facility details – 2) Marine Hall Reserve, Signal Station Road.....	7
Table 2-3 : Site suitability and facility details – 3) End of Signal Station Road.....	8
Table 2-4 : Details of the Facility – Kelly's bay.....	25
Table 3-1 : Summary of Estimates for Pouto Point Options.....	30
Table 3-2 : Summary of Estimates for Kellys Bay Options.....	30

Limitations

This report ('Report') has been prepared by WSP exclusively for [Kaipara District Council] ('Client') in relation to [condition assessments and high-level costing of upgrades/replacements of marine assets within the Kaipara Harbour] ('Purpose') and in accordance with the [Variation Order No.933 WSP VO3]. The findings in this Report are based on and are subject to the assumptions specified in the Report [and specified in our Offer of Services dated 12/03/20]. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

1 Introduction

This report presents the findings from high-level assessments undertaken at two sites within the Kaipara Harbour where there are existing Kaipara District Council (KDC) marine transport assets, or the potential for the future development of new assets. In the latter case, location options at the site are assessed. High-level cost estimates for the upgrade of existing assets or the development of new assets are also included.

1.1 Background

As part of the Kaipara Kickstart programme, Kaipara District Council (KDC) commissioned WSP to undertake condition assessments of 8 marine structures in the Kaipara Harbour. This task was undertaken and the report submitted in March 2020.

KDC then requested that two additional sites be investigated. The sites were to be assessed for whether wharves, jetties or boat ramps can be installed in those locations. These assessments were to allow for the estimating of upgrade costs of the 2 new sites so as to handle one or more of a passenger ferry or car ferry.

The sites that were visited, and their proposed requirements, are noted below:

1. Pouto Point – New wharf / jetty to allow for passenger ferry operations.
2. Kelly's Bay – New wharf / jetty / alternative landing for ferry operations to southern
– Upgrade for potential car ferry operations.

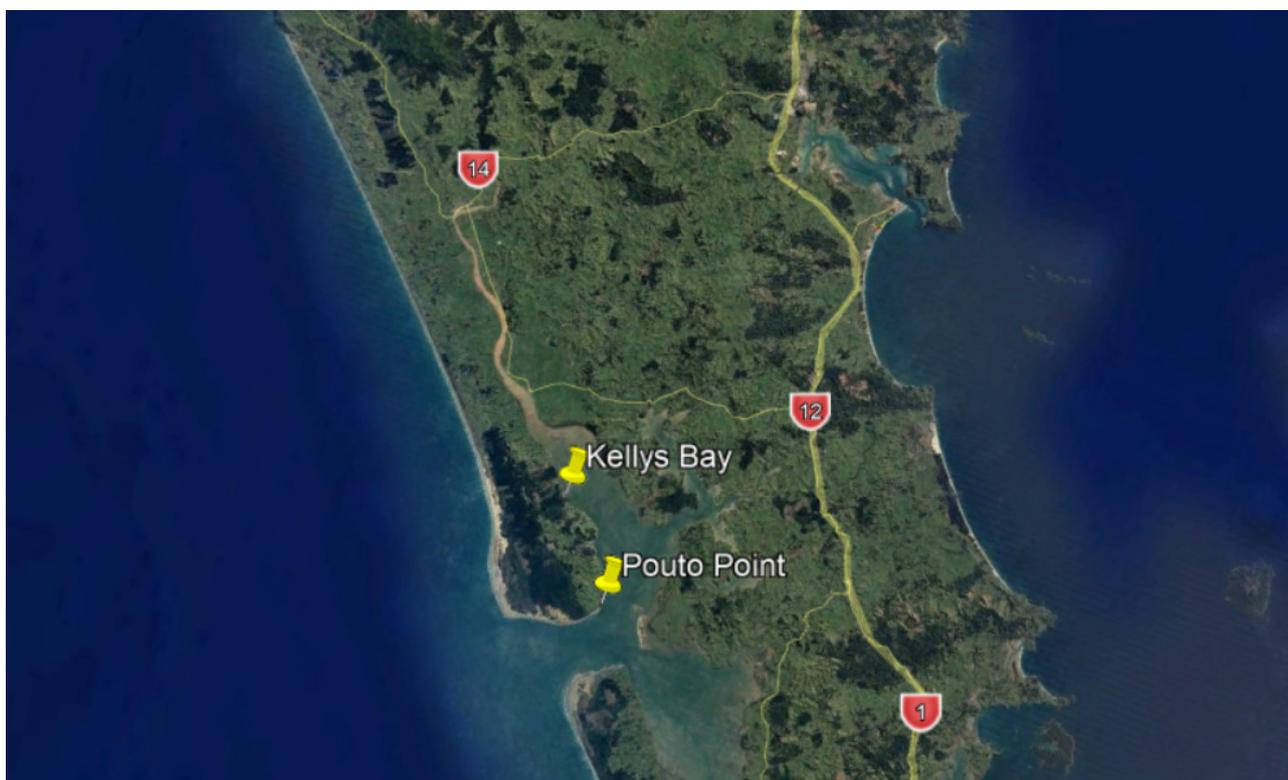


Figure 1: Asset Assessments Area Overview

1.2 Methodology

An initial desktop assessment was undertaken of the two proposed marine transport facilities sites at Pouto Point and Kelly's Bay. This desktop assessment reviewed the general

situation at each site, including a review of maps, land titles, available historical information, photographs, previous options reports by others (T&T, 2002), and discussions with a local ferry operator regarding the environmental conditions.

On review, a more detailed assessment and commentary regarding alternative options at Pouto Point was deemed to be necessary due to the complex nature of the site, and differing requirements of the eventual asset. A site visit was undertaken on the 18th March 2020, coinciding with low tide at approximately mid-day.

Where practicable a preliminary assessment of the condition of any existing facilities, structures, and/or assets, has been reported based on the condition rating grades as summarised in Table 1-1.

Table 1-1: Structural Asset Condition Rating

Grade	Classification	Action	Description
1	Very Good	No Action required	New or near new condition Some wear or discolouration but no evidence of damage. Can include repaired assets where the repair is as good as the original.
2	Good	Monitor to see if there are changes	Deterioration or minor damage that may affect performance. Includes most repaired assets.
3	Moderate	Consider specialist assessment.	Clearly needs some attention but is still working. Structure in need of repair. Includes repaired where the repair is deteriorated.
4	Poor	Get specialist assessment.	Either not working or is working poorly because of damage or deterioration. Condition or structure is poor or structural integrity in question.
5	Very Poor	Replace or repair	Needs urgent attention.

1.3 Assumptions

The assumptions and limitations of the condition assessment process and costing exercise are noted in the sections below.

1.3.1 Inspections

- Due to the compressed timescales, it was necessary to be selective when performing investigations and condition assessments of the structures. As such, we have used our knowledge of similar structures to focus attention on items / components or tasks that require the most attention.
- Similarly, the inspections had to be undertaken in rapid succession. Normally, marine structure inspections would be undertaken from a boat at mean low water spring (MLWS) tide level and mean high water spring (MHWS) tide level to allow for the maximum amount of the structure to be observed and physically investigated.
- No in-depth physical investigations, or comparisons of the coastal conditions was able to be undertaken. The report relies upon a high-level desktop study and the visual observations from a single site visit, made during a mild sunny day with calm sea conditions at slack tide over high water.
- No intrusive investigations and/or structural analysis were undertaken on the structures. Properties of materials were not investigated, or investigations undertaken that would reveal hidden defects or sub-surface elements.
- The recommendations herein are for high-level options costing purposes only. Further site investigations, surveys and assessments would be required before

concept design development, resource consent applications, detailed design, procurement and construction.

1.3.2 *Costs Estimates*

- It has been assumed that anywhere a passenger ferry/car ferry/charter operation is proposed, a parking area that allows for five cars to be parked will be required.
- It has been assumed that the access to any of the sites proposed, where they are single lane roads, will need to have passing bays constructed.
- It has been assumed that any proposed car ferry facility will be in line with the Hokianga car ferry between Rawene and Kohukohu. The actual design of the facility, however, will need to be responsive to the functional and operational needs of each location. It has not been possible, at this stage, to consider such items as forecast vessel numbers, dimensions and tonnage, schedule of arrivals / departures, berthing and layover requirements are unknown.
- The estimates for the upgrade of each site have excluded costs associated with dedicated housing/berthing for ferries, supply of services and amenities to the sites, ticketing and staffing facilities, public consultation, heritage constraints and land purchases.

2 Condition Assessments and Recommendations

2.1 Pouto Point

Facilities at Pouto Point have been assessed for their suitability to be converted to passenger transport operations. See Appendix A1 for photographs of the site.

2.1.1 *Location*

Address: Adjacent to 6573 Pouto Road, Pouto Point.

Coordinates: Lat: 36°21'45.69"S Long 174°10'54.74"E (WGS84)

Directions: End of Pouto Road, 69 km (1hr, 10min) by car south of Dargaville

2.1.2 *Site Layout & Geometry:*

The Pouto Peninsula is some 55 km long, and bounded on three sides by water, with Pouto Point located on the western side of the northern head of the Kaipara harbour entrance. The Coast here is a rounded line of broken sandstone cliffs and dunes, girded by an apron of sandy beach. Offshore, swift tides, and a combination of deep tidal cut channels and shallow shoals, mark the meeting place of the harbour waters and rolling waves from the open sea. Pouto point is at the interface between sandstone geology, the dune system and the harbour. There is a deep tidal channel very close to shore to the south and east. North from Pouto Point the sandstone continues and forms a shallow seabed shelf for an embayment (the "Northern Bay"), with deep water to the east of the shelf. A view of Pouto Peninsula is shown in Figure 2 below, and the general site arrangement at Pouto Point is shown on aerial imagery in Figure 3 below.

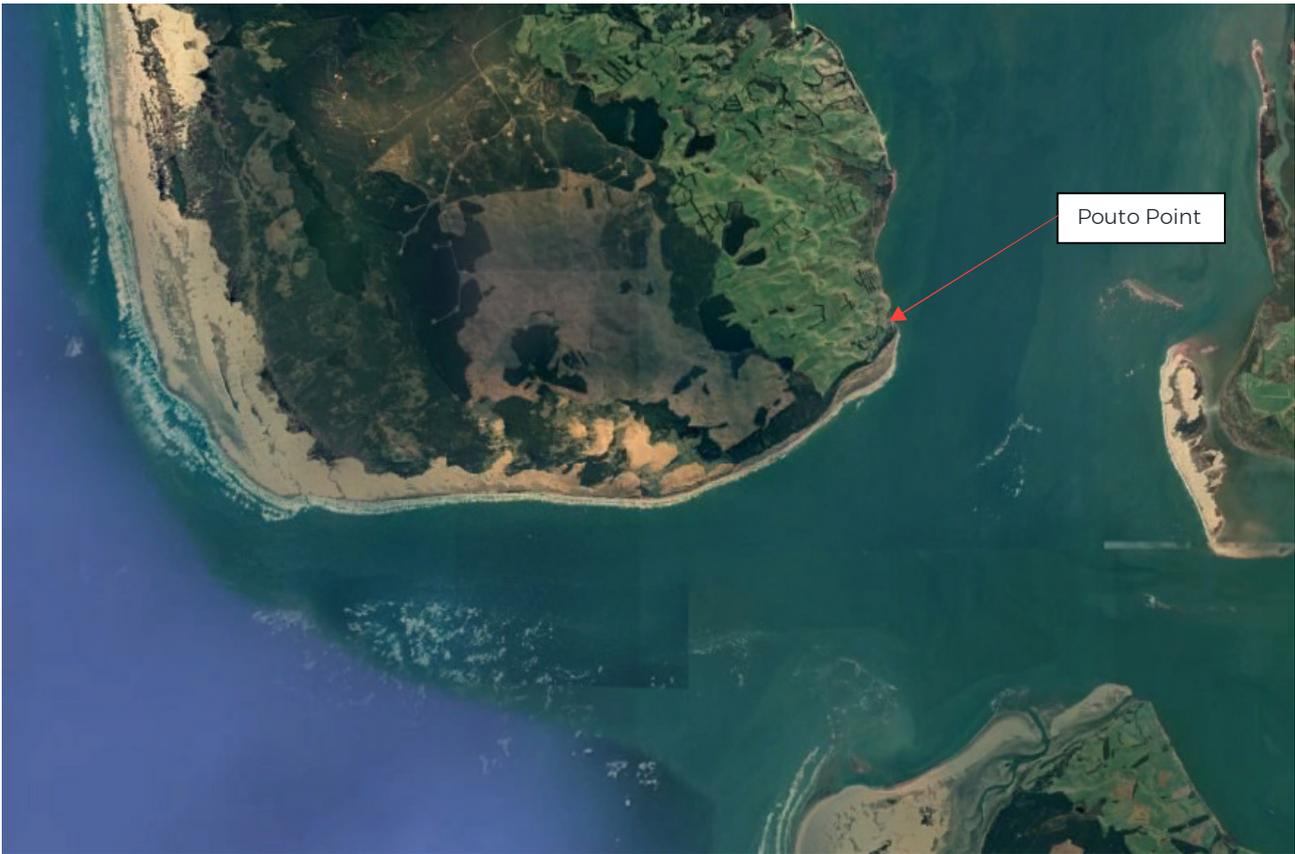


Figure 2: Pouto Peninsula



Figure 3: Pouto Point General Site Arrangement

Apart from the beacon at Pouto Point and the historic Pouto lighthouse (situated on the last outcrop of sandstone 7km along the beach to the south of the access point) there are no existing marine transport facilities at the site.

At Pouto Point, three main locations for an access to the coast line were considered, consisting of Sites 1, 2 and 3. Site 1 is located at the end of Pouto Road. Sites 2 and 3 utilise Signal Station Road for access.

Signal Station Road is approximately 10 to 20m above sea level, and Sites 2 and 3 consist of two land parcels that meet the sea via unoccupied land:

1. Pouto Point Road existing access
There is an existing 4x4 beach access point at the end of the road that follows the natural lay of the land around the high ground of Pouto Point headland. The facilities here consist of a public road and carpark (with public amenities) and a park land reserve. The access point opens out on to the northern end of the sandy beach, which extends southward. The access point is adjacent to the Pouto Point sandstone headland and small cliffs and wave cut rock platforms that extend northward. Four layout options for a jetty or wharf facility around this location have been previously investigated by others (T&T, 2002)
2. Marine Hall Reserve - "Northern Bay"
This location is accessed at the high ground off Signal Station Road and consists of the hall building and top camp sites, on an elevated flat site overlooking the harbour. On the seaward side of the hall site there is a parcel of land with two legal accesses back to Signal Station Road. The site is steep and terminates in a 4 to 5 m high cliff.
3. End of Signal Station Road - "Northern Bay"
At the end of Signal Station Road, a land parcel provides legal access to a coastal embayment, approximately 200 m NNW of Site 1 at Pouto Point. The access is via a driveway width legal corridor, down a moderately steep walking track to the unnamed northern bay. At this location there are 2 to 3 m high coastal sandstone cliffs, dropping to a sand and stone intertidal foreshore with visible wave cut platforms. Much of the legal lot is in the intertidal zone below the MHWS tide level, and consequently within what would normally be the Marine and Coastal Area (MCA).

Two further alternative locations were also briefly considered and ruled out during the course of the desktop review:

4. Tauhara Creek (3 km to the North)
Although there is an access road to the cemetery near the coast, it was considered to be too distant from Pouto Point with poor navigable boat access due to the small shallow tidal inlet.
5. Marae (1 km to the North)
Likewise access is via the Marae site, off Pouto road. The shallow rock shelf extends some 300 m from the shoreline before deep water is reached. It is private land with no formed access to the coast.

Details of the facilities at Sites 1, 2 and 3 at Pouto Point, and further commentary regarding the suitability of the sites, are provided in Tables 2-1, 2-2 and 2-3 below. As there were no existing assets or structures present, the assessment focusses on the suitability of the sites to be modified for KDC's intended purposes.

Table 2-1 : Site suitability and facility details – 1) Pouto Point Road existing access

Location	Element		Commentary regarding site suitability
1) Pouto Point Road existing access	Access		Good
	Length from Pouto Road	120m	1- Functional for present use as 4x4 or beach worthy vehicles (60m 4x4 track from car park) 2- Risk track may not always be reliable for heavy road busses due to soft dry sand on entrance track above MHWS tide level.
	Property		Good 1- Legal “paper” road beach access to foreshore
	Jetty		Nil - No structure 1- Present landing off beach or Fisherman’s rock (at low tide and in fair weather and sea conditions). 2- Only foundations remain of old jetty at Fisherman’s rock worthy vehicles.
	Ramp		Nil - No facilities 1- Beach launch/recovery of trailer boats (in fair weather conditions).
	Parking / queuing area		Good 1- Parking area; gravel 2- Adequate space for parking 10+ cars
	Retaining walls		Nil - No structure
	Services		Good 1- Toilets in good condition 2- Reserve / open public space 3- Signage / historic Information

Table 2-2 : Site suitability and facility details – 2) Marine Hall Reserve, Signal Station Road

Location	Element		Commentary regarding site suitability
2) Marine Hall Reserve	Access		Very Poor - Overall
	Length from Signal Station Road	50m	1- Legal access only. Site has 5 m high cliff between legal lot and foreshore. Site is steep slope. 2- Not viable for landward and seaward sites to share same level site. 3- No vehicular access to foreshore, potentially only steep pedestrian access steps viable. 4- May require retaining walls / slope stability works to enable access
	Property		Poor to Moderate 1- Title exists that could be purchased. 2- However, in addition to the camp ground another second legal title exists on the foreshore ¹⁴ .

Location	Element	Commentary regarding site suitability
		<ul style="list-style-type: none"> 3- Extent of usable property for landside use as carpark etc is limited to the extent of the foreshore cliff, and the steep slope. 4- Ownership; not currently a legal road but could be purchased. 5- Second property title on foreshore may also need to be purchased.
Landing site / jetty	Jetty 50m+	<p>Nil - No structure</p> <ul style="list-style-type: none"> 1- Landing at low tide is limited by the shallow waters because of an underwater bedrock shelf. Prevents landing at low water by larger craft such as a ferry. Thus, jetty would need to extend to deep water.
Ramp / ramp site		<p>Nil - No facilities</p> <p>Very Poor - Overall landside</p> <ul style="list-style-type: none"> 1- Due to access, and foreshore cliffs, lack of turning and steep access. <p>Poor to Moderate - Foreshore landing</p> <ul style="list-style-type: none"> 1- Foreshore and bay may not be usable 'all tide' due to shallow bathymetry and sandstone bedrock.
Parking / queuing area		<p>Very Poor – Nothing adjacent to foreshore</p> <ul style="list-style-type: none"> 1- Limited land parcel at top of 5 m high foreshore cliff.
Retaining walls		<p>Nil - at present</p> <ul style="list-style-type: none"> 1- Earthworks cutting, walls and slope stabilisation are likely to be required to enable vehicle access.
Services		<p>Poor</p> <ul style="list-style-type: none"> 1- Power and other services at signal Station Road campground

Table 2-3 : Site suitability and facility details – 3) End of Signal Station Road

Location	Element	Commentary regarding site suitability
3) End of Signal Station Road	Access Length from Pouto Road 60m	<p>Very Poor</p> <ul style="list-style-type: none"> 1- Walking track via legal driveway with 4 m high cliff between driveway access and foreshore, and steep slopes to adjacent properties: 2- Steep / narrow legal driveway width access to land holding adjacent to foreshore. 3- May require significant retaining walls / slope stabilisation works to provided access
	Property	<p>Moderate to Poor</p> <ul style="list-style-type: none"> 1- Unused legal title adjacent to foreshore exists.

Location	Element	Commentary regarding site suitability
		<ul style="list-style-type: none"> 2- Not currently a legal road but is in name of Crown "MoE" (Ministry of the Education). This could be purchased. 3- Extent of usable property for landside use as carpark etc is limited to the extent of the foreshore cliff. Part of the land parcel is eroded to the foreshore. Would require reinstatement or reclamation works to utilise full area of title. 4- Planning and consenting risk. Reinstatement works in vicinity of Coastal zone, which risks being defined as reclamation and may be complex, or prohibited as an alternative site does exist.
Landing site / jetty	Jetty 100m+	<p>Nil - No structure</p> <ul style="list-style-type: none"> 1- Landing at low tide is limited by the shallow waters because of an underwater bedrock shelf (i.e. a wave cut platform in the sandstone). This shelf appears to be across the entire mouth of the bay and potentially prevents landing at low water by larger craft such as a ferry. Thus, jetty would need to extend to deep water.
Ramp / ramp site		<p>Nil - No facilities,</p> <p>Very poor - Landside overall</p> <ul style="list-style-type: none"> 1- Due to access, and foreshore cliffs, lack of turning and steep access. <p>Poor to Moderate - Foreshore landing</p> <ul style="list-style-type: none"> 1- Embayment foreshore may be plausible due to sandstone bedrock and improved shelter in lee of Pouto Point.
Parking / queuing area		<p>Very Poor - Adjacent to foreshore.</p> <ul style="list-style-type: none"> 1- Limited land parcel at two of 4m foreshore cliff. Reinstatement and reclamation within the legal land parcel likely to be required to provide sufficient flat land suitable for turning and parking <p>Poor to Moderate-Signal Station Road</p> <ul style="list-style-type: none"> 1- Adequate space for parking and queuing and turning exists on gravel. But this is isolated from the foreshore by a steep walk.
Retaining walls		<p>Nil at present</p> <ul style="list-style-type: none"> 1- Retaining walls, slope stabilisation and rock revetments are likely to be required to gain vehicle access to the foreshore
Services		<p>Poor</p> <ul style="list-style-type: none"> 1- Power and other services at signal Station Road Road camp ground.

2.1.1 Background

It is noted that the mouth of the Kaipara Harbour, its sandbars and adjacent open coastlines, are known for being a hostile and treacherous environment. The sandbanks off the harbour entrance are known locally as the “Graveyard” because of the many historical shipwrecks. The light house 6 km South west of Pouto was erected in 1884. The lighthouse switched to automation in 1947 and closed in the 1950s with the decline of coastal shipping.

A jetty previously existed at the end of Pouto Point Road (Site 1). Its position is understood to have been Southwest of the Fisherman’s rock and the current beach entrance. No sign of the old piles was visible at low tide during the day of the WSP site inspection, but locals recall seeing them at that approximate location. A boat house can be seen on Fisherman’s rock in below, and evidence of its foundations are still present on site.

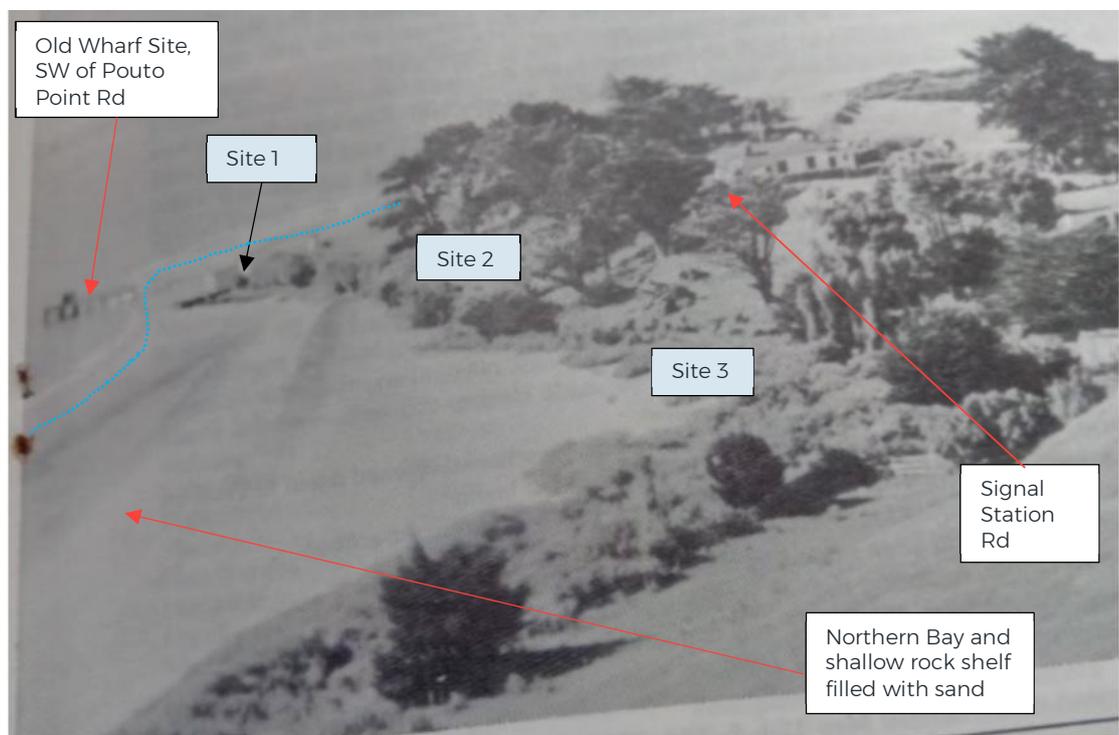


Figure 4: Pouto Point Circa 1936 (looking South)

A previous wharf options study report (T&T, 2002) only investigated four options at the Pouto Point site, presumably discounting alternative sites further away.

There has not been time for a detailed review of the history of the site or a review of the potential changes to the natural shoreline environment that have occurred over time, or that could occur in future with sea level rise.

However, it is noted that in the photograph in that the “Northern Bay” and shallow rock shelf around Sites B and C appear to have been entirely filled with sand, providing a high-tide beach of reasonable width. Also, that the low tide limit of the sand beach and the water line follows the approximate extent of the rock shelf and deep-water line.

The present-day situation sees the shallow bay in an erosional state almost entirely denuded of sand to the underlying bedrock. It is probable that this situation has occurred due to changes in harbour accretion and deposition patterns brought about by either natural storm events, documented sand dredging / mining at the harbour entrance, and/or sea level rise. Although none of the locals spoken to

during the site visit could recall the bay being infilled with sand in recent living memory, there were second hand accounts that the beach was once substantial enough that it stretched as far north as Tauhara Creek, 3km to the North. Thus, there is the possibility that storms or changes in erosion and deposition patterns could see the return of sand if it was able to bypass around Pouto Point. If this occurred the bay would no longer be navigable to boats even at high tide (unless dredged).

2.1.2 Existing Level of Service of Asset

Currently the site facilitates the following functions:

- An on-demand passenger ferry that is able to land a pedestrian ramp either directly onto the beach (at low tide) or the Fisherman's rock.
- Public road access to the beach.
- Carpark and public toilets.
- Access to the unformed 4x4 beach track.

The current ferry operators advised that the preferred time to access Pouto Point (from the water) is low tide +/- 3 hrs. This relates to two factors. Firstly, an easier landing as it is less affected by swell since at low tide open coast swell waves tend to dissipate most of their energy on the harbour entrance sand bars. Secondly, because low tide enables improved visitor access to most of the coastal activities, features and natural attractions around Pouto Point (e.g. vehicle and foot access to the lighthouse).



Figure 5: Historic Ferry Operations

Feedback from the skipper of the existing ferry service indicated that he saw no great advantage to Sites B or C as he believed them still to be exposed to the same sea conditions as at Site 1. However, the former sites also have the notable disadvantage of requiring disembarking passengers to walk uphill and a much farther distance to get to the local attractions and services.

Another commercial boat operator noted that given the present poor landing options, and uncertainty of sea conditions, landing at Pouto Point cannot always be relied upon. This can make it an unreliable proposition to market as a tour destination.

2.1.3 Preliminary Jetty Options

The following three preliminary layouts have been considered for the sites

2.1.3.1 Site 1) – Pouto Point



Figure 6: Site 1: Pouto Point

2.1.3.1 Site 2) – Marine Hall Reserve

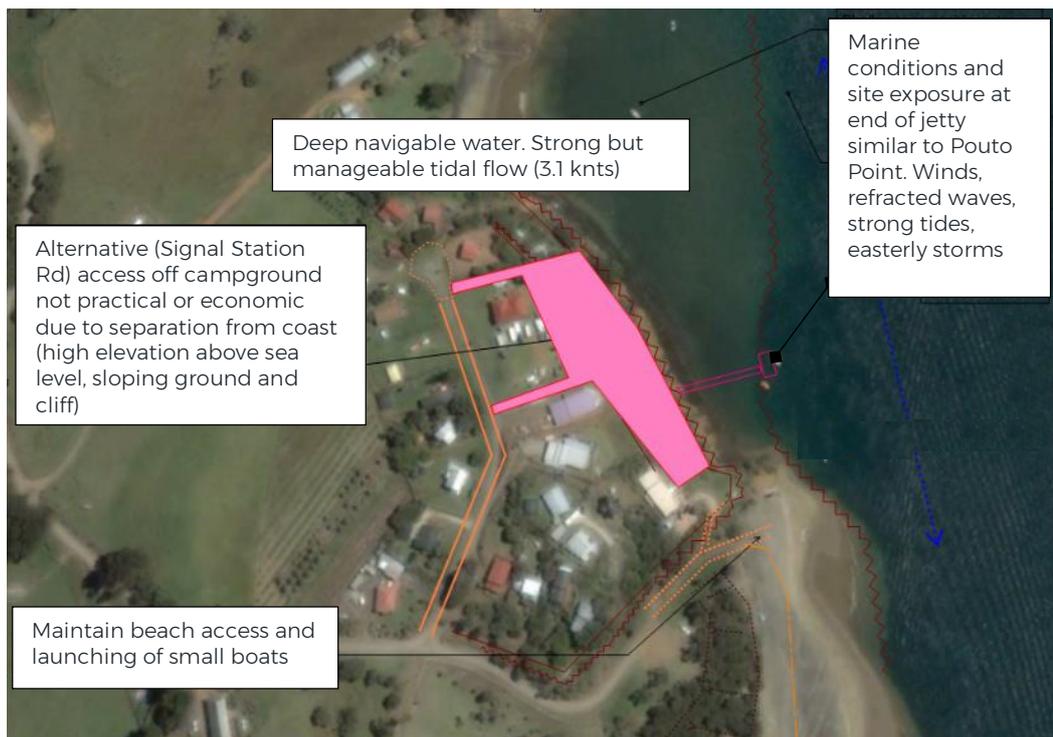


Figure 7: Site 2: Marine Hall Reserve

2.1.3.1 Site 3) – End of Signal Station Road

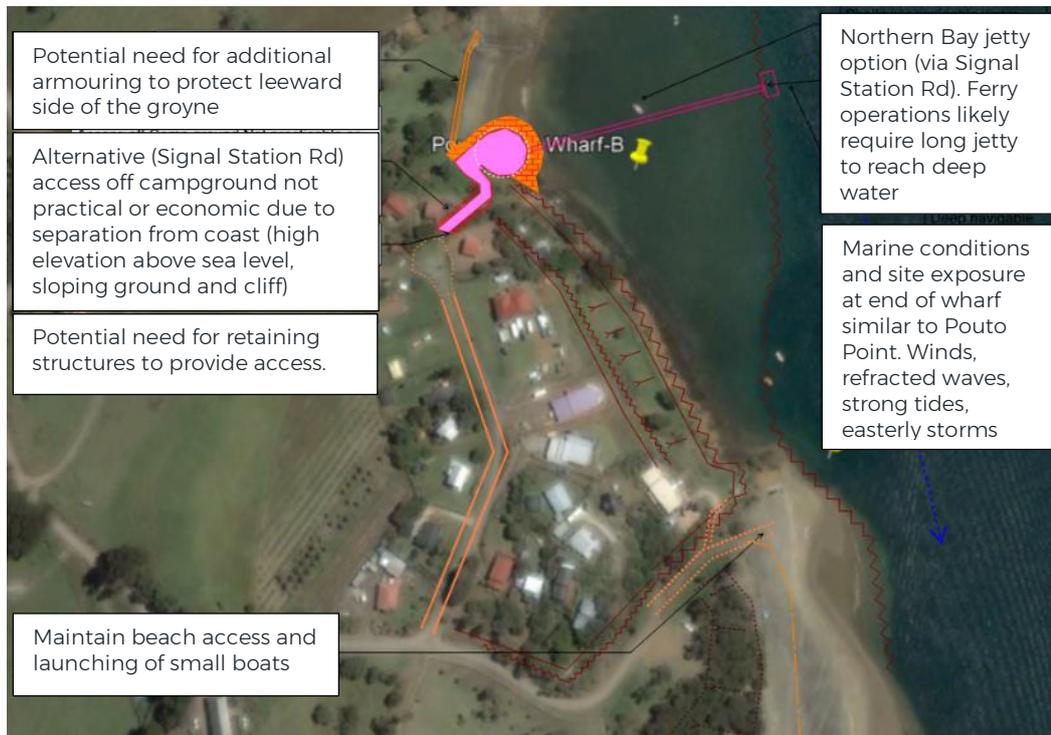


Figure 8: Site 3: End of Signal Station Road

2.1.4 Discussion

The Kaipara Moana Business Case outlines that any new marine transport assets developed at this location will need to accommodate the following operations;

- Passenger transport operations.

The most important function of a ferry facility is safe and efficient vessel and passenger handling. It is noted that a previous KDC appraisal indicated that safer marine conditions were perceived to exist at the “Northern Bay” (Sites B and C) in the lee of Pouto Point.

The possibility of recreational ‘wharf jumpers’ and swimmers getting into difficulty and being swept away by the strong tidal currents in the adjacent deep channel was also highlighted. In this context a preference was communicated for the consideration of facilities in the “Northern Bay”.

Public and user safety is an important factor, but one of several (including function, cost and environmental impacts) that must be considered and assessed to achieve best project outcomes for KDC, the public and community stakeholders.

Key functional elements for the potential sites are considered in the following sub-sections, including safety aspects.

2.1.4.1 Public Usage and Safety in Design Considerations

There is a perception that access to a jetty, at certain locations, carries with it an increased drowning hazard as a result of providing access for people to jump and swim around the end of the jetty which will be located in high current areas.

The drowning hazard is posed by the presence of the sea and the behaviours of individuals, and these can never be fully eliminated by design measures. Completely designing out all potential risk and hazards by seeking to avoid deep water and

currents is not necessarily practicable. The functional objective of locating a fixed jetty or wharf structure is to provide access to sufficiently deep and open water so that the design vessel(s) can safely berth and depart the facility 'all tide'.

Typical design measures for mitigating the risk of misadventure and drowning on a public marine structure can include:

- Appropriate pictorial and written warning signage to inform and educate users about unacceptable activities and the potential hazards (e.g. "no diving/swimming due to ferry operations, strong currents and deep water").
- Use of guard railings along all edges except where normal vessel and passenger/cargo handling operations require these to be omitted.
- Provision of safety ladders on the structure to enable self-rescue and exit points from the water if an individual accidentally enters the water (conversely this might also encourage deliberate swimming usage).
- Provision of public rescue equipment (e.g. a life buoy or throw line/bag).

With regards to the perception that the sites to the north would be safer as they could be in calmer water away from strong currents, the following commentary is provided.

- Site 1) – Pouto Point

Because the deep channel and its swift moving tidal flows are very close to the existing shoreline, locals will already be aware of the hazard this presents for swimmers. The proposed jetty is to be located as close to shore as practical but will still be in or near the deep swift flow that poses the hazard.

As the jetty is relatively close to shore, and the nearby settlement, this could also be an advantage for a quick shore based throw line rescue should someone get into difficulty.

Also, being located to the south of Fisherman's rock, a jetty here could even serve as the final shore-based rescue point for any swimmer swept south from the "Northern Bay" in an outgoing tide.

- Site 2) – Marine Hall Reserve

For the Marine Hall Reserve Site, refer site 3 below. The proposed jetty should extend far enough seaward to enable ferry operations at MLWS

- Site 3) – End of Signal Station Road

For the safety of the ferry and those onboard it is necessary to locate the jetty head beyond the shallow waters over the rock shelf, which would reduce the risk of vessel damage/loss by grounding. Alternatively, a shorter jetty within the embayment would require extensive and costly capital dredging of an access channel and turning circle through the shallow rock shelf to achieve the necessary water depth. This is not considered practicable.

Having the jetty head offshore puts it in the naturally deep water and swifter currents beyond the calm of the shallow embayment. However, in contrast with Site 1 the jetty must be much longer and farther from the shoreline. This is a relative disadvantage in safety terms as it would take any swimmers in difficulty from the jetty head longer to reach safety of the shoreline if they were caught in the current and were unable to return to the jetty. Similarly, a quick shore-based rescue may be less probable given the long distance from the settlement.

The shallow water of the embayment may also create a false sense of security and actually encourage use of the jetty for recreational swimming. There is also an additional risk of 'wharf jumping' or diving from the jetty stem into the shallow waters. This poses a hazard of injury from impact with the seabed, especially over low tide periods. To keep the ferry and its passenger's safe, it is necessary to locate the jetty outside the rock shelf. Although a site within the bay may seem desirable, due to the rocky nature of the shore bed (and notwithstanding any localised dredging), the principal hazard to the public at this site would not be drowning, but the boat sinking after grounding on the rock shelf while attempting to access a jetty set within the bay during high winds/strong swells.

2.1.4.2 Marine: Vessel Navigable Access / Bathymetry

The proposed jetty should extend far enough seaward to enable ferry operations at MLWS tide level such that the vessel has sufficient under-keel clearance to operate safely.

The following commentary is provided.

- Site 1) – Pouto Point

Deep water is very close to the shore. Anecdotal evidence from existing ferry operators indicates that when 'bow in' to the shoreline there is 12 m of water depth at the vessel stern (approximate vessel length is 7.6 m). Thus, any proposed jetty structure would not need to extend very far from the shoreline to achieve 'all tide' access. The deep water is estimated to be 20 m out from the shoreline (MHWS tide level). However, the previous options study report (T&T, 2002) indicated a required jetty length of 38 m and this requirement would need further review depending upon the particulars of KDC's required design vessel.

- Site 2) – Marine Hall Reserve

The rock shelf is still present, but deep water is closer to the shore than at Site B, partly helped by an apparent concave feature in the edge of the rock shelf. Deep water is estimated to be 40 to 50 m from the shoreline.

- Site 3) – End of Signal Station Road "Northern Bay"

The available water depth is very shallow until beyond the rock shelf. A jetty would need to extend perhaps four times farther (120 m) from the shore line to reach sufficient water depth and would thus be of much greater cost.

The bathymetry survey undertaken for the previous options study (T&T, 2002) did not extend to the north beyond Pouto Point. Updated bathymetry surveys would be required to confirm the present water depth assumptions for Sites B and C.

2.1.4.3 Marine: Sea Conditions / Site Exposure

Although Pouto Point is located on the leeward side of the Kaipara Head peninsula, the area is still likely to be exposed to wind, waves (both refracted swell waves and local fetch generated wind-waves) and tidal current flows in the adjacent deep channel. These factors may affect the daily availability of safe ferry berthing at a new jetty and would need to be considered by further site specific metocean studies.

A desktop review of publicly available information indicates tidal current flows of up to 3.1 Knots in the adjacent deep channel during spring tides (Figure 9).

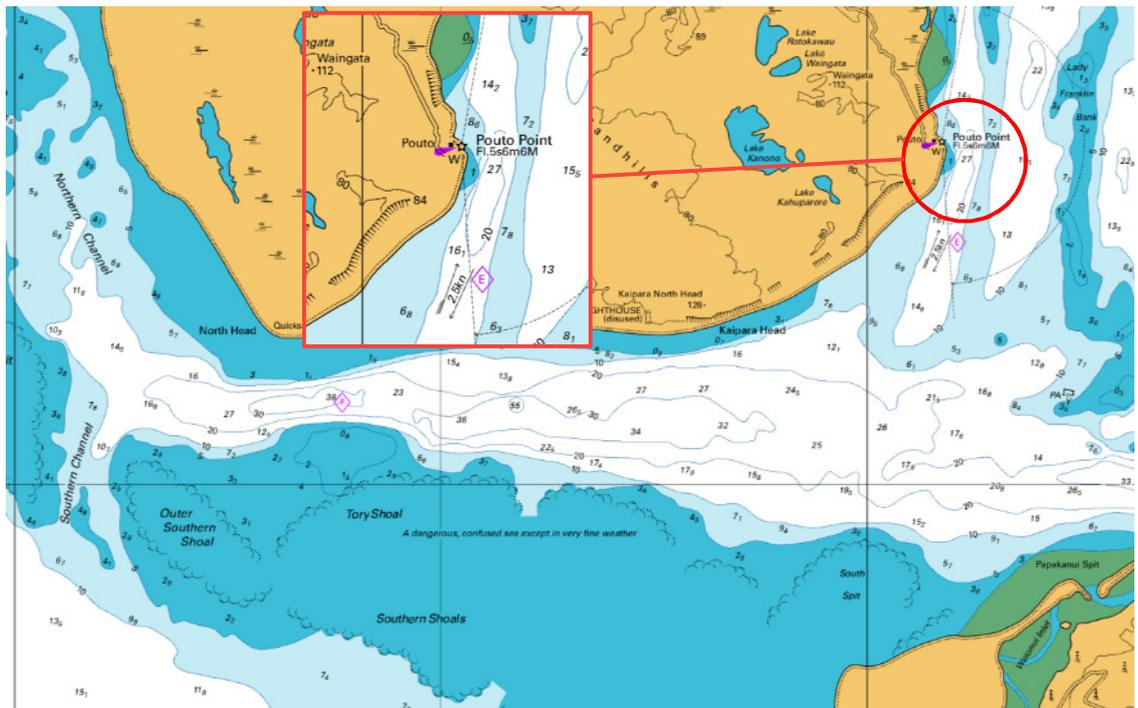


Figure 9: Extract from Chart NZ 4265 Kaipara Harbour showing Pouto Point (LINZ, 2018)

The prevailing wind is likely from the southwest, but there is also potential for strong north easterly or south easterly winds generating unfavourable directional wave conditions over the available harbour fetch lengths.

The dominant waves are considered to be swell waves entering the harbour from the west to south quadrant. These will be attenuated to a degree by depth limited wave breaking on the shallower harbour shoals, but the residual waves will then continue to propagate up the deeper harbour channels where they will be subject to nearshore refraction effects along the shoreline.

Ideally a site as well sheltered from waves as practical would be preferred, but in the absence of site specific metocean studies it is considered that the wave conditions near Pouto Point would likely be tolerable. Otherwise, wave protection in the form of a breakwater might need to be considered. However, given the deep water close inshore and the likely limited scale of the proposed ferry operations this is not considered practicable due to the cost implications of breakwater construction.

The key factors for each of the three sites are described below:

- Tidal flows up to a maximum of 3.1 Knots at spring tides are considered manageable by landing 'bow in' to the flow. The orientation of the jetty head would need to be carefully considered during design following site specific metocean studies.
- Wind effects can be expected as Pouto Point is exposed to open harbour directions from the north around to the south west. Dependent upon the design vessel particulars, the wind and wave movement effects upon the berthed ferry at the jetty head could be mitigated by provision of suitable fendering and mooring systems.

Also, having an adequately sized manoeuvring area in deep water around the jetty head, away from the shallow rock shelves and other obstructions,

provides a degree of safety for berthing vessels. It would enable a ferry operator sufficient time to consider whether to attempt berthing and to adjust their approach positioning in poorer wind conditions.

Sites B and C in the “Northern Bay” beyond Pouto Point appear on aerial imagery to be more sheltered from the prevailing south west wind direction. However anecdotal evidence from the ferry operators suggest that these sites may only be marginally better than the existing ad-hoc Fisherman’s rock landing at the point itself (Site 1). A potential jetty at Site B would also need to be approximately 100 m plus away from the leeward shelter of the cliffs at the point, so much of the perceived sheltering effect may in fact be lost.

The initial perception of a site to the north of the point being better sheltered is not necessarily correct given the conversations with the ferry operator and the absence of site specific wind records or metocean studies.

- The dominant wave direction is also anticipated to be from the south west, as evidenced by the accretion of the sand beach on the southern side of Pouto Point in the probable south-north direction of the local longshore drift. Therefore, Site 1 can logically be considered to have the most wave exposure of the three sites. However, normal wave conditions are considered manageable at this location given it was the historic site of a wharf and the present-day ferry / charter boat operators land at the point on or beside Fisherman’s rock.

It may be perceived that Sites B and C in the “Northern Bay” would be more sheltered from south westerly waves, but again the ferry operators believe it might offer only a marginal improvement. Incident waves in the deeper channel will refract (bend) into the shallower water of the embayment and potentially diffract around Pouto Point, despite the bay not being in the direct ‘line of sight’ of the incident wave fronts.

The rock shelves observed in the “Northern Bay” are examples of wave cut platforms, suggesting this area is frequently exposed to wave action. The ad-hoc armouring attempts in the bay at the cliffs and banks in front of properties, also indicate erosion due to frequent wave exposure.

The necessary projection of any jetty structure into deep water beyond the rock shelf at Sites 2 and 3 in the “Northern Bay” would place the jetty head in a similar wave exposure condition as for Site 1 at the point.

In conclusion, below is a summarised contrast of the three sites from the high-level desktop assessment of probable sea conditions / exposure:

- Site 1) - Pouto Point

The site is exposed, but likely manageable. The historic wharf structure and existing ferry / charter boat operations show it is a feasible site. A robust but short jetty structure founded into the sandstone bedrock would suffice given the deep water available nearshore. The jetty head would need to be aligned with the channel tidal currents, and dominant wind and wave directions. Appropriate fendering and mooring systems could also help mitigate movements of berthed vessels. Breakwater wave protection is not considered practicable.

- Site 2) - Marine Hall Reserve

With a shorter jetty closer to the point (60 m) the wind exposure situation may be improved by being closer to the wind shadow of the point. The wave

environment is again considered comparable to Site 1 due to both the jetty projection to the channel edge and the probable wave refraction and diffraction effects.

- Site 3) – End of Signal Station Road

The wind exposure situation may be marginally improved, but any sheltering effect is limited as the jetty would be 100 m from the leeward side of the point and 120 m from the shoreline in order to reach sufficiently deep water for 'all tide' operation. The wave environment is considered comparable to Site 1, due to both the long jetty projection and the probable wave refraction and diffraction effects around the point. A robust jetty structure will be required as at Site 1.

The perceived sea condition / exposure benefits of the "Northern Bay" Sites 2 and 3 would likely be minimal compared with Site 1. Any benefit would be outweighed by other project considerations including the absence of existing access infrastructure and the requirement for longer more costly jetties due to the shallower water within the embayment.

2.1.4.4 Marine: Safe Pedestrian Access

At the present Fisherman's rock landing site there are no dedicated facilities for passenger access/egress, with ad-hoc vessel gangways and ladders being deployed directly onto the rock or beach, depending upon the tidal state. Although this has been permissible for the current level of operations, the level of service could undoubtedly be improved with a dedicated jetty that minimises the health and safety risk to passengers while improving 'all tide' accessibility.

For all three potential jetty sites:

- Ideally an 'all tide' jetty head with safe level egress/access points to/from the ferry will be provided. This can be achieved with either:
 - 1) A multi-level stepped platform complete with anti-slip decking that is subject to tidal inundation (like those found at Shelly Beach or Ruawai boat club ramp), or;
 - 2) A floating pontoon against which vessels berth with an access ramp up to the fixed jetty structure. NOTE: the feasibility of this option will need to be fully assessed following site specific metocean studies, but at this stage it is considered unlikely to be suitable for the anticipated exposure at Site 1 where it will likely be insufficiently robust for the expected prevailing winds, wind-waves, and swell waves.
- Ideally the jetty head would be orientated parallel to the strong tidal flows (i.e. parallel to the channel and shoreline). This would allow a vessel to berth 'bow in' to the currents and dominant waves. In addition, and if practicable, the alternative option of being able to dock perpendicular to the shoreline may be an advantage should wind-waves be approaching from the east. Again, this would need to be assessed following site specific metocean studies. Consequently, different jetty head shape arrangements might offer the potential for multiple berth options to suit changing wind and sea conditions.

2.1.4.5 Landside: Adequate Unobstructed Vehicle Access

It is preferable that vehicle access be provided to the root of any jetty to enable pick-up and drop-off of passengers or cargoes. Vehicle access also assists for future structure inspection and maintenance. At this stage it is unknown whether KDC

would require vehicle access onto the jetty itself for either cargo handling or future structure maintenance purposes.

The existing vehicle access provisions or the ability to accommodate future vehicle access at the three sites is discussed below:

- Site 1) – Pouto Point

There is enough room for two-way vehicle access with turning facilities close by at the existing car park above the beach. There is only a single lane 4x4 access to the beach, and no pedestrian walkway out to the landing point near Fisherman's rock.

It is expected the most practical place for a jetty would be alongside the sandstone outcrop beside Fisherman's rock. Passenger access to the jetty would need to be improved with a higher level robust walkway (or even a light vehicle access route for cargo handling). Potentially a three-point turning area could also be provided.

These improvements would involve a sufficiently high paved reclamation area protected by an armourstone revetment to resist wave induced erosion and overtopping. A suspended deck timber board walk is not recommended, due to potential damage from wave action during storms, and an increased condition inspection and maintenance obligation over its design life.

- Site 2) – Marine Hall Reserve

Vehicle access at this site is not viable. Even pedestrian access is considered difficult. The existing shoreline cliff and steep banks limit landside access with minimal space for the development of any facilities at the jetty root.

From Signal Station Road there would need to be extensive earthworks and modification of the hillside. Retaining walls and/or slope stabilisation would be necessary to provide flat space suitable for parking vehicles distant from the jetty. Land purchases would also be required at the high elevation site and adjacent to the foreshore. The loss of the camping ground amenity overlooking the water would also be undesirable as it is one of the features and attractions of Pouto Point.

Alternatively, walking only access could be provided to this site. This has the same drawbacks as identified for Site B and would likely require steep steps up the cliff that would prohibit accessibility to less mobile ferry users.

Similar to Site 3, the relative remoteness of the jetty also isolates passengers and ferry users from Pouto Point beach where most of the local attractions are accessed

- Site 3) – End of Signal Station Road

There is no vehicle access from the end of Signal Station Road; presently only a walking track is available. To get vehicles to the lower level there would need to be a land purchase and significant earthworks likely involving retaining walls and/or slope stabilisation to hold a concrete driveway. Even then space and access would be tight.

Once down on the lower level, the site is constrained by the presence of the foreshore cliff, which allows no space to turn. An option to provide turning space would be to undertake a reclamation of the foreshore (within the legal land title).

Any reclamation would need to be of a sufficiently high level with an armourstone revetment to provide erosion protection and limit wave overtopping during storm surge events. Potentially there would also need to be armouring of the neighbouring shoreline to limit any potential 'end effects' caused by the reclamation. This would be a complex and expensive undertaking. There is a high risk that resource consent permission for reclamation in the Marine Conservation Area may not be given.

A different vehicle access route could be via the farm road to the north, but this further isolates passengers and ferry users from Pouto Point beach where most of the attractions are. It would also require additional and larger land purchases.

An alternative option is to only provide walking access to this site. The remoteness of the area followed by a short but steep walk to the end of Signal Station Road is not ideal, and it would not allow for cargo transport.

2.1.4.6 Environmental Impact of Potential Jetty Location

The potential impacts of jetty location on the environment and surroundings will be an important consideration, especially during the consenting phase of any future project.

The following commentary is provided in relation to a high-level qualitative assessment of the three sites:

Site 1) – Pouto Point

- This site is considered to have the least impact.
- There is already an existing access road, car park and beach access point for tourism related excursions to the lighthouse.
- Historically there was a jetty near this location up until the 1950s.
- As an open-piled structure, any new jetty extending across the beach zone would continue to allow wave and tide movements that enable sand sediment transport processes around Pouto Point past Fisherman's rock.
- Angler access to Fisherman's rock will continue and this local feature would not be affected by the new structure; the intent would be to minimise impact by aligning the jetty just to the south of Fisherman's rock.
- The footprint of any new turning area and jetty access would seek to minimise reclamation and would have an armourstone revetment for erosion protection. The existing beach access point would be maintained and upgraded.

Site 2) – Marine Hall Reserve

- This has a moderate impact on the foreshore and seabed but could potentially involve the largest disruption to the hillside land within 20 m of the foreshore, for levelling of the campground to enable vehicle parking and access.
- As the mid length jetty option, there would be a moderate extent of disturbance to the rock shelf ecosystem during construction. Because it is open-piled it would continue to allow normal wave and tide movements across the shelf.

- To provide vehicle access and parking behind the jetty, extensive landside earthworks and cuts to the existing cliff-line and sloping ground would be required.
- Alternatively, only pedestrian access might be provided but this would still require cutting of the cliff for ramp or stair structures. Some loss of the foreshore would also be unavoidable.

Site 3) – End of Signal Station Road

- Of the three site options this has the largest impact on the foreshore and seabed.
- To provide vehicle access to the jetty a new road is needed down the hillside from Signal Station Road.
- A sizeable reclamation of the foreshore would be required to provide parking and turning, with consequential habitat loss.
- As the longest jetty this would entail the most disturbance of the rock shelf ecosystem during construction. Because it is open-piled it would continue to allow normal wave and tide movements across the shelf.

2.1.5 Summarised Pros and Cons

Site	Pro	Con
Site 1	<ul style="list-style-type: none"> • Very good existing access • Existing legal “paper” road beach access. • Very good parking nearby • Existing public amenities and toilet • Site near level • Close to beach attractions • Functional for present • Close to deep water 	<ul style="list-style-type: none"> • Visual impact on natural environment but historical context provided considering the previous jetty at the same site • Exposure
Site 2	<ul style="list-style-type: none"> • Sheltered from wind • Away from Fishermans rock • Close to Pouto point but still a strenuous walk for passengers • 	<ul style="list-style-type: none"> • Two land title purchases required • Vehicle access not viable. • Cliff very steep requiring walking track or stairs. Difficult for those with mobility issues • Very high cost
Site 3	<ul style="list-style-type: none"> • Visual impact • Remote location away from Fisherman’s rock - long walk for passengers 	<ul style="list-style-type: none"> • Single land title purchase required • Wharf 4X longer • Vehicle access difficult • Reclamation planning risks • Cost of reclamation • Steep walking track • Distant from Pouto Point • Very high cost

2.1.6 *Recommendations*

The Pouto Road Site 1 is recommended as it is expected to be more economic to develop into a facility that will match the demand.

A suitably sized piled jetty structure would need to be founded into the sand and underlying bedrock. A paved reclamation turning area and access way would likely need to be formed between the jetty and the existing access track, which would also require upgrade. The reclamation area would require erosion protection in the form of an armourstone revetment, with a 4x4 beach access ramp.

The upgrades that are to be costed are:

- Steel or concrete piled jetty with an appropriately angled head complete with fendering and mooring systems, services provision (e.g. lighting), deck furniture (guardrails, safety and historical/cultural context signage, lifesaving equipment, safety ladders etc.), tidal access steps or ramps.
- Paved reclamation turning area and accessway with 4x4 beach access ramp.
- Armourstone revetment.
- Upgrade of the existing access track.

2.2 Kelly's Bay

The facility at Kelly's Bay is to be assessed for its suitability for car ferry operations.

See Appendix A2 for photos of the site.

2.2.1 Location

Kelly's Bay boat ramp is located at:

Address: Kelly Bay reserve, Off Bay View Road, Kelly's Bay Road, Pouto 0391.

Coordinates: Lat: 36°14'48.86"S Long: 174° 6'7.95"E (WGS84)

Directions: 250m East of Dale Rr and Bay View Road Intersection.

2.2.2 Site Layout & Geometry

The general arrangement of the site is shown in Figure 10 below.

The assets at the eastern head of the bay consist of an 'all tide' recreational boat ramp with timber marker piles and an old jetty in disrepair, which was not checked as part of this assessment.

The 'all tide' status is somewhat misleading as the concrete boat ramp is of limited length. A section of intertidal sand foreshore must be traversed by vehicles at low tide for the launch and recovery of trailer mounted boats.

There is also an existing beach access / high-tide boat ramp to the west of the point.



Figure 10: Kelly Bay General Site Arrangement

Details of the Facility are shown in Table 2.2 below.

Table 2-4 : Details of the Facility – Kelly's bay

Boat ramp & General	Element	Detail
Access	Length	From Dale Road Intersection 250m length by 3m wide chip sealed
Ramp	Ramp	Moderate to good 1- 100m long (overall) across intertidal sand flats to MLWS tide line 2- Concrete in moderate to good condition 3- Very gentle slope so car ferry may have trouble getting close enough to disembark cars at mid-tide levels
	Parking / queuing area	Moderate to good 1- Gravel manoeuvring and Parking for 2-3 cars adjacent to ramp 2- Queuing limited at Ramp, (May need to queue down the road around corner, 100m away at reserve carpark
	Services	Poor 1- Single street light column with signage and litter bin
Jetty		V-Poor 2- No All tide wharf exists at Kelly's Bay 3- Deep water is approximately 100 of the MHWS at the point

2.2.3 Background

No Resource Consent documentation relating to the 'all tide' ramp site was found with Northland Regional Council (NRC).

2.2.1 Existing Level of Service of Assets

Currently the facility accommodates the following level of service:

- A public 'all tide' concrete recreational boat ramp at the eastern head of the bay that requires vehicles to traverse the sands at low tide for boat launch and recovery.
- A public beach access / high-tide boat ramp 50 m due west of the 'all tide' boat ramp at the head.
- Numerous small private tidally restricted jetties that do not appear to be in-service.

2.2.2 Sea Conditions / Site Exposure

Kellys Bay is located approximately halfway up the Wairoa River arm of Kaipara Harbour on the eastern side of the Kaipara Head peninsula (Figure 11). It is therefore well sheltered from the heavy seas of the open coast and harbour mouth. In the

absence of site specific metocean studies it is reasonable to assume it will only be exposed to directional wind-waves generated in the available harbour fetch lengths from the north to the south east. These waves will also be depth-limited as they approach the shallows of Kellys Bay.

A desktop review of publicly available information indicates tidal current flows of up to 1.5 Knots during spring tides in the deep water at Martine Point near Opuna Bay at the upper reaches of the Five Fathom Channel, 3 km southeast of Kellys Bay (Figure 9).

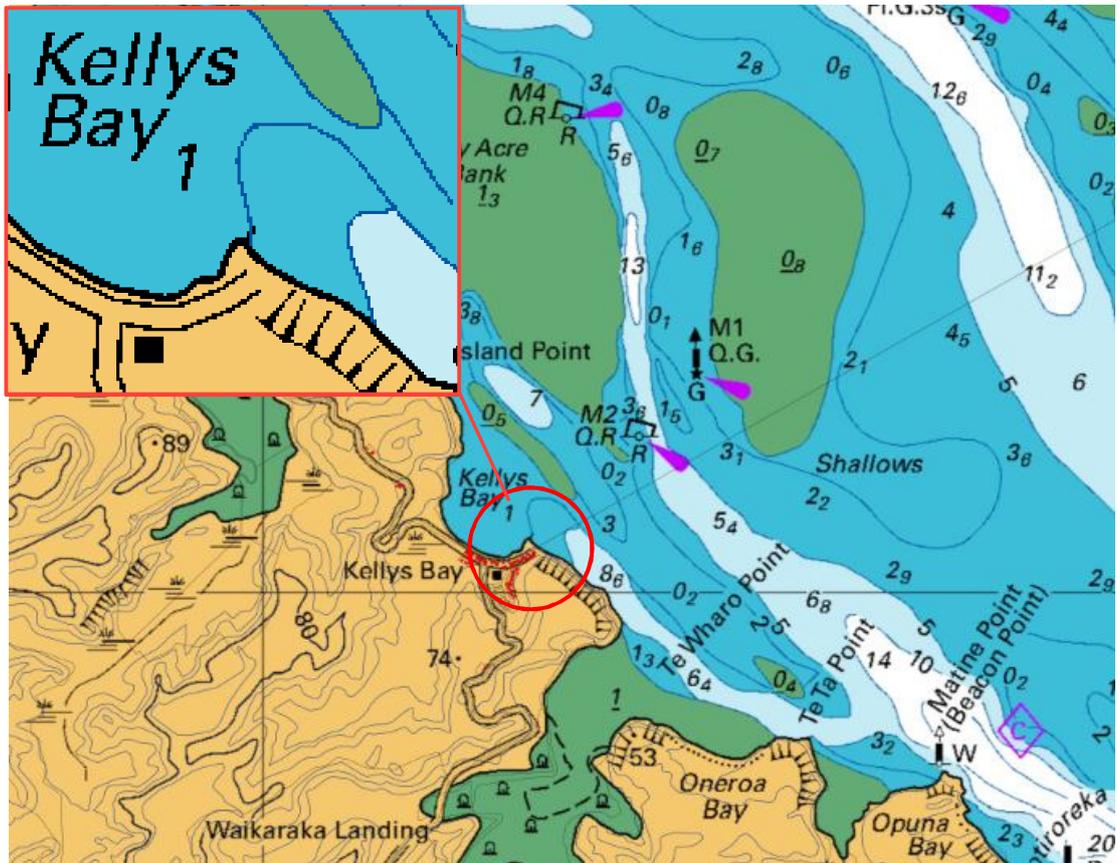


Figure 11: Extract from Chart NZ 4265 Kaipara Harbour showing Kellys Bay (LINZ, 2018)

Near shore currents at Kellys Bay might conservatively be assumed in the region of 0.5 to 1 Knot, although they are probably much less given the shallow site bathymetry of -1 m Chart Datum (CD).

2.2.3 Boat Ramp Condition Assessment

The 'all tide' boat ramp is in Moderate condition. It is one lane wide and adequate for small trailer launched recreational boats only. There are a series of painted timber marker piles identifying the seaward approaches to the ramp. There are also three larger legacy piles to the east that may have been intended for use as fender or mooring piles or could simply be the remains of an old lead-in jetty structure. The condition of the piles was not investigated but they are highly likely to require replacement if the site was to be converted to accommodate a car ferry operation.

Landside vehicle access is very limited with minimal room for turning or parking.

2.2.4 Preliminary Options

The following preliminary layouts have been considered for this site



Figure 12: Kelly's Bay Proposed layout

2.2.5 Discussion

The Kaipara Moana Business Case outlines that this asset will need to accommodate the following operations;

- Roll on roll off (RORO) car ferry operation.
- Ferry wharf for the Southern Pouto peninsula (as weather back up to Pouto Point)

The most important function of a RORO or Ferry facility is the safe and efficient movement of vehicles and people to and from ferries.

Focussing attention only on items, components or tasks that need the most attention, the key elements at this site are:

2.2.5.1 Marine: Jetty

There is no suitable all tide jetty at Kelly's Bay. However, if a back up to Pouto Point is desired for the south end of the peninsula, a suitable structure could be developed at the southern point alongside the existing slipway.

Deep water is estimated to be 100 m out from the shoreline and carpark. There are expected to be strong tidal flows and a T head structure to allow vessels to bow into the flows would be recommended.

The site is still exposed to the potential of eastly storms but is less exposed to the open sea conditions like at Pouto Point. Thus, a more economic structure should suffice here (predominantly timber).

2.2.5.2 Marine: Adequate Ramp

Currently the ramp is suitable for small recreational craft and the concrete surface extends below the MHWS tide level but is at two different slopes. The first sloped

section drops steeply to the intertidal foreshore, but is manageable for 4x4 vehicles or tractors.

The ramp then levels out at a much gentler grade, matching the existing sand foreshore. It is probable that some sections of the concrete ramp are hidden under the sand, while farther out to MLWS tide level some sand-only areas might have to be traversed.

Although the existing ramp is suitable for use by vehicles with high ground clearances (i.e. 4x4 and tractors), it is not suitable for car use during a RoRo ferry operation. This is because at low to mid-tide levels the shallow foreshore would not provide sufficient underkeel clearance for the ferry to get far enough inshore to land on the dry portion of the boat ramp. This would result in cars being flooded as they attempted to access / egress the vessel ramp.

This would have to be resolved with the construction of a new wider, higher and more suitably sloped ramp (e.g. 1V:10H) to suit the design vessel's particulars and ramp geometry. Potentially this would have to extend well beyond MLWS tide level with a vehicle access approach constructed on reclamation across the intertidal zone.

Alternatively, an approach channel might be dredged across the intertidal zone to reach sufficiently deep water (note the end of the natural -8.6 m CD subtidal channel to the southeast in Figure 11). A dredged channel would likely require sheet pile walls to retain the adjacent beach profile. Regular and costly maintenance dredging would also be necessary to prevent siltation and infilling of the channel.

Both options could allow RoRo vessels to operate quickly and efficiently in all weather and tides. An upgraded all-weather sealed surface would also be needed connect the ramp to the existing access road and any new car park and queuing areas.

2.2.5.3 Marine: Vessel Navigable Access

The access channel should extend far enough seaward to provide safe underkeel clearance for operations at MLWS tide. This appears to be approximately 100m without dredging.

2.2.5.4 Marine: Adequate Navigation / Fender / Mooring Systems

The site is unlikely to have strong tidal current flows as already identified in Section 2.2.2. Suitable channel marker, fender and mooring piles to assist docking should be provided parallel to any new dredged channel and ramp structure. These might be required on one or both sides and would likely also require an access jetty for any mooring lines handling and maintenance access.

2.2.5.5 Landside: Queuing / Marshalling

Currently there is only parking room available at the Ramp for two to three cars, or a single 4x4 and boat trailer. The turning area is equally limited, being constrained by the adjacent cliff. There is no room for both turning and queuing adjacent to the ramp. The sealed road approaching the ramp is single lane width for 100 m, so not suitable for queuing or the two-way traffic that might occur when a ferry is unloading.

This issue may need to be resolved depending upon passenger numbers and RoRo operation demands. Alternatively, there is adequate parking and queuing at the grassed reserve approximately 130 m back up the access road. This area is not in direct line of sight to the ramp so a traffic light system might be necessary to

indicate when a ferry had unloaded and was ready to receive queued traffic awaiting the return trip.

2.2.6 *Recommendations*

With regards to a potential passenger ferry service, it is recommended that a jetty be constructed alongside the slipway at the southern point. This would extend approximately 100m from the shore and should include a T or L head or similar, and submerging steps with gripped decking.

Although portions of the existing recreational boat ramp concrete are still intact a new fit-for-purpose ramp would need to be constructed of greater width and improved level and gradient to suit 'all tide' RoRo ferry operations. This could require reclamation across the intertidal zone or access channel dredging.

Due to the tight access it is recommended the parking area be sealed and parking arrangements and turning areas be formalised with line marking. A priority give way system should also be established on the access road and that overflow parking / queuing and signage be provided at the reserve 100m to the west.

The upgrades that are to be costed for a new ramp are:

- Construction of a 10 m wide concrete ramp suitable for RoRo operations.
- Construction of an approach reclamation across the intertidal zone or a sheet pile dredged channel.
- Fender and mooring piles with access jetty for lines handling.
- Improved lighting and services provision, including signage and/or traffic signal system.
- Upgraded shoreline protection.
- Sealed car park.
- Parking and queuing at the reserve.

The upgrades that are to be costed for a new jetty are:

- New timber jetty
- New concrete pontoon and associated aluminium gangway
- Sealed car park
- Parking and queuing at the reserve.

3 Cost Estimates

On top of the previously noted recommendations for the sites, the cost estimates also include for design fees, establishment, and other ancillary works necessary to complete the projects.

Given that this is a high-level estimate with a number of unknowns, a margin of error equal to +/- 30% is deemed appropriate.

The cost estimates have been split for both sites. Sites A, B and C at Pouto Point have been costed based on the options shown in Figures 6, 7 and 8. Kellys Bay options are shown in Figure 12.

Table 3-1 : Summary of Estimates for Pouto Point Options

Site	Estimate	Contingency	Final Estimate
Site 1	\$975,000	30%	\$1,267,500
Site 2	\$1,687,500	30%	\$2,193,770
Site 3	\$2,812,000	30%	\$3,656,250

Table 3-2 : Summary of Estimates for Kellys Bay Options

Site	Estimate	Contingency	Final Estimate
Jetty and Pontoon	\$982,500	30%	\$1,277,500
Ramp	\$1,290,000	30%	\$1,677,000

4 Recommendations

As has been previously noted, this report only provides rough-order cost estimates. To refine the estimate to a point where there is reasonable cost certainty, KDC will need to engage relevant experts to perform the following, non-exhaustive, list:

- Establishment of design criteria, vessel usage, and specific Level of Service (LOS) requirements
- Detailed inspection work including, but not limited to, low and high tide inspection from boat, dive survey, chloride ion testing of reinforced concrete elements, coring and inspection of timber elements.
- Search of KDC archives for structure design and as-built drawings.
- Perform structural analysis to ascertain loading capacity of existing assets.
- Assessment of bathymetry and dredging requirements for all tide access of proposed vessels.

5 References

- Discovery Marine Limited C/o Tonkin & Taylor (2003). *Report of Survey - Pouto Point - Kaipara Wharf Design*. Kaipara District Economic Development Trust .
- Tonkin & Taylor Ltd (2002). *Pouto Point Wharf Options Report*. Kaipara District Economic Development Trust: G.W.Pearce.
- Te Uri O Hau pouto Waikareetu Resource Management Unit. (2003, June 9). Pouto Cultural Impact Assessment

Appendix 1

Site Photographs

Pouto Point

Pouto Point
Fisherman's
Rock



Pouto Point



Pouto Beach



Pouto Point
Fisherman's
rock looking
North to
Northern bay



View landward from Fisherman's Rock to beach access point



Pouto Point
Typical
passenger ferry
beach landing
(photo by
others)



Pouto Point and cliff at campground site 2 - Bedrock and wave cut platforms visible at foot of cliffs



Cliff at Site 2
Campground –
Note ad-hoc
erosion protection
at base of cliff for
properties above
(stone rip-rap,
concrete
demolition rubble
and gabion
baskets)



Campground site 2
- too steep for
vehicle access



Site 3 Northern Bay
- wide shallow
intertidal beach
zone



Site 3 - Bedrock and wave cut platforms visible at foot of cliffs



Access to Site 3



Site 3 - Ad-hoc
concrete block
erosion
protection at
MHWS tide level

Thin veneer of
sand over
bedrock with
wave cut
platforms visible
at foot of cliffs



Site 2 & 3 at
"Northern Bay"
viewed from
high ground at
Pouto Point.
Note extent of
shallow water
seaward of
MLWS tide level



Kelly's Bay

Concrete boat ramp and timber marker piles viewed at high tide



Ramp turning area at foot of cliff



Ramp access



View landward on concrete boat from shallow intertidal area at low tide



Potential queuing and parking areas 100m from ramp



View south east on boat ramp - note insitu mass concrete pours for bank erosion protection either side of ramp



View on boat ramp at mid-tide



wsp

wsp.com/nz