

Piha South Road Reserve

Dune Management



Review and Proposed Management Plan

Prepared for Auckland Council

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1. Introduction

1.1 Purpose of Review

The study for this report is the area of Piha along Marine Parade South (south of Lion Rock) (Figure 1), one of New Zealand's most iconic beaches and a popular destination for surfing and swimming.

The high levels of use and strong onshore winds have, historically, resulted in significant damage to critical sand trapping vegetation on the natural dunes backing the beach, leading to problems with wind erosion damage and windblown sand. Historically, the dunes and back beach areas have also been altered by various human activities – including subdivision and development, roads and car parks, and stream training and reclamation.

Eco Nomos was engaged by Council to review dune management at in this southern area of Piha Beach to date, to identify further work required in the short term to improve the containment of the dune sand, and to produce a management plan to guide future management and maintenance of the dunes.

1.2 Area Relevant to this Review

The area of Piha Beach relevant to this review is the area extending from the dunes on the southern side of Piha lagoon to the south end of Marine Parade (Figure 1). It includes:

- The dunes fronting the surf club car park and private properties to the north
- The Moana Stream entrance area
- The dunes fronting the southern car park and private properties to the south, as well as the large dune at the very southern end of the beach seaward of the boat launching access road. (The large dune at the south end, together with the access road and boat launching road are part of the Waitakere ranges Regional Park).

The area is approximately 550 metres in length.

For this purposes of this review, this area is referred to as Piha Beach – with the areas north of Lion Rock referred to as North Piha. The study area is also occasionally referred to as South Piha but that term has been avoided in this report except where it appears in quotes from other sources.



Figure 1: Area of Piha Beach relevant to this review

1.3 Work Undertaken

The work undertaken during the review included:

- Site inspection and assessment of recent dune management works and present dune condition
- Review of dune condition and changes over time using historic photography
- Review of available information on coastal processes and trends – including the previous work by NIWA (2006) and beach profile data held by Auckland Council (including surveys to October 2011)
- Consideration of earlier work - including the decision by Hearings Commissioner former Justice Arnold Turner decision in 1992 (often known locally as the Turner Decision), the Piha Coastal Management Plan completed in 2000 (WCC, 2000), Piha Reserves Management Plan and outcomes from the two 2009 Community Open Days on Piha Beach and dunes (WCC, 2009)
- Informal discussions with representatives and individuals from various stakeholder groups - including Piha Ratepayers and Residents, Piha Coastcare, Piha Boardriders, Piha Surf Life Saving Club and a beachfront landowner. These informal meetings discussed matters related to dune

management – including any concerns, activities and interests that need to be taken into account, and suggestions to ensure future dune management continues to improve and is widely supported.

- Review of the draft Management Plan by Council staff.
- Workshop with Local Board
- Community workshop ... (to come).

2. Coastal Processes and Shoreline Trends

This section discusses the coastal setting of Piha Beach and the consequent shoreline trends experienced – which have significant implications for dune and coastal management at Piha.

2.1 Description and Coastal Setting

Piha Beach is approximately 2.6-2.7 km long. The embayment in which the beach is contained (sometimes called Piha Bay) is formed by headlands at either end which extend approximately 300-500 m seaward from the beach. The beach is backed by dunes over most of its length, the total width of dunes varying from 50m to in excess of 200 m. The dunes are backed by relict sea cliffs cut into the Waitakere Ranges. The isolated promontory of Lion Rock divides Piha Beach into Piha and North Piha.

The beach is characterised by high wave energy with a modal wave height somewhere between 1.5-2.5 m (up to 6.5 m in storms) and mean wave periods of 12 seconds (NIWA, 2006). During storms, breaking waves can extend more than 500 m offshore. The seaward edge of the active beach system and cross-shore sand transfer probably extends to water depths of at least 6-8m and possibly deeper.

Piha Beach is also part of a much larger scale interconnected sand system - that extends from Taranaki to North Cape. The beach sands along this coast, including those at Piha, are ultimately derived primarily from erosion of andesitic volcanic materials in Taranaki – over time undergoing a net northwards movement by waves. There may also have significant historic contribution to west coast sands from the Taupo Volcanic Zone via the Waikato River but this is now minimal as the river is dammed in upper regions.

The beach also lies only a short distance north of the large Manukau Harbour entrance. The harbour entrance disrupts the northwards longshore movement of sediment – with the sediment tending to accumulate and bypass the entrance in large “slugs” of sand. This has a significant effect on shoreline trends observed at Piha – as discussed in more detail below.

2.2 Shoreline Trends at Piha Beach over the last 70-80 Years

Piha Beach has been undergoing an overall trend for shoreline advance since at least the 1930's (and possibly earlier). While periods of erosion have occurred within this period, the overall trend has been for net shoreline advance (NIWA, 1999 & 2006).

This shoreline advance reflects the northward alongshore movements of colossal volumes of sand bypassed past the Manukau Harbour entrance to Whatipu over the last 150 years.

The earliest recorded period of shoreline advance occurred at Whatipu between 1844 and 1910 when the shoreline prograded several hundred metres from the cliffs behind. This was followed by a period of erosion. A second and even more significant period of shoreline advance has occurred since the mid 1930's, causing the shoreline at Whatipu to advance seaward by up to approximately 1400 m between the 1935 and 1954 (Williams, 1977).

The very large volumes of sand which have accumulated at Whatipu over this period are evident in aerial photographs of this area (Figure 2). Prior to this accumulation the shoreline lay along the rocky cliffs behind.

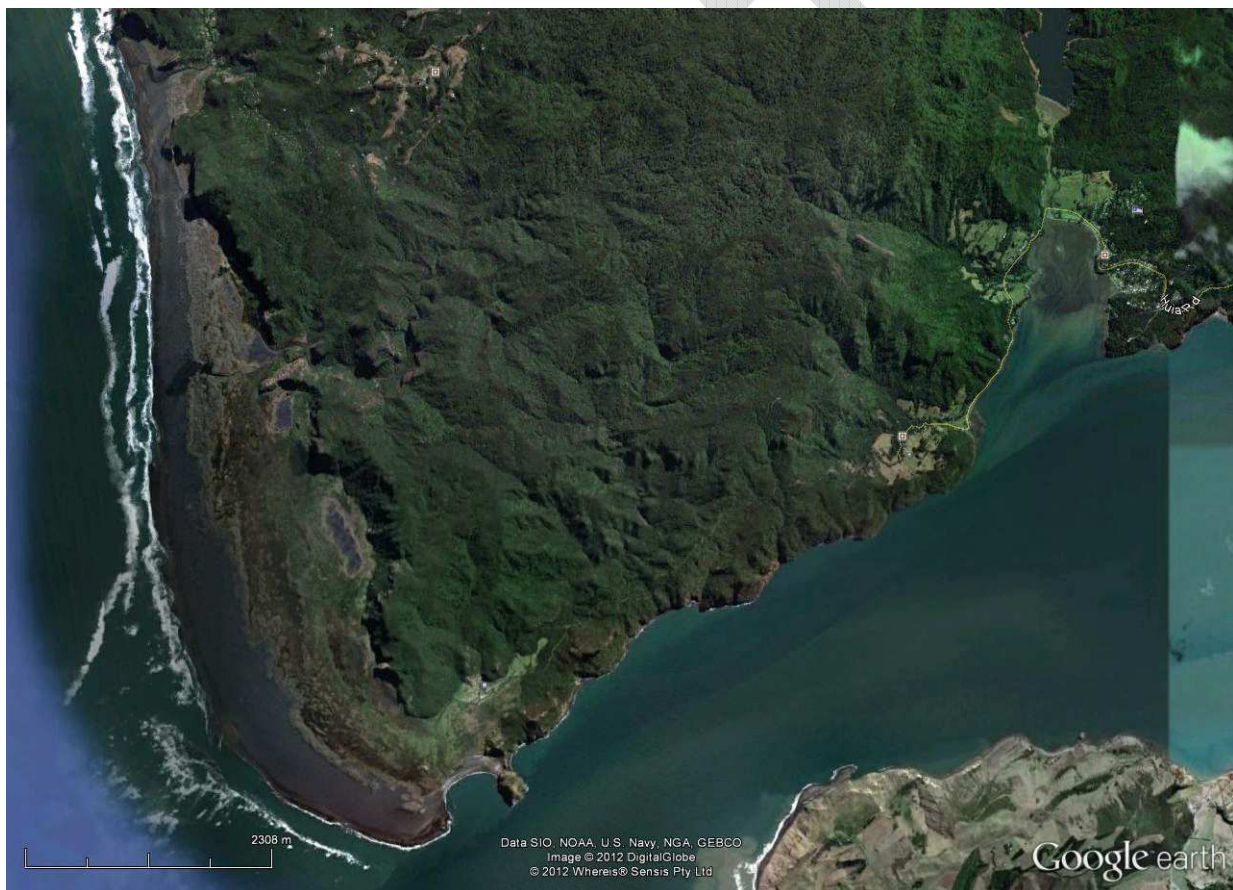


Figure 2: Sand accumulation at Whatipu

The large volumes of sand that have bypassed the Manukau Harbour to Whatipu are being progressively moved northwards causing shoreline advance at both Karekare and Piha.

For instance, several years ago access from Karekare to Whatipu was only possible at low tide. However, the shoreline has now built out to the point that it is now possible to walk from Karekare to Whatipu even at high tide.

Photographs in Sandra Coney's book "Piha - A History in Images" (Coney, 1997) suggest the shoreline advance at Piha had commenced by the 1930's and perhaps even earlier.

NIWA (2006) mapped shoreline changes at Piha between 1940 and 2000 and found that over the 60 year period, the beach experienced an overall average annual rate of shoreline advance of about 0.4 metres per year at the southern end of Piha Beach, about 1.2 metres per year in central areas and 0.8-1.1 metres per year at the northern end. While periods of erosion were also experienced, the overall trend has been for significant shoreline advance.

Beach profiles surveyed at the southern end of Piha Beach by Auckland Council indicate that this shoreline is continuing to advance seaward in front of the surf club (Figure 3) and the landward end of the southern car park.

The volumes of sand required to effect shoreline advance of this scale along Piha Beach are huge - as the seaward edge of the beach system lies over 500 m offshore and the entire beach width has to build.

Scientific and engineering formulations have been developed to estimate the volumes of sand required to cause a given beach to advance seaward because beach nourishment (i.e. placement of sand to enhance a beach) is a very common practice overseas (e.g. eastern United States, Holland). Application of these methods to Piha indicates that 1 metre of net shoreline advance along the entire 2.6-2.7 km length of Piha Beach requires at least a million cubic metres of sand and probably much more.

2.3 Likely Future Shoreline Trends at Piha

It is difficult to reliably estimate how much longer the Piha Beach shoreline will continue to advance and how much further seaward it will ultimately extend. However, there are still very large volumes of sand stored at Whatipu (Figure 2) and it is likely that, ultimately, most of the sand stored here will move northwards.

The understanding of the details of this movement is still poor - but it is likely that Piha Beach will continue to experience an overall trend for net seaward advance (albeit with occasional periods of erosion) for some time, probably decades.

On the basis of existing understanding, it is difficult to reliably estimate the total shoreline advance that will occur at Piha and the rates of this advance. At the southern end of the beach relevant to this review, the long term rate of advance has varied from an average of 0.4 m per year (the average rate noted by NIWA between 1940 and 2000) to in excess of 1 m per year (the higher average rate evident in the beach profile record). It is possible that future rates will lie in this range, though by no means certain. It is important to also remember that the historic rates were long term averages and the changes in any given year often varied significantly.

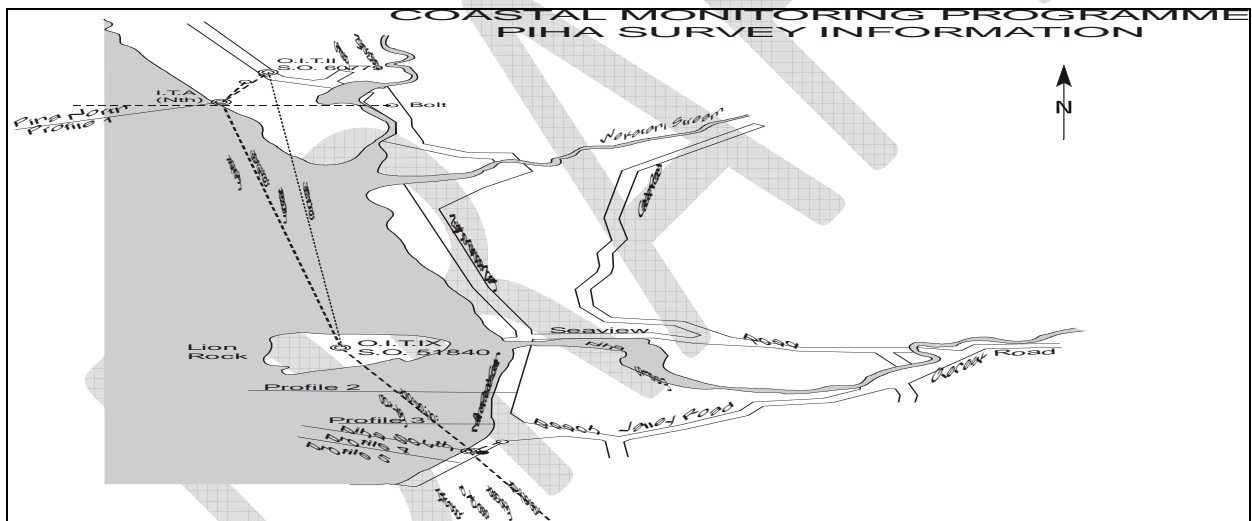
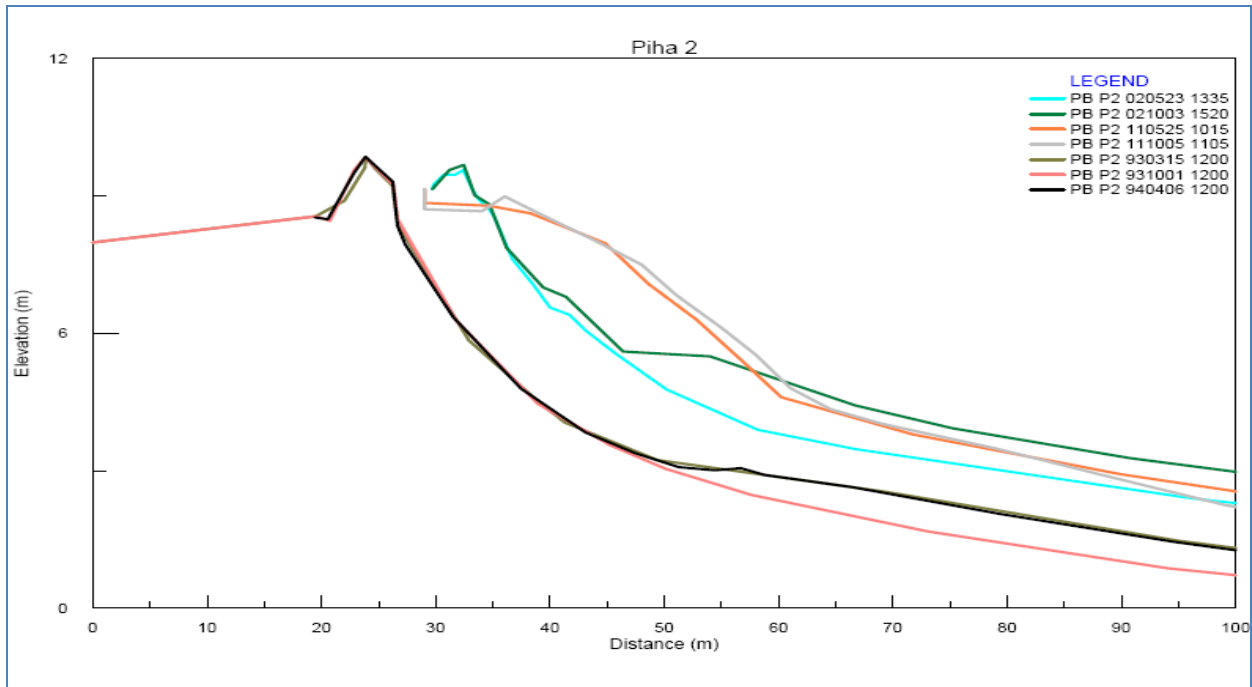


Figure 3: Selected surveys conducted at Auckland Council beach profile site Piha 2 (top) showing progressive shoreline advance over time since surveys commenced in 1993. The most landward profiles are from 1993 and 1994; the mid profiles from 2002 and the most seaward profiles date from May and October 2011. The beach profile monitoring site is located near the surf club as shown in the location map (bottom) – where it is labelled “Profile 2”.

2.4 Implications of Ongoing Shoreline Advance for Piha Beach

The ongoing shoreline advance has significant implications for Piha Beach.

Many of the surfing and swimming values of Piha Beach in particular relate to the embayed nature of this area and to the partial sheltering from (and refraction of) the prevailing southwesterly swell around the southern headland. These values may be diminished as the beach continues to advance seaward and the area gradually becomes more exposed.

For instance, a long-standing Piha surfer advises that the shoreline advance to date has already eliminated a very popular surf break that used to exist between Pakiti and the shore (Mr Barry Davis, pers. comm.), a break variously known as the “reform” or the “ditch”. Mr Davis notes there was a strong current that ran through this area, landward and southwards around Pakiti and then out to sea - creating a deep gully and providing useful surf break as well as an important fishing area. With the very large volumes of sand that have moved into this area from Whatipu in recent decades, the beach has now built out and it is no longer possible to surf this area. The rip is now seaward of Pakiti.

Lifeguards also advise that the shallowing of the beach has made the situation around the rocks at the south end more dangerous because the areas have become more accessible. They also advised that the shoreline advance means that it has been much easier to walk around some seaward areas of Lion Rock in recent years.

2.5 Can the Shoreline Advance be stopped by Human Intervention?

In a word, no.

The reason for this is simple – the sand volumes being input to Piha are simply huge and the scale of these natural changes is beyond reasonable human control.

For instance, NIWA (2006) estimated that the shoreline area increased by just over 121,000 square metres between 1940 and 2000. They calculated that even the limited volume of sand stored above mean sea level (i.e. about mid tide) was about 700,000 cubic metres.

Given that the seaward edge of the beach system at Piha extends over 500 m seaward to depths of at least 6 m below mean sea level (probably deeper), it is obvious that the total volumes required to effect the shoreline change were huge. For instance, assuming the seaward edge of the beach system is as shallow as only 6m, formulas used to calculate beach nourishment volumes suggest that at least 60 million cubic metres of sand were required to cause the increase in shoreline area noted between 1940 and 2000 alone. If the seaward edge of the beach system is deeper, the calculated volumes would be even larger.

2.6 Will the Shoreline Advance eventually cease naturally?

Yes. While the Piha shoreline seems likely to continue to advance seaward for the foreseeable future for the reasons noted above, a point will eventually be reached when the volumes of sand moving northwards alongshore out of Piha exceed the volumes arriving. The shoreline will then cease advancing.

Moreover, Piha is not the final destination of the large ‘slug’ of sand gradually being moved alongshore from Whatipu. This slug of sand will eventually move past Piha. As it does so, the shoreline at Piha will eventually experience a sustained period of shoreline erosion.

The work by NIWA (2006) suggests that this future period of retreat may well remove most or even all of the sand that has accumulated over the last 80 years or more. Accordingly, as emphasized in the Piha Coastal Management Plan, it is not appropriate to assume the dunes will also be there. In the long term, development and infrastructure in these areas may have to be retreated landward.

It is very difficult to usefully predict when this sustained period of erosion will commence – but it does not seem likely within the next few decades, given the large volumes of sand still stored at Whatipu.

2.7 Implications for Dune Management

The ongoing trends have significance for dune management for a number of reasons.

Firstly, beach advance causes dune advance – so as the beach builds seaward due to the input of sand from Whatipu, the dunes behind the beach will also advance seaward. Similarly, in the long term future, when the beach erodes, the dune will also erode.

The present seaward advance of the beach and dunes at Piha will also affect windblown sand. Historically, the natural dunes along the back of Piha Beach were narrowed by encroachment of human development (discussed further in Section 3). These narrow dunes give rise to increased issues with windblown sand - which will diminish as the dunes prograde seaward and the zone of sand trapping vegetation seaward of roads and properties, increases.

The seaward advance of the dunes will also create sufficient space behind the critically important sand trapping vegetation to provide for improved amenity over time if desired (for example, raised areas that can be grassed to provide elevated viewing areas).

Seaward advance of the dunes also acts to help limit dune height. A stationary dune would grow higher over time because more sand is added to the dune face and crest.

On the negative side, the dunes on the immediate northern side of the Moana Stream entrance (often referred to locally as “artificial dunes” as they were man-made and occupy an area that was previously part of the stream entrance) will probably tend to push the stream entrance into the dunes fronting the southern car park – aggravating erosion of these narrow dunes (particularly towards the eastern end of the car park). However, as discussed later in the report, there are means of addressing this and potential to return the stream entrance to a more natural state. (Rocks and rubble in this area have already been removed by Council but a local advises that a great deal more lie within the dune and general area).

The ongoing trends for shoreline advance also have impacts on dune management because they have been poorly understood by some parties and the shoreline advance has even been attributed to dune management by some parties. By way of example, the following quotes are taken from an article on a web site by an influential local surfer:

“When the tide went out at South Piha, everything changed. The surfing moved out to the famous Piha Bar beside Camel Rock which was in its prime This was before the Sand dunes at

South Piha had been built with earth movers and there was no outer sand 200 meters off the beach to defuse the Tasman swells”.

And again:

“Unfortunately though, in 1995 it all ended. The legendary Piha Bar disappeared. The famous reform at the south end of Piha, a.k.a. the 'ditch', became filled in with sand as the man made dunes advanced down the beach and the strong surf culture that Piha had known for 40 years started to fade.”

The concern at the loss of the surf breaks is entirely understandable. However, the link drawn between the dunes and the demise of the surf breaks is misinformation and quite simply wrong. As discussed above, the reasons for the beach advance relate to the alongshore input of very large volumes of sediment from Whatipu.

Natural vegetated dunes at Piha Beach are evident in the earliest photos of this area (see Section 3) and these dunes have played no role whatsoever in the changes to the surf break. Dunes build simply because sand blown landward from the beach is trapped by vegetation. I.e. Beach advance causes dune advance, not the other way round.

In fact, the volumes of sand trapped in dunes are small relative to the volumes which have caused the noted beach advance. As noted earlier, NIWA estimated that shoreline advance between 1960 and caused the volume of sand above mean sea level (i.e. about midway between high and low tide) to increase by only about 700,000 cubic metres. The total volume that accumulated in the dunes over the same period is obviously only a part of this. If this total volume were to be dug up and placed seaward of the beach, it would cause on average less than 1 m shoreline advance along the full 2.6-2.7 km length of Piha Beach. In contrast, as noted earlier, calculations using beach nourishment formulas indicate that something in the order of 60 million cubic metres (quite possibly more) was required to cause the observed shoreline advance. The source of that sand is visibly obvious (Figure 2).

What about the artificial dunes across Moana Stream entrance?

The training of the Moana Stream and associated work was unnecessary as made clear in the 1992 Turner decision. However, the infilling and reclamation of the former flared stream entrance did not cause the beach advance – the advance of Piha Beach relates to the alongshore movement of the very large volumes of sand from Whatipu.

It would be possible to restore a flared entrance to the Moana Stream entrance if the community as a whole wished to pursue this. However, this would have no measurable effect on future shoreline advance. The volumes of wave run-up that used to wash into and out of this area, even in a storm were quite minor relative to the very strong currents associated with wave generated circulation in the Piha Beach embayment. Breaking waves transport large volumes of water into the Piha Beach embayment every day - the return of this water to the sea generating very strong longshore currents and rips. The volumes of water circulating in this wave-driven circulation are orders of magnitude larger than the volumes of water that used to wash in and out of the Moana Stream Estuary. Yet even these forces have

not been able to prevent the overall trend for shoreline advance in Piha Beach as large volumes of sand are transported into the embayment.

3. Review of Dune Management to Date

3.1 Dunes and Dune Vegetation at Piha

Dunes and dune vegetation are natural features on this coast, evident at the southern end of Piha Beach since the earliest photographs in the late 1800's and early 1900's.

Early historic photographs indicate two separate areas of natural vegetated dunes within this area of Piha (Figure 4):

- The area between Piha lagoon and the former embayed Moana Stream entrance
- The area between the southern side of the Moana Stream entrance and the south end of the beach

The photos indicate a relatively extensive cover of spinifex over the dune areas and patches of darker vegetation further landward, with little to no evidence of human damage (Figure 4).



Figure 4: Photograph of Piha Beach dating from the early 1930's showing areas of natural dunes (arrowed) – also evident in earlier photos. (Photograph from Alexander Turnbull Library).

The dunes at Piha Beach are often referred to as “artificial dunes”, even within parts of the Piha Coastal Management Plan. However, it is clear from this historic photography that vegetated dunes are natural

to this area of Piha – except in the immediate vicinity of the Moana Stream entrance. The latter are the only artificial (i.e. man-made) dunes.

In their natural state, the most seaward or frontal dune was dominated by native sand trapping vegetation – particularly spinifex with a lesser component of pingao (Esler, 1975). This vegetation is of sufficient height to slow the wind in areas close to the ground where the highest concentrations of windblown sand occur. This decreases sand transport capacity of the wind, causing sand to be deposited.

This sand trapping vegetation plays a number of critically important roles in natural dune function and character, including:

- The sand trapping process is critical to natural dune building and repair. For instance, after storm erosion, spinifex grows down the seaward face of the eroded dune - trapping windblown sand and naturally repairing the erosion.
- Significant reduction in problems with windblown sand further landward
- Prevention of wind erosion damage to dunes
- Ecological values – pingao, one of the key sand trapping species, was almost eliminated from New Zealand dunes by historic human and animal damage and is still relatively rare on this coast

The native sand trapping vegetation on the seaward dune is however vulnerable to damage from human trampling. Once the vegetation is damaged or destroyed, windblown sand simply passes straight up and over the dune and is deposited further landward – causing issues with windblown sand. In addition, damage to the native sand trapping vegetation causes bare areas of sand to appear and opens the dune to wind erosion damage.

Low vegetation such as exotic perennial grasses (e.g. kikuyu) and iceplant are often more resistant to human trampling. However, these are too low to be effective sand trapping species. They are far less effective than the native species at reducing windblown sand and in natural repair of dunes. Exotic perennial grasses (e.g. kikuyu twitch) also compete with spinifex and invasion of spinifex areas by this vegetation needs to be managed.

Inland of the frontal dune, spinifex and pingao gradually gives way to other plant communities of increasing diversity and height. Immediately inland of the spinifex zone, common native vegetation can include pohuehue and knobby clubrush. Further inland, trees and shrubs start to appear – such as the karo dominated shrubland evident at North Piha.

3.2 Historic Dunes Damage and Modification

Human damage to dune vegetation and resultant problems with wind erosion and windblown sand have been significant issues at Piha, especially adjacent to the high use car park areas. There has also been significant human modification of the natural dunes over time.

Early dune condition

Early photography suggests the natural vegetated dunes of Piha remained in a relatively undamaged state up until at least the early 1930's (Figure 4).

Dune damage and modification

However, following subdivision in the 1930's there is evidence of increasing damage to the natural dunes and stabilising dune vegetation, leading to consequent problems with wind erosion and windblown sand.

For instance, in the vicinity of the surf club, early subdivision extended seaward over the natural dunelands reducing the width of natural dunes further seaward. Photographs from the 1940's show poorly managed human use, with intense human pressure on the critical sand trapping vegetation on the seaward dune face (Figure 5)



Figure 5: Photograph of area in front of the former surf club. Note people sitting all over the seaward face of the frontal dune, damaging the sensitive native sand trapping vegetation. (Photograph from Alexander Turnbull Library).

By the 1950's, photos indicate that human disturbance of vegetation and consequent wind erosion was common with widespread use of brush wind break fences to minimise wind erosion and windblown sand (Figure 6).



Figure 6: Photograph of Piha taken in January 1951 to the immediate north of the surf club showing brush fences (examples arrowed) erected to control wind erosion. (Whites Aviation photo – from Alexander Turnbull Library).

In the mid 1950's, levelling of dunes in front of the surf club began to create car parking and this area was progressively extended into the 1960's (Figure 7).



Figure 7: Photograph from 1963 showing area of Piha fronting surf club and areas to the north. Note that dunes fronting the surf club have now been levelled to create a car park and the dune face seaward of this car park is now largely devoid of vegetation. (Whites Aviation photo – from Alexander Turnbull Library).

Long term residents advise that clay fill was also placed extensively over these areas at this time (Helen Pearce, pers. comm.). The car parks also encroached seaward, significantly further reducing the width of natural dunes seaward of the car park. The poor management of beach access resulted in the dune face seaward of the car park being largely devoid of vegetation at this time (Figure 7)

Historic photographs show a similar sequence of events at the southern end of the beach. By the early-mid 1950's, subdivision, roading and car park areas had encroached over the former natural dunelands – extending right to the top landward edge of the seaward dune face.

Parking occurred along the full length during high use periods and access to and from the beach was unmanaged – resulting in extensive disturbance of sand trapping vegetation on the seaward dune face by the early 1960's (Figure 8).



Figure 8: Photograph of southern car park area dating from January 1963.

In the mid 1980's, the Moana Stream entrance was also significantly modified – including training the stream with a concrete-lined channel (Figure 9), reclamation of the former embayed stream entrance and construction of dunes across the head of the former embayment (these dunes often referred to locally as the “artificial dunes”). The modification of the Moana Stream entrance was controversial and was subsequently deemed unnecessary by the Turner decision.

There were some ongoing attempts at improved dune management at Piha in the 1980's and the early 1990's – including attempts at access management and planting. In the early 1990's, this work included significant and successful revegetation of the dunes fronting the southern car park – largely using pingao (at that time, spinifex could not be obtained from nurseries). While this useful planting work was endorsed by the Turner decision, it encountered various problems and opposition and did not persist.



Figure 9: View of surf club car park and Moana Stream entrance area in 1985. Note the concrete stream training works in the Moana Stream and the placement of sand trapping fences (arrowed) to create dunes on the immediate northern side of the former embayment.

By the early 2000's, the high use area in front of the surf club was still seriously damaged with exposed clay fill and very little native sand trapping vegetation (Figure 10).



Figure 10: Area in front of surf club (undated but circa 2003) - before commencement of Coastcare dune restoration works. (Auckland Council photograph)

The Piha Coastal Management Plan also reported that storms periodically uncovered rubble and waratahs and other sharp material, and there were issues with weeds (including cape ivy and boneseed). Serious problems with windblown sand continued to be experienced on both the surf club and southern car parks.

3.3 Dune Restoration Work to Date

Piha Coastcare was formed in 2002 to address the various dune management issues and for the general enhancement and protection of the natural environment at Piha. It was initially set up under the auspices of the Piha Ratepayers and Residents but is now a separate trust.

The serious dune damage and windblown sand problems has necessitated an initial focus on restoration of a good cover of native sand trapping vegetation over the frontal dune and management of human use to provide for beach access while preventing damage to this restored vegetation.

The work to date has primarily involved:

- Some dune reconstruction using machinery to rebuild dunes in badly wind damaged areas prior to planting and to bury historic clay fill
- Restoration of native sand trapping vegetation (particularly spinifex) over the frontal dune
- Installation of defined accessways and guiding fencing (bollards and ropes) to provide beach access while protecting the sensitive sand binding vegetation – together with signage.
- Weed control – eliminating the problem species noted in the Piha Coastal Management Plan and ongoing management to stop exotic perennial grasses invading the native sand binders.

More recently, a retaining wall has also been installed along the back of the dunes to:

- To provide a collection area for windblown sand that gets past the frontal dune and thereby reduce the volumes directly going onto the road and car park
- To provide for pedestrian accessway along the back of the dune but separated from the car park area for improved safety.

The minimum width of the accessway has been set to allow a machine to come in from time to time to remove sand as it builds up.

3.4 Review of Work to Date

The works conducted to date are generally of a high standard and despite setbacks have been very successful in addressing the serious dune damage and restoring a good cover of critical native sand trapping vegetation.

This is particularly evident in the area between the Moana Stream entrance and Piha Lagoon, including the area fronting the surf club car park. There is now an extensive cover of native sand-trapping vegetation in this area, contrasting markedly with the state prior to the formation of Coastcare. While there are still some localised areas of dune damage which need to be addressed, the improvements to date are impressive.

The most recent works fronting the southern car park were only completed in mid 2011 and so the plants are not yet well established. This area has also suffered from some ongoing vandalism since the plantings, including deliberate pulling of significant areas of the planting. However, the approach undertaken in this area is sound and with ongoing establishment and maintenance of the plantings will significantly reduce the serious windblown sand issues historically experienced. There is a minor issue with exotic perennial grasses recovering among the spinifex plantings. Problems of this nature can be minimised in future by spraying such grassed areas and allowing time for die-off before earthworks. These exotic grasses can be readily sprayed out on a calm day – though some spinifex may also be affected and require replanting. The spraying of the grassed areas should occur before the 2012 plantings of spinifex are undertaken.

A difficulty is the limited width of natural dune in front of the car parking areas, reflecting the historic encroachment of development and infrastructure seaward over the former natural dunes. An ideal minimum width of sand trapping vegetation for Piha is probably in the order of 30m – but existing dunes are generally less than this, particularly along the front of the southern car park (typically <20 m width). The limited width means that ongoing problems with windblown sand will continue to be experienced for some time and these areas will require particular attention. However, over time, ongoing seaward advance will increase dune width in some places – particularly the area between Piha Lagoon and the eastern end of the southern car park. Available data suggests less certainty of dune advance in central and western areas fronting the southern car park.

There appears to be widespread support for the work undertaken to date. Coastcare report a good turnout to working bees and note considerable positive response to the gains achieved so far. Field inspections during this review also indicate that the vast majority of beach users use the defined accessways rather than cutting across the dunes. In addition, surf club personnel spoken to advise that they now train their volunteers from nipper stage in terms of accessing the beach using defined accessways rather than trampling the sensitive dune vegetation.

Some tensions were however identified in relation to matters such as:

- Consultation and communication
- Concerns with the impact of dune management structures (e.g. fences, retaining walls) on natural character
- Dune height blocking views from properties and car parks to landward
- Lack of elevated grassed areas for viewing and amenity.

Dune management is an incremental process and the focus to date has necessarily been on repair of the seriously damaged dune and reduction of issues with windblown sand. These wider matters can be increasingly addressed in the future as seriously damaged dune is restored and various recommendations in regard to these matters have been included in the proposed Management Plan.

A particular concern however is the persistence of serious misinformation on the role of the dunes in the natural shoreline advance, despite this matter having been traversed in detail by the earlier NIWA report (NIWA, 1999). This misinformation is concerning as it has no basis in fact (see discussion in section 2) and appears to have stirred up considerable antagonism towards dune management – particularly among some younger surfers. The misinformation appears to have played a significant role in the vandalism experienced to date. The issues arising from this kind of misunderstanding and misinformation (including abuse, vandalism of plantings, etc) are proving difficult and exhausting for Coastcare volunteers to deal with.

Coastcare volunteers emphasized the need for more support from Council with consultation and communication - as the work is very demanding and time-consuming on top of the practical works required. I strongly endorse this and the matter is discussed further in the proposed Management Plan.

Overall, it is my opinion that the achievements to date are outstanding given the seriously degraded dune state at the start and the range of considerable difficulties faced. The planting, access management and earthworks have generally been undertaken very well and progress to date is notable despite the recent vandalism. It is important that these gains are maintained and built upon with future work and this has been given focus in the proposed Management Plan discussed in the next section.

4. Proposed Dune Management Plan

4.1 Objectives of Dune Management

In my opinion, the work to date is generally excellent and a considerable achievement by all those involved. A key aim of the Dune Management Plan is to provide an agreed basis to maintain and build upon these achievements.

It is also emphasized that dune management is an incremental rather than an overnight process. The damage and modification of the dune system over the past 70-80 years will take some time to restore. It also takes time to develop a good understanding and community agreement on relevant matters at any beach – let alone this site, one of New Zealand's most iconic and intensively used beaches.

The extremely popular nature of Piha Beach means that dune management in this area must necessarily provide for both human use and enjoyment and for the protection of natural values. Accordingly, the key objectives suggested for dune management in this area of Piha include:

- Continuing to raise community support, awareness and involvement
- Minimising problems with windblown sand and wind erosion

- Maintenance and enhancement of public access and amenity values
- Protection and restoration of natural character

These objectives overlap, as do the actions recommended to achieve them.

It is important that any dune management plan is not overly prescriptive as a degree of flexibility is required to accommodate coastal change and various management issues as they arise.

4.2 Raising Community Support, Awareness and Involvement

Discussion

The raising of community support and awareness is an important objective for any dune management work and is particularly important at Piha Beach as:

- Piha Beach is one of New Zealand's most iconic and popular beaches with a wide range of stakeholders, with various interests and values. The support of beach users and the local community is critical to the long term success and sustainability of dune management. This requires good communication and consultation and a balancing of interests – it is not an easy task.
- An informed and supportive beach user community provides the most effective protection for coastal dune values – while also minimising maintenance requirements and the need for control and structures. Natural dunes not subject to human pressure require little to no management. Most dune management is focused simply on repairing natural dunes that have been damaged by human action and/or action designed to protect critical dune vegetation from human disturbance.
- The physical setting of Piha results in significant shoreline movements over long periods of time due to natural forces and changes that are beyond reasonable human control (as discussed in Section 2). A good understanding of these natural shoreline changes allows proactive planning and avoids the kinds of misunderstanding which have often complicated dune management at Piha to date and impacted on community support. Awareness of ongoing trends is also important – as management issues at Piha will change radically when the beach system eventually moves from its present long term trend for advance to a long term trend for shoreline retreat.

Sustainable protection of natural dunelands Piha ultimately requires informed beach users who understand the critical role played by dune vegetation and conduct their beach use activities in a manner which do not disturb this vegetation – particularly the vegetation on the most seaward dune exposed to strong onshore winds.

Piha Coastcare has already built a good level of community support and awareness – with good support for working bees (for instance, 60-100 people turning out in mid 2011 to assist with restoration of the dunes fronting the southern car park) and a large network and Email list of supporters. Coastcare also maintains a web site which endeavours to keep the community informed on current activities and plans – as well as providing an opportunity for interested community members to sign up to the Coastcare

Email list to be kept informed of activities. The web site and Email contact list are very good initiatives and awareness of these should continue to be promoted to assist in expanding the level of community involvement. A concern was however expressed that the present web site was seen to be associated with a private website and there was need for Coastcare to have an independent web site.

Some parties spoken to raised the need for more openness and active community consultation prior to major works (e.g. significant reshaping of dunes, etc) so everybody could understand what was being planned and why, and there was opportunity for input. They expressed the view that there had been less opportunity for community participation and dialogue in decision-making in recent times. A Memorandum of Understanding (MOU) with the new Waitakere Ranges Local Board was suggested as a useful way forward to ensure clear roles, expectations and boundaries and I concur with this.

However, the wide range of demands are very difficult for Coastcare volunteers to meet and they noted that the workload is presently very high and too demanding, with more support required. Council and Coastcare should work together to provide appropriate consultation and communication.

Prior to Coastcare, many attempts at dune management failed at this site due to the extreme difficulties. Strong Council (and community) support is critical to ongoing success. Many councils involved in dune management employ or contract dedicated coordinators to support and assist Coastcare volunteers – though the most appropriate model for Auckland Council needs to be assessed. Subsequent to formation of Auckland Council, a key Council staff member has been appointed and this has improved the situation – though the staff member covers the whole western area.

Management Plan Recommendations

It is recommended that:

- i. A specific MOU be developed between Piha Coastcare and the Waitakere Ranges Local Board
- ii. Auckland Council give consideration to how best they can improve the level of support provided to Piha Coastcare, particularly to assist with:
 - a. building community awareness and support for dune management
 - b. improved communication with those stakeholder groups who have ongoing reservations and concerns regarding dune management
 - c. improved consultation and communication in relation to dune management
 - d. addressing existing misunderstandings of coastal processes at Piha
 - e. resolving stakeholder concerns as they arise
 - f. provision of an independent web site that is kept up to date with annual work plans and working bees

- iii. The Coastcare Email contact list be more widely promoted to encourage participation and opportunity for input

4.3 Minimising Problems with Windblown Sand and Wind Erosion

Discussion

This is a critical element of dune management at high use public beaches such as Piha – as historic issues indicate (see brief summary of these in Section 3). The main requirements are:

- Restoration and maintenance of a good cover of native sand trapping vegetation (spinifex with a component of pingao) over the most seaward dune and particularly the seaward face to the crest
- Managing beach access and human use on the frontal dune dunes to avoid trampling and disturbance of this critically important vegetation
- Building community and beach user understanding (see Section 4.2 above)

Earthworks are also occasionally necessary to repair serious human damage to natural dunes (e.g. remove clay and rubble, reshape dune to natural topography following serious wind erosion damage, address areas of serious weed infestation).

As noted in the review, Coastcare have significantly improved management of this aspect. There is now generally a good cover of native sand trapping species and beach users generally use the defined accessways rather than cut across vegetated areas. These gains need to be maintained and built upon.

The dunes fronting high use car parking areas will require particular ongoing attention as, because of historic encroachment, they remain too narrow to completely avoid windblown sand issues. Any problems in this area with disturbance of vegetation cover and poor management of human use will be reflected in windblown sand issues.

The following recommendations are suggested to reinforce existing sound practice and ensure ongoing improvement in the management of windblown sand:

Management Plan Recommendations

In regard to planting and weed control:

- i. Plantings on the seaward face should continue to emphasize spinifex with a subcomponent of pingao. These are the most appropriate species for the control of windblown sand at Piha and are also part of the original natural character of Piha dunes. Plants should be appropriately eco-sourced, ideally within the Waitakere Ecological District – even though alongshore dispersal of spinifex seed-heads is such that spinifex populations in the adjacent west coast (i.e. Awhitu and Kaipara) ecological districts may not be genetically distinct.
- ii. Give particular emphasis to maintaining a good cover of spinifex over the narrow dune areas seaward of the car parks – to maximise the sand trapping potential of these narrow dunes.

- iii. It is important to eradicate exotic perennial grasses within spinifex areas (even if some area of spinifex are damaged and need to be replanted) and to ensure exotic perennial grasses do not invade from grassed areas to landward. Spraying is best undertaken during active growth periods in autumn and/or spring using a grass-specific herbicide (e.g. Gallant®) with an appropriate wetting agent (e.g. Uptake®). Spraying among spinifex should only be undertaken on very calm days using a nozzle that gives strong control over direction – to minimise damage to adjacent spinifex. Spraying among spinifex is probably best done in autumn so any spinifex damaged can be replaced during the following planting period.
- iv. Any incursion by common garden plants (e.g. gazanias, arctotis and agapanthus) should also be addressed by removal - these species can spread rapidly and impact native vegetation.
- v. Where dunes are reworked by machinery to prepare for planting, ensure that any exotic perennial grasses are appropriately sprayed and die-off prior to the earthworks to minimise reinvasion. Otherwise, stolons broken up by the earthworks may lead to serious re-invasion of the exotic grasses.
- vi. Ideally, knobby club rush should be planted along the landward margin of the spinifex zone where grassed areas exist to landward. This will assist in managing invasion by the exotic grasses (allowing grass specific herbicides to be used) without damaging spinifex, while also enhancing natural character of the dunes. It can also assist with access management as noted below.
- vii. When dunes have to be reworked to bare sand prior to planting, dense planting (e.g. spacing 0.3-0.5 m) should be adopted to assist in rapid restoration of a good vegetation cover.
- viii. The Coastcare annual plan should incorporate an inspection of the spinifex areas (particularly seaward of the car parks) in autumn – so that any significant bare areas that have developed (e.g. as a consequence of human damage over summer) can be planted that growing season.

In regard to accessways:

- i. The existing practice of aligning accessways so the seaward end is not aligned into prevailing southwest winds is sound and should be retained.
- ii. Over time, where reasonably practicable, accessway alignments can be adjusted as required to include curvature - located so that any sand blowing into the seaward end lands on spinifex, rather than travelling through to the landward end of the accessway. Straight accessways are less desirable as they tend to act as a “conveyor belt” for sand movement into landward areas.
- iii. The state of the accessways should be monitored to ensure they stay well maintained, including allowance for sand removal when required (e.g. the alongshore accessways landward of the dunes and seaward of the car parks). Observing where particularly significant windblown sand accumulations occur in these areas will also provide useful clues on the issues that need to be addressed in the dune areas to seaward.

- iv. An additional defined accessway be established at the southern end of the surf club car park (as arrowed below in Figure 11) where an informal accessway presently exists.



Figure 11: Location of informal accessway (arrowed) at the southern end of the surf club car park. It is recommended that this accessway be formalised and defined.

- v. The double-entry on the landward side of the accessways fronting the southern car is a useful design innovation. However, with the present narrow dunes in this area, the double-entries tend to provide more opportunity for windblown sand to penetrate to landward areas. The dune “islands” formed between the landward entrances are also difficult to manage. This is not a pressing issue but, over time, these accessways could be reduced to a single landward entry if required to minimise issues with windblown sand. Ideally, any revision in accessway alignment should also include appropriate curvature so that sand blowing into the accessway generally ends up deposited on a spinifex vegetated zone – rather than being conveyed right through the accessway. The dune “islands” presently formed between these double entrances can be merged with the adjacent vegetated dune areas as this work is undertaken.
- vi. The present practice of generally avoiding surfacing on accessways (e.g. board and chain structures; boardwalks) is supported. These structures tend to get buried with sand and are difficult to maintain and should be adopted only where essential. In most places, a sand surface is adequate and preferable.
- vii. The surf club concrete accessway is an important feature for access to and from the beach and as practical should be cleared each time machinery is taken to Piha to clear sand from the roads or pedestrian access track (particularly over summer).
- viii. If the present boat ramp ultimately has to be replaced because of excessive maintenance accompanying beach advance, it should be removed at the time of replacement rather than allowed to be buried. The new ramp should maintain the existing northwest orientation to minimise problems with windblown sand.

- ix. The retaining wall to minimise sand blow onto the road and the associated pedestrian access and sand trap along the back of the dune is a useful innovation and will remain necessary for some time because of the narrow width of the natural dunes to seaward. The design to allow seating on top was commented on favourably by various parties and is well used according to surf club members spoken to. Concerns were however raised by some parties in relation to natural character (see discussion of natural character further below).

Note: The accessway on the northern side of Piha Lagoon and creeks (outside the study area) should be widened to improve it for use by the surf life saving club – who occasionally have to use this accessway in an emergency.

In regard to dune reshaping and earthworks

General guidelines for this work are:

- i. Earthworks are occasionally necessary to restore seriously damaged dunes
- ii. Where clay fill or rubble occurs on dunes, this should be removed to the extent reasonably practicable.
- iii. Earthworks addressing serious grass or weed infestation should be preceded by appropriate spraying of the relevant weed species, allowing time for die-off before the works. Deep (>0.75 m) burial of the surficial sand that contained the weed materials can also be helpful when the earthworks are implemented. These actions help minimise weed re-establishment.
- iv. The earthworks should be conducted as close to the planting date as practicable to reduce the risk of windblown sand before planting. Earthworks should not be conducted outside of the best spinifex planting period and ideally within the period from April to October inclusive.

4.4 Maintenance and Enhancement of Public Access and Amenity Values

On a popular public beach like Piha, dune management needs to give attention to ensuring human use and enjoyment is provided for. This was a common theme in the feedback received during discussions with representatives of various stakeholders.

Two particular areas that were drawn attention to (in the initial discussions) were:

- The general issue of views – including the maintenance of views from car-parks and properties landward of the dunes.
- The need to provide grassed areas (ideally with shade) in elevated locations where people could sit and view the sea. These areas would also be valuable during the frequent surfing, surf

lifesaving and other competitions held at Piha. However, not all parties agree with this and it is an area where community feedback is particularly required.

Views and Dune Height

The issue of views from behind the dune is a difficult one to exercise much control over - as dune height is governed by natural processes. Fortunately, any changes in dune height over time are relatively slow. Nonetheless, it is important to maintain an empathetic approach to the issue as views from landward properties and areas are important to those affected. Most properties in the study area were developed when the dunes to seaward were degraded by wind erosion due to poor management of human use (see discussion in Section 3.2 of this report). At this time, dunes were probably lower due to wind erosion and deflation. The natural seaward advance of the shoreline has also likely impacted views by increasing dune width to seaward.

Auckland Council conducts regular beach profile surveys (usually 1-2 times per year) and this provides a means by which dune height can be monitored.

The options for intervention with natural dune characteristics and processes are limited. For instance, periodic earthworks to lower the dunes would require ongoing intervention as well as disruption of native dune vegetation and natural character and this is not likely to be an appropriate approach.

There are however measures that can be taken to minimise the potential for issues. For instance:

- Encouraging an extensive cover of natural sand trapping vegetation on the seaward dune face down to the seaward toe can greatly assist in limiting dune height. An extensive cover of sand trapping vegetation in this area helps reduce the volumes of sand reaching the crest where it can lead to increases in height.
- Managing access to prevent damage to dune vegetation. Human damage of dune vegetation at the toe and on the seaward dune face can result in more windblown sand reaching the crest and (typically localised) increases in dune height. Therefore, providing defined accessways as at present and encouraging use of these helps.

The present general trend for the shoreline to advance in many areas will also help minimise increases in dune height (e.g. Figure 3) – as advancing dunes tend to build less height than static dunes in the same environment.

Elevated Grassed Viewing Areas

In regard to the provision of elevated grassed and viewing areas, further community and beach user feedback to this draft will be required to confirm (or otherwise) the need for this. If there is widespread support for, provision of such areas will also require appropriate design and consultation.

Recommendations on this matter are beyond the terms of reference and scope of the present report. However, a discussion of potential options is included below to help guide further community consultation and any future action.

With the present narrow dunes, there is no useful opportunity to introduce (or extend existing) grassed areas seaward of the car parks – as maintaining the full dune width in spinifex and pingao is required to minimise windblown sand to landward. In the longer term, continuation of existing seaward beach advance may eventually create sufficient dune width in these areas for new grassed areas to also be established. For instance, if the rate of dune advance in front of the surf club observed over the last 20-30 years (Figure 3) is maintained, suitable dune width is likely to develop within the next 10-15 years. However, a width of at least 30 m of sand trapping vegetation must be maintained seaward of any future grassed areas. Shade trees are unlikely to be practical in any grassed area eventually able to be established seaward of the surf club - as views from the surf club must be maintained for beach safety. Surf club personnel advise that the existing small pohutukawa currently presents no issues but may need to be managed as it grows – or possibly relocated.

In terms of more immediate action, the existing grassed area at the western end of the southern car park (arrowed in Figure 12) is already extensively used and could be enhanced for use in the near future. For instance, ground levels are presently irregular and the area could be leveled to improve it for recreational use. There are also existing small pohutukawa here that will in time provide useful shade – though they may need to be managed (e.g. periodically opened up with careful pruning) to maintain views from landward.



Figure 12: Grassed area behind spinifex zone at western end of the southern car park. This area provides an important grassed elevated viewing area and could readily be levelled to improve suitability for use.

There are also elevated backdune areas to the immediate north of the surf club car park where quite extensive elevated grassed areas could potentially be established, while still maintaining wide spinifex zones (at least 30 m) to seaward (Figure 12). An advantage of this area is that it is not only immediately

adjacent to the surf club car park but also borders the beach access from the Domain. However, any future development of elevated grassed viewing area in this location would require appropriate design and consultation. Additional beach accessways might also be required.



Figure 13: dashed line outlines backdune area to the immediate north of the surf club car park within which a grassed viewing area could potentially be established – subject to appropriate design and consultation.

Another option relates to the dunes on the northern side of the Moana Stream, which have been a bone of contention among some parties since they were established. As noted earlier, these dunes are to some extent artificial as their existence depends totally on the existing Moana Stream training works. The Turner decision suggested some restoration of natural character be undertaken in this area. Detailed comment on this is beyond the terms of reference and scope of this report, but in my opinion this are likely to be practical options in this regard – though appropriate design and consultation would be required to ascertain the best way forward (see discussion under natural character below). If such work proceeded, the design could probably also provide elevated or improved beach viewing areas.

Ideally, any provision of grassed viewing areas should also incorporate shade trees as they are otherwise less likely to be used, particularly in summer. Shade trees can create concerns with views from residents to landward but with active intervention and pruning to open the trees up these concerns are usually able to be managed. This is particularly so with pohutukawa where appropriate pruning can maintain shade without significant impacts on views. Nonetheless, the reflex action of beachfront owners is to

oppose tree plantings and so any such works will need to be undertaken and designed with appropriate consultation. Any agreements in regard to ongoing safeguard of views must be honoured – as high levels of trust are required to get workable solutions.

Incorporation of native backdune planting would also be desirable to maintain natural values.

Management Plan Recommendations

In relation to dune height and views from landward:

- i. Trends in dune height can be regularly reviewed (say every 1-3 years) following resurvey of the Auckland Council beach profile sites. If there is evidence that significant (say >0.5-1 m) height changes are occurring, options to manage this could be reviewed.
- ii. Any disturbance or significant gaps in sand trapping vegetation should be repaired to avoid isolated raising of the dune crest.
- iii. Where practical, spinifex runners should be encouraged to extend as far down the dune toe as practical to maximise sand trapping seaward of the dune crest.

If community and beach user consultation on this draft confirms support for increased provision of raised grassed viewing areas:

- i. The existing grassed area seaward of the southern car park (see arrowed area in photo above) could be leveled to enhance use. Soil should also be built up to natural ground level where the roots of pohutukawa tree have been exposed by wind erosion. Over time, modification of landward accessway entries (discussed in 4.2 above) can also ensure access paths are moved away from the pohutukawa to the extent practical – to enable these potential shade trees to be used to enhance reserve amenity. As the pohutukawa increase in size, Council will probably need to maintain a reasonable pruning regime (designed and undertaken by trained arborists) to keep the trees open and minimise impacts on landowner views - while maintaining shade and amenity. Building landowner trust in areas of existing trees such as these is the key to any expansion of shade trees on future grassed viewing areas.
- ii. If there is community and beach user support, options to create additional raised grassed viewing areas could be the subject of further investigation and design. Key potential areas include the backdunes immediate north of the surf club car park and/or the dune and grassed reserve area north of the Moana Stream entrance. Community and beach user consultation will need to be a critical element in the design of any such raised viewing areas.
- iii. In the much longer term, a raised grassed area may also be practical seaward of the Surf Club car park as this shoreline advances – though only when the dune is of sufficient width to retain a minimum 30 m width of native sand trapping vegetation seaward of any grassed area

- iv. Opportunities to provide shade trees in any additional raised grassed viewing areas could also be investigated in future work - with appropriate consultation. Any shade trees in these areas will need to be carefully managed to avoid significantly impacting views. This work could include negotiations with adjacent beachfront owners and the development of agreements in regard to views that provide reasonable certainty to owners. While the beach and reserves are public space and there is no right of veto on the basis of views, a balanced approach that respects all interests is preferred.

4.5 Natural Character and Biodiversity

Discussion

Piha Beach is an iconic New Zealand beach with significant natural character and landscape values, notwithstanding the extensive human development and modification of the area. These values need to be protected and, where practical, restored – as outlined in the Piha Design Guidelines (ARC, 2010 - <http://www.arc.govt.nz/parks/parks-projects-and-plans/projects/piha-area-design-guidelines.cfm>).

The work to date by Coastcare has significantly restored natural dune character and vegetation and there is opportunity to build on these gains over time by:

- Minimising the use of human built structures as much as practical
- Addressing historic modification around the Moana Stream entrance
- Integrating backdune biodiversity into planting and amenity provision

In regard to human-built structures, fences and other access management structures are presently essential to protect restored dunes from a repeat of the serious human damage which historically characterised these dunes. The need for these measures was acknowledged in the Turner decision and is also evidenced in the degraded dune condition that resulted over the preceding 60-70 years (since mid-late 30's) when access management was generally poor (see Section 3.2). The wooden retaining walls separating pedestrian use along the back of the dune from car parking area are also important for safe use and access, and to act as a sand trap to minimise windblown sand issues on the car parking areas.

Nonetheless, as the level of beach user awareness and support for dune management improves, it may be possible to reduce the level of access management required.

In the immediate future it would be possible to soften fencing in some areas by appropriate plantings. For instance, planting of dense knobby club rush and associated species (e.g. *Muehlenbeckia complexa*, sand coprosma and native spinach) could be undertaken along the landward margin of the naturally vegetated dunes and the landward margins of accessways. Over time, as this vegetation establishes and as support for dune management increases, it may even be practical to eventually remove the fences in such areas and rely on the natural vegetation for access management.

The use of vegetation for access management where this is practical has obvious natural character advantages over human-built fences. Other advantages include the fact that natural vegetation is not buried over time as can happen with fences.

Initially, any such planting should be additional to the existing fences but, if successful, it may ultimately enable many areas of fencing to be removed. This would be best approached by small trial removals (carefully monitored) once the knobby club rush vegetation community is well established.

Plantings of this nature would also enhance native dune biodiversity and simplify the control of exotic grasses invading the spinifex zone from landward.

Knobby clubrush and associated backdune species will not be able to be used in more seaward dune areas (where these species are not appropriate and are also unlikely to survive). However, in such areas pingao may be able to be used to provide subtle visual cues as to the location of accessways. Planting strips of pingao along the seaward margins of accessways is likely to appear unnatural but subtle planting schemes that achieve this purpose may be practical. In all cases, use of vegetation for this purpose should ensure plantings maintain a natural character.

The training of the Moana Stream in the mid 1980's has significantly modified the natural character in that area and is an ongoing concern to many (particularly longer term) members of the Piha community. The Turner decision concluded that these works were unnecessary and proposed that a degree of restoration of natural character would be desirable – in particular flaring of the stream entrance. During this review, concerns were expressed that to date there has been little attempt to undertake such work – though accumulations of concrete and rubble have now been removed from the seaward end of the trained stream channel.

Design of such work is outside the scope and terms of reference of this report but I concur with the Turner decision on the desirability of such work. Further work and appropriate consultation would be required to scope and design the best option; but in my opinion there would be practical options to significantly restore the natural character of this area - if the community and beach users support such an outcome. This reflects the fact that the natural seaward advance of Piha Beach in recent decades has increased the potential to restore natural character through flaring of the stream entrance and realignment of the (man-made) dunes to the immediate northern side of the stream. With appropriate design, this work could also enhance the existing grassed reserve by the stream (a useful picnic area according to feedback received) and achieve a variety of amenity gains in this area (e.g. in regard to reserve use, beach access and beach views). There is also potential for this restoration to reduce (but not eliminate) stream erosion at the eastern end of the narrow dune fronting the southern car park.

Native backdune communities are very rare on the remaining areas of natural dunelands in the study area and, while backdune amenity would be given preference in this high use area, there would be opportunities to integrate natural vegetation with access management and enhancement of amenity.

Management Plan Recommendations

- i. It is recommended use of native dune vegetation be adopted to assist in access management as part of a longer term effort to reduce reliance on human-built structures, including:
 - a. Planting of knobby club rush planted densely (spacing of 0.4-0.5 m) along the landward margin of the naturally vegetated dunes – ideally over a width of at least 2-3 m. *Muehlenbeckia complexa*, sand coprosma and/or native spinach could also be planted among the knobby clubrush or introduced later.
 - b. Experimentation with use of pingao as a visual cue for accessway location on the seaward dune face – while ensuring plantings maintain a natural pattern and appearance (i.e. simply defining the margins of the accessways with pingao may not be appropriate)
- ii. This work should be additional to existing fencing. However, once dense vegetation is established, removal of existing fences could be trialled in limited areas with close monitoring.
- iii. Restoration of natural character and enhancement of amenity values in the vicinity of the Moana Stream can probably be achieved with appropriate design and consultation – should the community and beach users support further investigation of this aspect.
- iv. The design of amenity areas (including grassed areas) should usefully incorporate native backdune species where appropriate, in preference to exotic vegetation.