

OPTIONS FOR LYALL BAY COASTAL REMEDIATION



PROJECT PURPOSE:

To Propose Options for Lyall Bay with regard to Protecting the Natural and Built Coastal Infrastructure and Reinstating a Functioning Dune. Specifically, to:

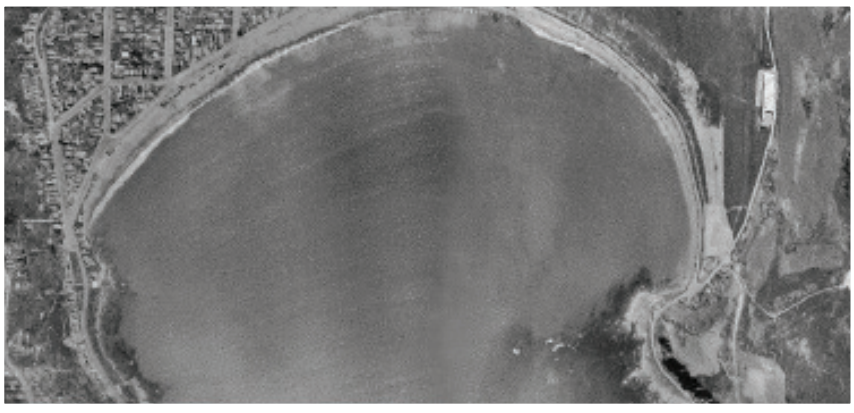
- Investigate options for restoration of dunes at Lyall Bay to maximise their effectiveness in absorbing wave action and protecting natural and built infrastructure.
- Investigate options to protect the rocky shoreline, grassed area and trees on the western side of the bay.
- To investigate options around the shifting of sand around the bay and dealing with current infrastructure within the beach environment.

Lyall Bay is a very important recreational asset for Wellington. It is popular for walking, running/jogging, dogs, surfing, boogie boarding, kayaking, kite surfing and wind surfing, surf life saving, swimming, fishing from land, diving and spear-fishing, cycling, scenic drives, picnics, visiting cafes, outings with families and watching planes (TRC, 2015).



A CHANGING BEACHSCAPE

When considering Lyall Bay it is important to be aware that it is a highly modified beach environment that has been developed since early last century. These lead to a number of constraints and changes when coastal processes are considered:

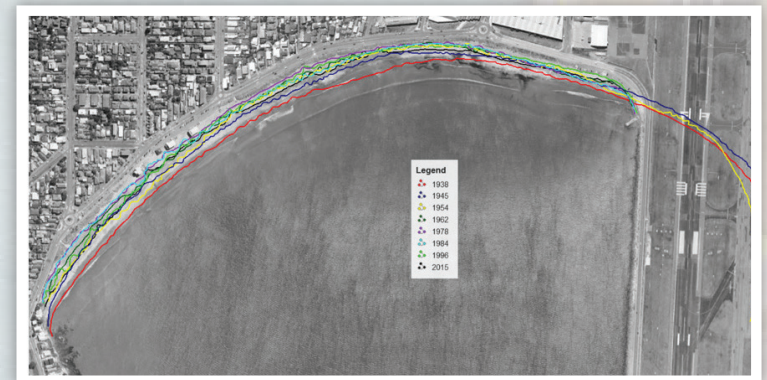
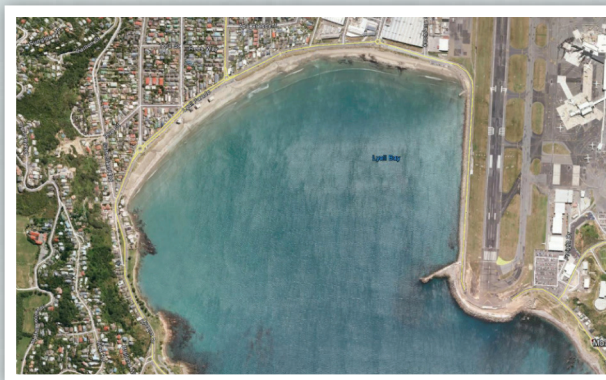


- The dune field has been replaced by people/houses/buildings
- The bay has been contained within walls, roads and parking
- Stormwater discharges into the bay through over 20 different outfalls
- The eastern third of the bay has been reclaimed for the airport, and a further 350 m of reclamation is proposed in the near future.

These constraints prevent the beach from responding naturally to extreme events and mean it requires on-going management and maintenance.

1945

Between 1938 and 1984, the beach at Lyall Bay retreated/eroded up to 55 m, due to both wind-blown loss of sand and the inability of the beach to respond to extreme events due to the loss of the dune system. The beach has widened/accreted some 15-20 m in the past 20 years following the establishment of dune plants in the mid-late 1990's.

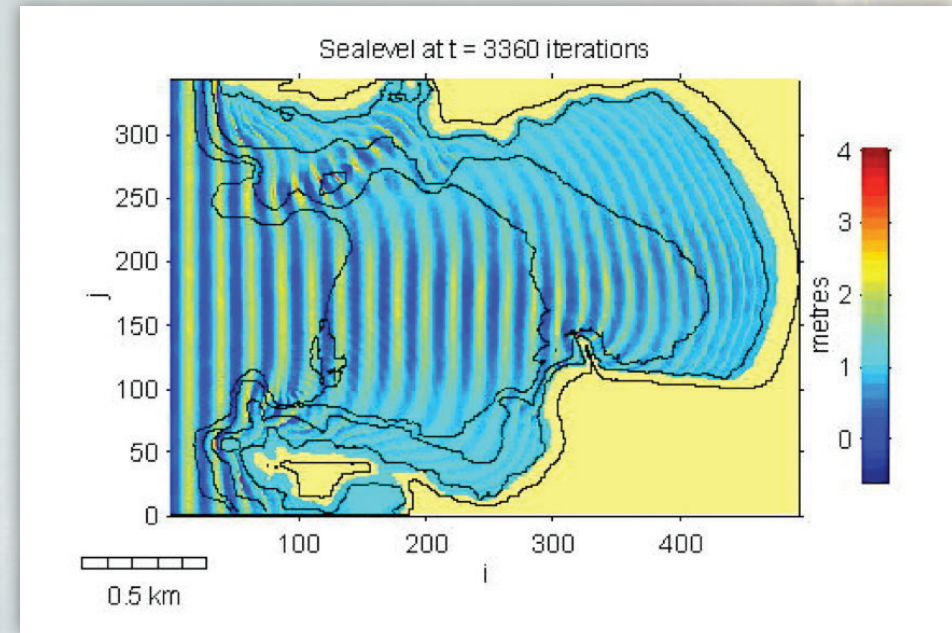
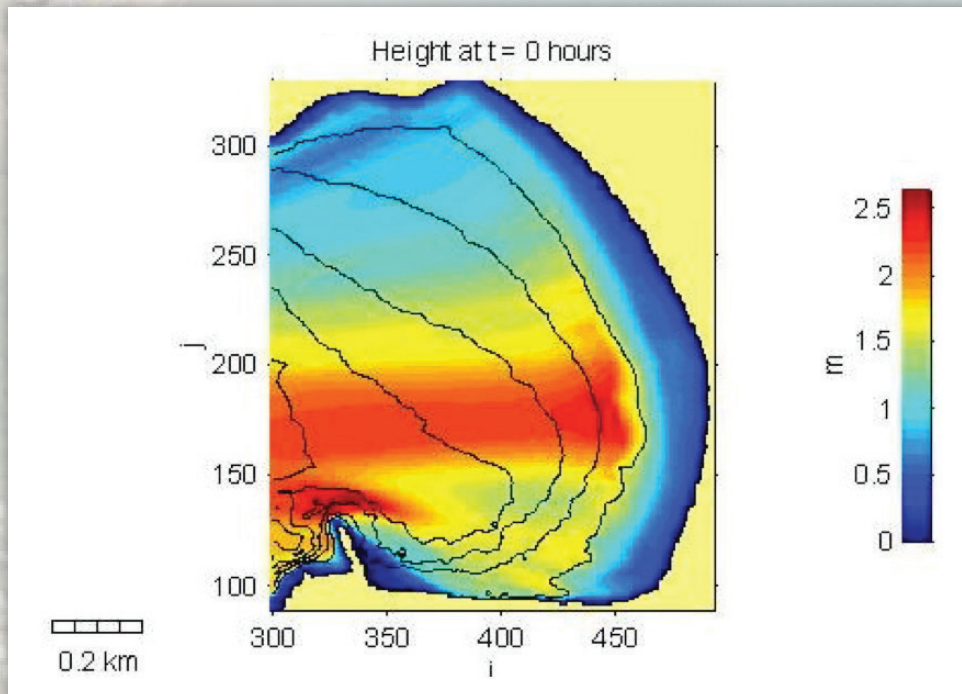


Recent storms have impacted heavily of the dune system – this project is looking to reinstate a functioning dune, which means continuing to widening/grow the dunes seaward. As has been shown over the past 20 years, Lyall Bay is a sink for sand that is slowly transported into the bay from the Cook Strait; this provides a source of material to slowly widen the dune field and increase the robustness of Lyall Bay beach.

2015

COASTAL PROCESSES

The main driver of beach change in Lyall Bay is wave-energy. Wave energy is 'lost' to the sides of the Bay as they propagate into the beach through the process of refraction, or bending into the shallower sides of the Bay. This results in smaller wave heights at the beach than at the entrance to the bay, as well as a wave height gradient with greatest wave heights in the middle of the bay (since they have been less impacted by refraction) and decreasing wave height towards the sides of the bay. One of the effects of this is the sorting of sand and gravel, with the centre of the beach having the coarsest sand and gravel, which gets finer and less gravelly towards the east and west.



The process of refraction also aligns the waves to the seabed contours, which means that by the time they break at the beach, they are breaking parallel to it. As a result there is very little alongshore sediment transport along Lyall Bay beach.

AREAS OF INTEREST WITHIN LYALL BAY

There are 4 areas of interest within Lyall Bay:

- A. Surfer's Corner
- B. Surfers Corner to Playground
- C. Playground to 249 Queens Drive
- D. Dorrie Leslie Park

Some of the options being considered for remediation are bay-wide, while specific options have been considered to address particular issues within each area of interest.



BAY-WIDE REMEDIATION OPTIONS

- 1. Do nothing.** This option means continued repairs to the Surfer's Corner carpark, continued damage to dunes that are easily accessible, continued removal of beach sand from the road and back to the beach, liquefaction and consequent enhanced erosion of the beach where stormwater outlets discharge above the high-tide mark, and continued erosion of Dorris Lesley Park. This will be exacerbated by continued sea level rise (SLR), and so increasing the robustness of the existing dune system is recommended rather than doing nothing.
- 2. Stormwater outlets around the bay are of varying types and those discharging above the high-tide mark have a detrimental impact on the dunes and beach – local liquefaction results in erosion.** Since there is very little alongshore sediment transport, the stormwater outlets that have been lengthened and discharge into the intertidal zone do not impact on coastal processes and do not impact on dunes. While a range of longer-term options have been accessed, the best option in the short term is to lengthen the stormwater outlets so that they discharge into the intertidal zone. Burial through the beach and dune above the high-tide mark is preferred in order to not result in a hindrance to access along the beach. Further recommendations have been made for each of the 21 outlets around the bay.
- 3. Currently, the dunes are planted with marram grass and pingao.** Marram grass 'grows' vertical dunes, which are not as advantageous as wide low dunes in terms of buffering the

impacts of storm events. Spinifex is similar to Marram, although it grows wide low dunes and can also tolerate saltwater inundation. The addition of spinifex and gradual removal of marram grass will increase the effectiveness of the dune system.



should be angled to reduce sand loss and increase the robustness of the dune system.



- 4. Many of the beach access ways are perpendicular to the footpath that backs the dunes/beach.** As a result, sand can easily be blown out of the beach system during strong southerlies. In extreme wave events, waves can also run-up these access ways that open directly on to the beach. All access ways should be angled to reduce sand loss and increase the robustness of the dune system.
- 5. Additional signage to encourage people to stay off of the dunes is also recommended to reduce the damage that foot-traffic does to the dune plants.** It is also important that people are aware that dogs should also be kept out of the dune area – they represent additional foot-traffic and can quickly damage areas with digging. A review of the dog-walking area could consider relocating to the western end of the bay where the dune/erosion threats are less severe and the beach is more conducive to walking; i.e. the gravel swash-ridges across the beach are not present.
- 6. Because the Lyall Bay beach system has been so highly modified by human impacts, it cannot always respond naturally to storm events.** Therefore, the beach requires management such as the redistribution of sand following storm events using earth-moving equipment and regular inspection and clearing of stormwater drains. By following the recommended options, it is likely that less wind-blown sand will have to be removed from the roads and replaced on the beach and that over time an increasingly robust dune system will be developed, both of which will help maintain the valuable beach amenity and lead to a reduction in on-going beach management and maintenance input.

SECTION A – SURFER’S CORNER: REMEDIATION OPTIONS

The existing carpark at Surfer’s Corner is currently too far seaward. As a result, it is often within the zone of wave run-up and surf. This is detrimental to both coastal processes and asset management – when waves hit the vertical wall of the carpark reclamation they reflect wave energy and drag sand offshore, which also impacts on the integrity of the carpark and the need for ongoing repairs. There is also anecdotal evidence that the seaward extension of the carpark impacted negatively on the surfing wave quality of the breaks in this area known as ‘The Corner’.



RECOMMENDATIONS: In order to reinstate a functioning dune and increase the robustness of the beach, the recommended option is the removal of all but a small area of the eastern carpark and to plant with spinifex and pingao. The road reserve on the opposite side of the road (between Tirangi Road and Cochrane Street) is available for conversion to a carpark to compensate for the removal of the Surfer’s Corner carpark.

SECTION B – SURFERS CORNER TO PLAYGROUND: REMEDIATION OPTIONS

This area, also known as ‘The Bend’, is the most exposed area of the beach and receives the largest waves. The eastern part of this stretch of beach (from approximately Kingsford Smith Street) was reduced when the road was first constructed (pre-1938), and as a result has the narrowest dune field and was most impacted by the storms of 2015. In addition, the dune area from Surfer’s Corner to Tirangi Road is not backed by a wall, and so there are many tracks through the dunes (despite the 4 access ways) reducing the health of this stretch. There is also a 60 m stretch in the middle of this section of the beach that has no wall and is only backed by a steel-mesh fence since the wall was removed in the 1990’s, and the dune area adjacent to the playground in the west of this section is

also negatively impacted due to easy access and walking on the dunes. Offshore of this stretch of the beach is also the proposed location of a wave-focussing structure



to compensate for the reduction in wave quality that the airport extension will cause, should it proceed.

POTENTIAL IMPACT OF WAVE FOCUSING STRUCTURE:

Wellington International Airport Ltd (WIAL) are proposing to extend the Airport Runway by 350 m. Investigations undertaken to date indicate that the extension will lead to a reduced number of surfable waves within the bay, especially in the central and western part of the bay. This is due to decreased ‘peakiness’ in the waves due to the presence of the extension. WAIL has

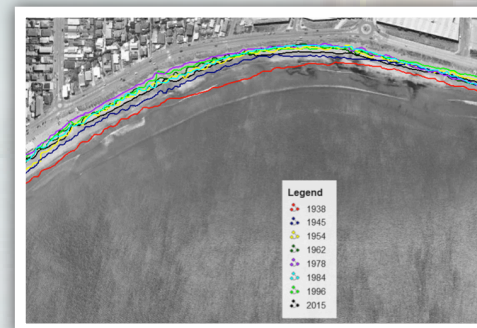
proposed to reintroduce peakiness into waves by the incorporation of a wave focussing structure in the central bay. The impact of the is likely to be a subtle widening of the of the beach in the lee of the focussing device. This could be considered an advantage in terms of dune restoration and maximizing the effectiveness of the dunes.

RECOMMENDATIONS:

This stretch of the beach has experienced the greatest increase in beach width due to the establishment of the dunes, but also the highest amount of damage due to it being in the most energetic part of the beach.

Limiting access to the eastern and western dunes along this section of the beach will increase the health of the dunes in these area.

The seawall should also be extended along the eastern area adjacent to Surfer’s Corner and rebuilt in the middle 60 m section to reduce the loss of wind-blown sand. Introducing more spinifex into the dune system is recommended to develop wider dunes, and there is also the option of increasing the height of the wall to 1.5 m to provide a higher backing to accommodate a wider and higher dune. This is the area of highest waves, which result in the highest run-up and erosion levels during storms, and so continuing to widen the dune through planting and sand-retention is required to increase its effectiveness as a storm buffer. Finally, should the wave-focussing structure be constructed, it will have the impact of subtly widening the beach in its’ lee, which could effectively result in a wider dune system in the central area of this stretch of beach.



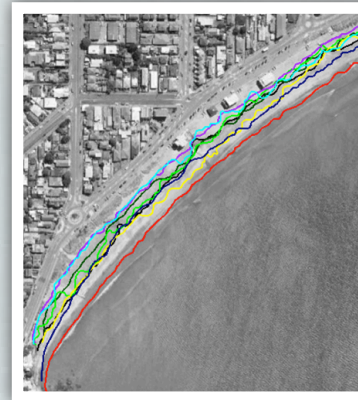
SECTION C - PLAYGROUND TO 249 QUEENS DRIVE: REMEDIATION OPTIONS



This section of the beach is the most modified and is shown to be highly variable with respect to beach position, has an area of reclamation behind 4 buildings on the beach, and similar to the eastern section of the middle part of the beach (Section B), the western corner of the beach has been cut-off/reduced by the construction of Queens Drive from the Queens Drive roundabout to Sutherland Road. The high variability is in part due to the absence of a planted dune from the playground to Maranui SLSC/café.

RECOMMENDATIONS: Although there are no dune plantings along the eastern part of this section, the beach has widened significantly in the past 20 years. It is recommended that dune planting is undertaken in front of the playground and between the buildings and fenced off except

for access ways to limit access to the dunes. This will reduce the variability to sand in this area and potentially reduce the issues with access to the SLSCs due to piled up sand following events. Even so, as recommended as part of the bay-wide options, the beach requires management such as the redistribution of sand following storm events using earth-moving equipment and regular inspection and clearing of stormwater drains in this area. It is recommended that the stormwater outlets adjacent to the playground and Maranui SLSC/café are extended out into the intertidal



zone to reduce flooding and liquefaction/erosion. The western part of this section is relatively sheltered due to the process of refraction, although continued planting of spinifex is recommended to increase the width of the dune in front of the seawall.

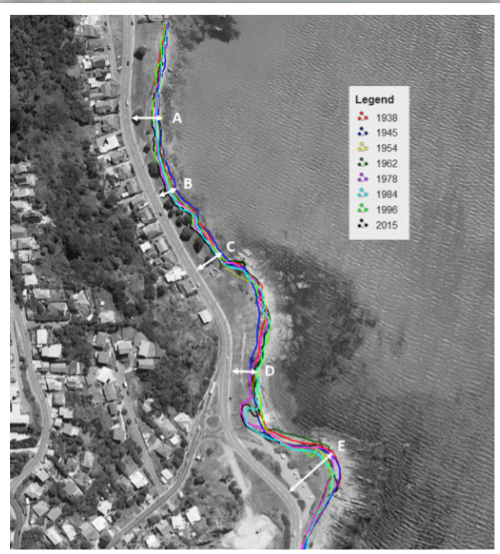
SECTION D - DORRIE LESLIE PARK: REMEDIATION OPTIONS

This western section of Lyall Bay is mostly typified by a gravel/soil substrate above a gravel beach which is perched on a fringing reef. The northern 220 m of this area is a grassed reserve with Pohutakawa trees along the edge of the gravel beach. Over time, chronic

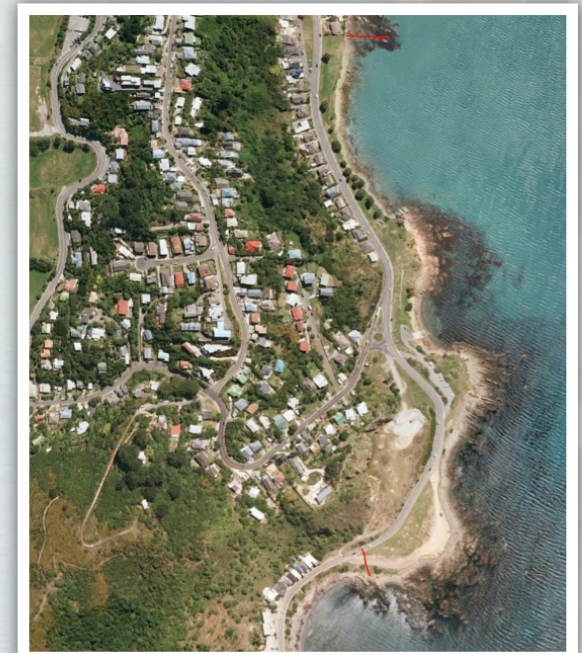


erosion has created a scarp of up to 2 m high so that today many of the Pohutakawa trees are at risk of being completely undermined and falling seaward. Further south of this grassed section, the fringing reef becomes wider and chronic erosion has cutback the foreshore up to

8 m in the past 80 years so that now some of the infrastructure is being impacted, and significant areas of the park are vulnerable to acute erosion during storms. The southernmost 300 m of the park has recently been protected by a tipped rock revetment to safeguard the coastal road and carpark.

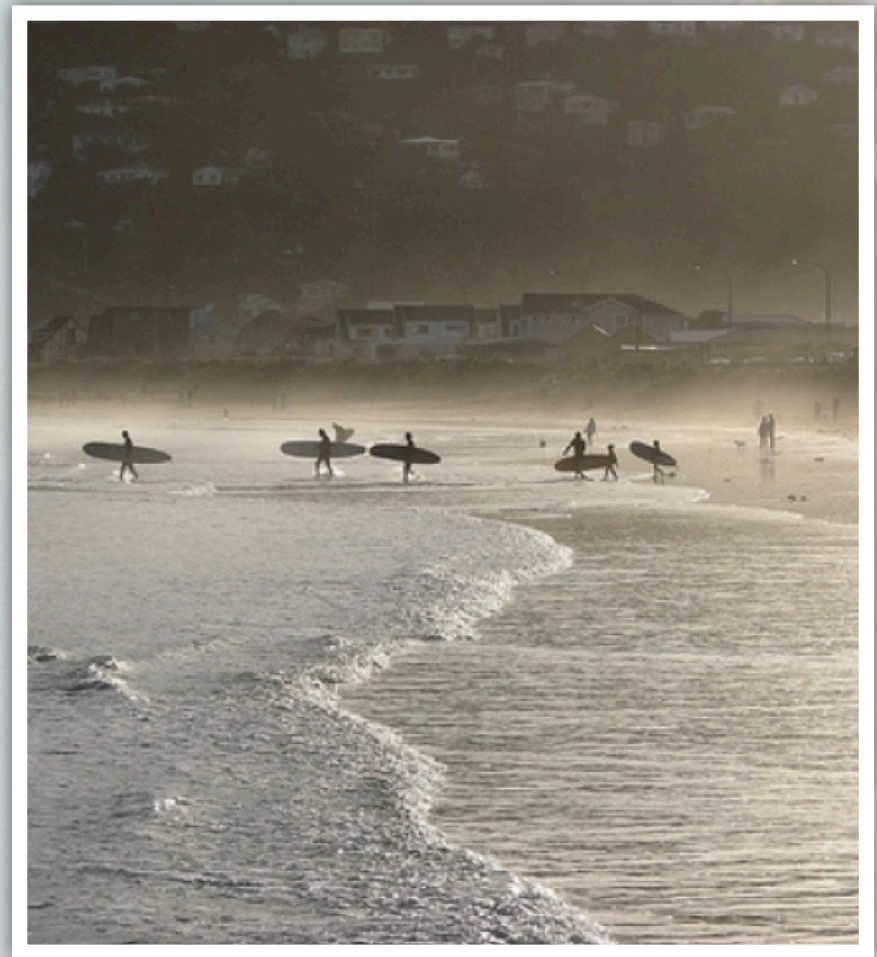


RECOMMENDATIONS: The northernmost area of the grassed part of the park has experienced relatively little erosion, and it is recommended that some re-grading of this area where the scarp is <math><0.5\text{ m}</math> high is undertaken and coastal plants such as flaxes are planted to help reduce future loss of soil. Where the Pohutakawa trees are threatened by undermining and the high beach scarp is present, armouring with similar materials as have been applied to the southern part of the park is recommended (i.e. tipping rock on a geotextile filter cloth to prevent undermining and loss of fine materials behind the rock). In the central area of the park, it is mainly the small headland on which the stone statue, Moai, is located that is the most vulnerable to future erosion. The options in this area are to either move the statue and seating landward, or place tipped rock revetment around this area. The latter is recommended given the current vulnerability of the site, which will increase with ongoing SLR.



SUMMARY

1. Over the past century, Lyall Bay has experienced ongoing human impacts, which has led to an increasingly modified beach system; it is constrained and impacted so that it no longer functions like a natural beach.
2. There are a variety of different areas that experience different levels of energy and consequently movement of beach sand (erosion/accretion).
3. The beach is constrained by wall and road, which in some areas is not in harmony with the beach's natural position – moving this infrastructure is not currently an option (with the exception of the Surfer's Corner Carpark).
4. Each of the 4 locations have specific intervention and management options, although the whole beach should be managed holistically – it is less robust with areas without plantings (e.g. between buildings and in front of the playground and Surfer's Corner Carpark), all stormwater outlets should be as seaward as possible, sand should be moved from areas of accretion to areas of erosion following storm events, sand on the road goes back on the beach, preferably on the foredune to encourage managed advance of the dune system, and so on.
5. All accessways should be angled to restrict wind-blown sand loss and wave run-up during storms.
6. Continual Planting – there is no large coastal source of sand, only slow input from Cook Strait, and all efforts should be made to maintain it in the beach system to ensure a healthy beach and build resilience for sea level rise.



For any further information and comments, please email info@ecoast.co.nz