# Matakana Island:

# Coastal Hazards and Natural Coastal Features Opportunities and Constraints: Summary

**Prepared for Land Matters Ltd**

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**Prepared by: Eco Nomos Ltd**

# Matakana Island: Coastal Hazards and Natural Coastal Features

## Opportunities and Constraints: Summary

**Report prepared for: Land Matters Property Consultants, Otaki**

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# Matakana Island: Coastal Hazards and Natural Coastal Features:

1. The report provides a preliminary review of the constraints and opportunities in respect to coastal hazards (coastal erosion and coastal inundation) and natural coastal features – including consideration of the potential effect of projected sea level rise.
2. The results provide indicative and precautionary guidelines for the entire island but more detailed work in focused areas would be required to refine the results.

## Coastal Erosion – Century to Millennia Timescale

3. The northern and southern ends of the island have been truncated by periods of severe erosion in historic times.
4. These periods of erosion truncated the:
   - northern end of the island by 2.5-3.5 km relative to the present northern end (Area A, Figure 1), and
   - southern end of the island by 2.5-4 km relative to the present southern end (Area D, Figure 1).

   The red arrows in Figure 1 show the approximate locations of the eroded shorelines.
5. The frequency of this severe erosion is unclear but appears to be relatively rare. There is evidence of at least 3 such events over the last 6000 years, though others may also have occurred.
6. The cause of the severe erosion has not yet been investigated – but was possibly related to increased tidal flows through the entrances accompanying major tsunami events. Such events need to be viewed in the context of the wider Tauranga Harbour and coastal areas of the Western Bay of Plenty District which are also likely to have been impacted.

## Coastal Erosion – Decadal to Century Timescale

7. The most significant shoreline changes occur at the northern and southern ends of the island adjacent to the harbour entrances. While available mapped data is limited, it is clear that shoreline fluctuations of 100-200 m can occur in some areas. These shoreline movements reflect the very dynamic processes that occur at tidal entrances and along shorelines adjacent to ebb tide deltas.
8. In areas removed from the influence of the tidal entrances, the ocean foreshore is less dynamic. Available shoreline change data is limited in accuracy, number of "snapshots" and/or record length. Beach profile data indicates that duneline changes are typically less than 30-40 m though historic mapped shorelines (of uncertain accuracy) suggest larger changes may occur.
9. The ocean foreshore is also slowly advancing seaward over time - averaging approximately 0.2 m/year since the Kaharoa Eruption some 700 years ago (1314 $\pm$12 AD).
10. The harbour shoreline is subject to coastal erosion associated with both tidal currents and wave action.
11. Erosion of harbour shorelines is most notable where tidal channels lie close to the shoreline and particularly where the apex of meander bends occurs close to the shore – such as parts of Hunters Creek.
12. There is also evidence of slow net erosion along much of the harbour margin not fronted by wetlands. In many areas, pine forests also extend close to the shoreline and the harbour coast lacks a spinifex vegetated frontal dune – inhibiting natural repair of storm erosion.

13. In places, shoreline change has been impacted at a local scale by coastal structures (e.g. wharves) built across the shoreline (e.g. parts of Hunters Creek near the old mill). Shoreline adjustment is likely to accompany removal of such structures.

## Coastal Erosion – Potential Impact of Projected Sea Level Rise

14. The ocean foreshore is likely to experience significant shoreline retreat in response to projected sea level rise over the next century and beyond. A conservative range of present sea level rise projections of 0.5-1.5 m over the next century could see the ocean foreshore retreat by 20-35m and 60-100 m, respectively.
15. Sea level rise is also likely to exacerbate erosion adjacent to the entrance areas - through increased tidal prism, increased storage of sediment in flood and ebb tide deltas, landward adjustment of adjacent ocean shorelines and other influences.
16. Erosion of harbour shorelines is also likely to be exacerbated by sea level rise – though probably not to the same scale as the ocean foreshore.

## Coastal Flooding - Harbour Foreshore

17. Low lying areas are particularly extensive along the harbour margin and will become increasingly vulnerable to coastal inundation with projected sea level rise of between 0.5-1.5 m over the next century; together with ongoing sea level rise beyond that period.
18. Low areas that are particularly vulnerable include:
    - Swales and depressions between the landward recurved dune ridges at the northern end of the island – often occupied by wetlands and lakes (Area A, Figure 1).
    - Back-barrier sand flats along the landward side of Matakana Island at the northern end of the island (Area B in Figure 1). This low lying area extends more than 6 km alongshore and is commonly 400-650 m (and up to 750 m) wide.
    - The area surrounding Blue Gum Bay (Area C, Figure 1)
    - The southern end of Matakana Island to the south of Duck Bay, particularly on the landward side of the island (Area D, Figure 1)
19. In addition, water tables in low lying areas will increase with sea level rise.

## Ocean Foreshore

20. The risk of coastal inundation storm is low along most of the ocean foreshore - apart from the northern and southern ends of the island which was discussed above.
21. The low vulnerability to coastal storm inundation reflects:
    - the wide (typically > 100-150m) and relatively high (typically >5-7 m) frontal dune complex that extends along most of the ocean foreshore
    - the elevation of relict dune ridges further landward – commonly 6-10 m (and in some places 10-15 m) above mean sea level

22. The risk from tsunami is presently unknown – though the limited available data suggests the potential for local- and distantly-generated tsunami of 2-4 m height for a return period of 500 years. This is unlikely to pose a threat along the ocean foreshore due to the wide high frontal dune but could seriously inundate low-lying areas along the harbour side of the island and at the northern and southern ends. The serious erosion evident at the northern and southern ends of the island does however suggest the occurrence of larger less frequent tsunami events – but as yet little is known about the potential magnitude or return period of such events.

23. The risk from inundation, including potential aggravation of existing hazard associated by projected sea level rise, can be minimised by ensuring maintenance of a wide vegetated frontal dune along the foreshore.

## Natural Coastal Features

24. The island contains a number of significant natural features, including coastal and estuarine wetlands, remnant forest areas and native vegetated dunes.

25. Coastal and estuarine wetlands are extensive in low-lying areas along the harbour margin. It is important to protect and enhance these features and to provide for lateral expansion in response to projected sea level rise. Restoration could also include provision for appropriate riparian buffers.

26. The seaward areas of the frontal dune complex have a narrow width of native dominated vegetation cover, commonly 12-25 m wide. The most seaward spinifex-dominated vegetation zone is critically important to natural dune repair and protection from wind erosion. There is evidence that wind erosion has occurred along much of the foreshore in historic times associated with disturbance of native sand binding vegetation.

27. There is also generally a limited width of native backdune communities immediately landward of the spinifex zone along most of the foreshore length – typically dominated by knobby club rush. There is considerable potential to extend the native back-dune vegetation sequence further inland over time, including restoration of appropriate dune forest. Palynological investigations indicate that prior to human arrival; native forests on Matakana Island included extensive areas of kauri, rimu, kahikatea and pohutukawa.

28. The nature and pattern of the Holocene dune ridges contains important information about the evolution of the island over the past 6500-7000 years. Ideally, modification of the dune ridges should be minimised to the extent reasonably practicable.

29. The island also contains a number of parabolic and other transgressive dune landforms formed by natural and human-induced wind erosion. Past work has suggested that these features could be actively managed to protect related values – as they may bury archaeological deposits and dune soils that have otherwise be extensively modified by historic land use, including forestry.

## Constraints and Opportunities

30. **The northern end of the island (Area A, Figure 1)** has constraints for intensive development including:
    - Very rare but severe erosion that has affected most of the area historically
    - Large scale shoreline fluctuations over decadal and longer timescales

- Extensive low-lying areas vulnerable to coastal flooding with projected sea level rise of 0.5-1.5 m over the next century
- Large areas of estuarine and coastal wetlands of high natural value, with these areas likely to expand in size with projected sea level rise

**Summary:** The area is unlikely to be suitable for intensive development unless more detailed work on rare and severe erosion indicates that future risk is acceptable. Any areas suitable for development are likely to be limited to higher areas or construction of building platforms (>RL 4-5 m) removed from the shoreline and wetland margins.

31. **The southern end of the island (Area D, Figure 1)** has significant constraints including:
    - Very rare but severe erosion that has affected most of the area historically
    - Large scale shoreline fluctuations over decadal and longer timescales
    - Extensive low-lying areas vulnerable to coastal flooding with projected sea level rise of 0.5-1.5 m over the next century

    **Overall:** The area is unlikely to be suitable for intensive development unless more detailed work on rare and severe erosion indicates that future risk is acceptable. Any areas suitable for development are likely to be limited to higher dune ridges or elevated building platforms (>4-5m) well removed from the shoreline. Higher dune ridges are also relatively close to the ocean shoreline near areas identified by other reports as having high natural character.

32. **Ocean foreshore and relict dune ridges to landward (excluding Areas A and D shown in Figure 1).** The primary hazard and natural coastal feature constraints in this area are:
    - The need to ensure any development is adequately set back or otherwise designed to accommodate potential future shoreline retreat in response to projected sea level rise
    - Ensure maintenance of a wide protective frontal dune over time to provide protection from coastal inundation (including tsunami)
    - Maintain sufficient width of native dune vegetation to prevent wind erosion and facilitate natural dune repair following storm erosion.

    **Overall:** It is probable that reasonable setbacks from the coast (possibly 100-150 m) will be required to provide for the above and protect the high natural character values of the shoreline identified by other reports. Extensive back-dune areas are likely to be suitable for development. There are also significant opportunities to enhance natural coastal values over time through extension of existing native dune vegetation sequences landward into appropriate native dune forests.

33. **Harbour foreshore (excluding Areas A and D shown in Figure 1).** The primary coastal hazard and natural coastal feature constraints along this shoreline include:
    - Ensure development is adequately set back or otherwise designed to accommodate existing erosion trends and aggravation of that erosion by projected sea level rise.
    - Extensive low-lying areas vulnerable to coastal flooding with projected sea level rise of 0.5-1.5 m over the next century
    - Large areas of estuarine and coastal wetlands of high natural value, with these areas likely to expand landward into low lying areas with projected sea level rise

**Overall:** Avoiding areas with elevations less than RL 3 m will probably be adequate to provide for expansion of estuarine and coastal wetlands over time and to avoid areas likely to become prone to coastal storm inundation – though higher areas may be required to avoid tsunami inundation. Accordingly, development should focus in areas with elevations or construction of elevated buildings area > RL 4-5 m until the risk posed by tsunami is clarified – with appropriate set back from the coast to avoid erosion and protect natural values. Setback requirements will vary considerably – probably from 50 m to >100 m. Setbacks should include allowance for the removal of existing coastal structures where this is relevant.

## Overall Constraints and Opportunities Summary:

The Western Bay of Plenty District Council are to:

> *Investigate a future land use and subdivision pattern for Matakana Island, including papakainga development, through a comprehensive whole of island study which addresses amongst other matters cultural values, land which should be protected from development because of natural or cultural values and constraints, and areas which may be suitable for small scale rural settlement, lifestyle purposes or limited Urban Activities.*

From a coastal hazards and processes perspective:

1. There would be little constraint in providing for land use like papakainga, rural settlement or limited urban activities on the elevated back dune areas of the barrier or the elevated areas of the inner habour peninsula of the Island. On other areas of the Island rural lifestyle occupation with built form > 4 – 5m allowing limited restriction to natural and possible changing coastal hazards could be managed;
2. There is an opportunity for those activities to include management techniques to enhance natural values of particularly the dune areas by way of specifying plant species and sequences and education about pest plants that invade these areas. The education aspect should also refer to appropriate methods for eradication;
3. Opportunities exist to return parts of Hunters Creek back to a more naturally functioning system through removal of derelict structures that have modified sediment transport along the shoreline;
4. Opportunities exist to set aside low lying land to provide for expansion of coastal and estuarine wetland systems in response to projected sea level rise;
5. Some constraint exists for the northern and southern barrier ends, and those areas would be more suited to low intensity rural lifestyle activities subject to elevated building areas and buffering from areas of significant natural value;
6. Further opportunities may exist for the northern and southern barrier ends but that would need to be the subject of more detailed analysis of severe erosion events and in particular return frequency;
7. These constraints and opportunities can be mapped in more detail through a Plan for the Island.

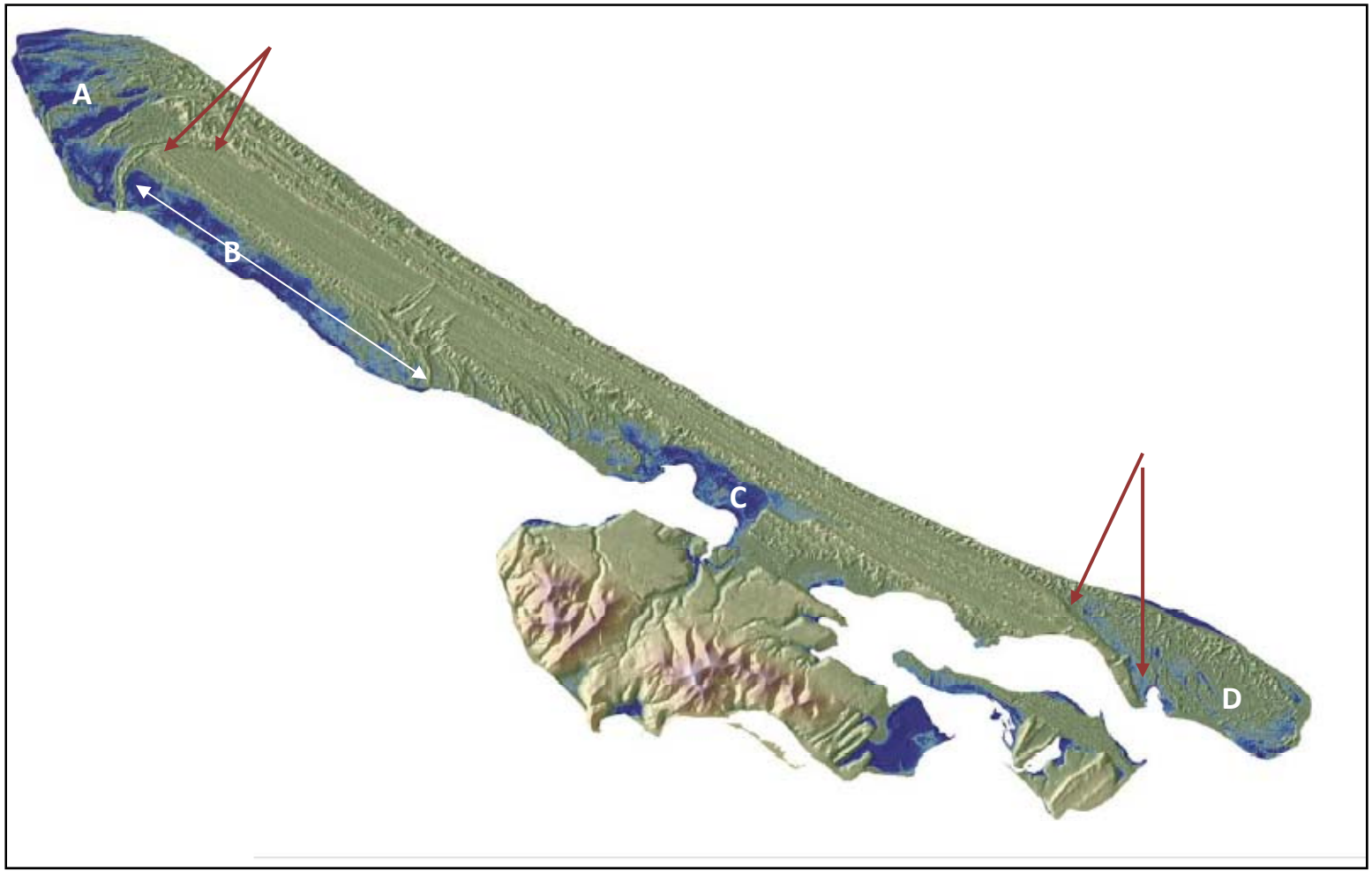


**Figure 1:** LiDAR survey maps of Matakana Island showing pattern of dune ridges and areas referred to in text. The areas shaded in blue are low lying areas less than 2m above mean sea level (the darker the shade the lower the elevation). Arrows show historic eroded shorelines.