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Prepared for:
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MININOA-SIUMU BEACH SHORELINE ANALYSIS

Aerial photographs were obtained for Mininoa-Siumu from MNRE Technical Services for 1954 (1:18,000 scale) and 1999 (1:10,000 scale). Additional satellite imagery was obtained from DigitalGlobe for 2003, 2009, 2010 and 2015. The 2009 and 2010 samples bracketed the September 2009 tsunami. This imagery was georeferenced to a consistent geographical location using geological and anthropogenic control such as rock outcrops, bridges and houses. Shorelines were then digitised using the vegetation-front as indicator, this being normal practice when using such data for shoreline analysis. Allowance was made for overhanging vegetation by interpolating between adjacent overhang-free locations. Other short-term irregularities were removed by shoreline smoothing across 50 m in the longshore direction. The detected shoreline accuracy (including georeferencing errors) is estimated to range between +/- 2 m and +/- 5 m.

Historical imagery with superimposed digitised shorelines are overlaid upon the August 2015 satellite image in Figure 1. The measurement transects are marked 1 to 9, these sites being chosen to represent variation in coastal setting observed to occur within the area of interest. The shoreline time-series are depicted in the 9 graphs shown in Figure 2. Note these graphs all have the same horizontal and vertical scales enabling direct comparison when inspecting. The rate of change analysis (average annual change) for the 1954 to 2015 period, and also for the more recent 1999 to 2015 period, were determined using linear regression modelling. The derived values for each site, together with the corresponding net shoreline change distance for the two time spans, are listed in Table 1. The probability of the derived rates of change being statistically valid (80% likelihood) were calculated and are identified by the green highlighting in Table 1.

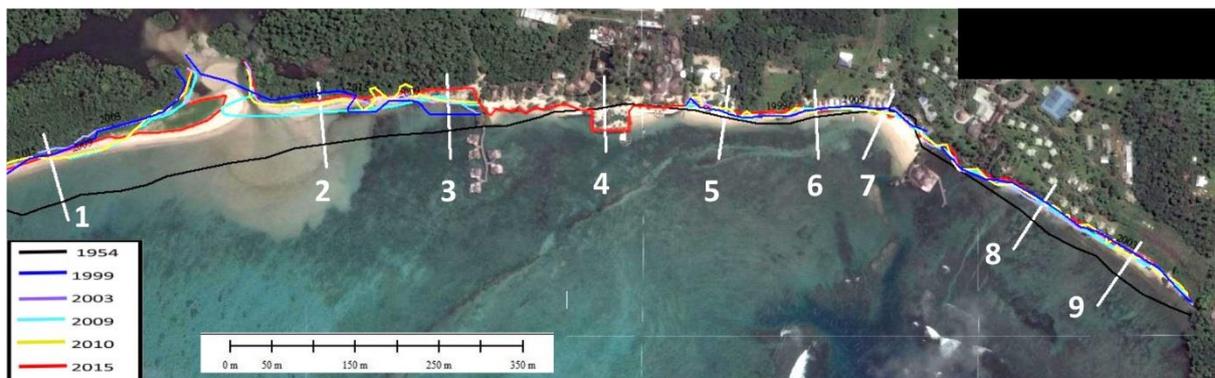


Figure 1 Historical shorelines overlaid upon the August 2015 satellite image. White lines locate measurement transects for Sites 1 to 9.

The results show that this coast is dominated by long-term shoreline retreat with the highest erosion values occurring at the western end: 43.3 to 61 m for Sections 1 to 3. These elevated values may be related to inlet dynamics which often effect adjacent shoreline behaviour. Values at the eastern end (Sites 8 and 9) are somewhat lower at 26.3 to 31.7 m. The central beach (Sites 5 to 7) is relatively stable at -9.8 to +3.7 m, with the accretional site (7) benefitting from the sheltering effect of the nearby breakwater/wharf structure. The more recent analysis (1999 to 2015) produced half accretional and half erosional results ranging from 6.4 m of accretion down to 25.1 m of erosion. However, the green highlighting in Table 1 shows that only 2 of the 9 sites gave significant values; Site 7 (3.7 m) which is the wave sheltered site, and Site 3 (-25.1 m) which is in the lee of the seawall and alongshore erosional adjustment is likely to occur in such a location. Of course the shoreline at the seawall site (4) has no recent change value. Finally it is noted that the regression analysis incorporated the tsunami effects.

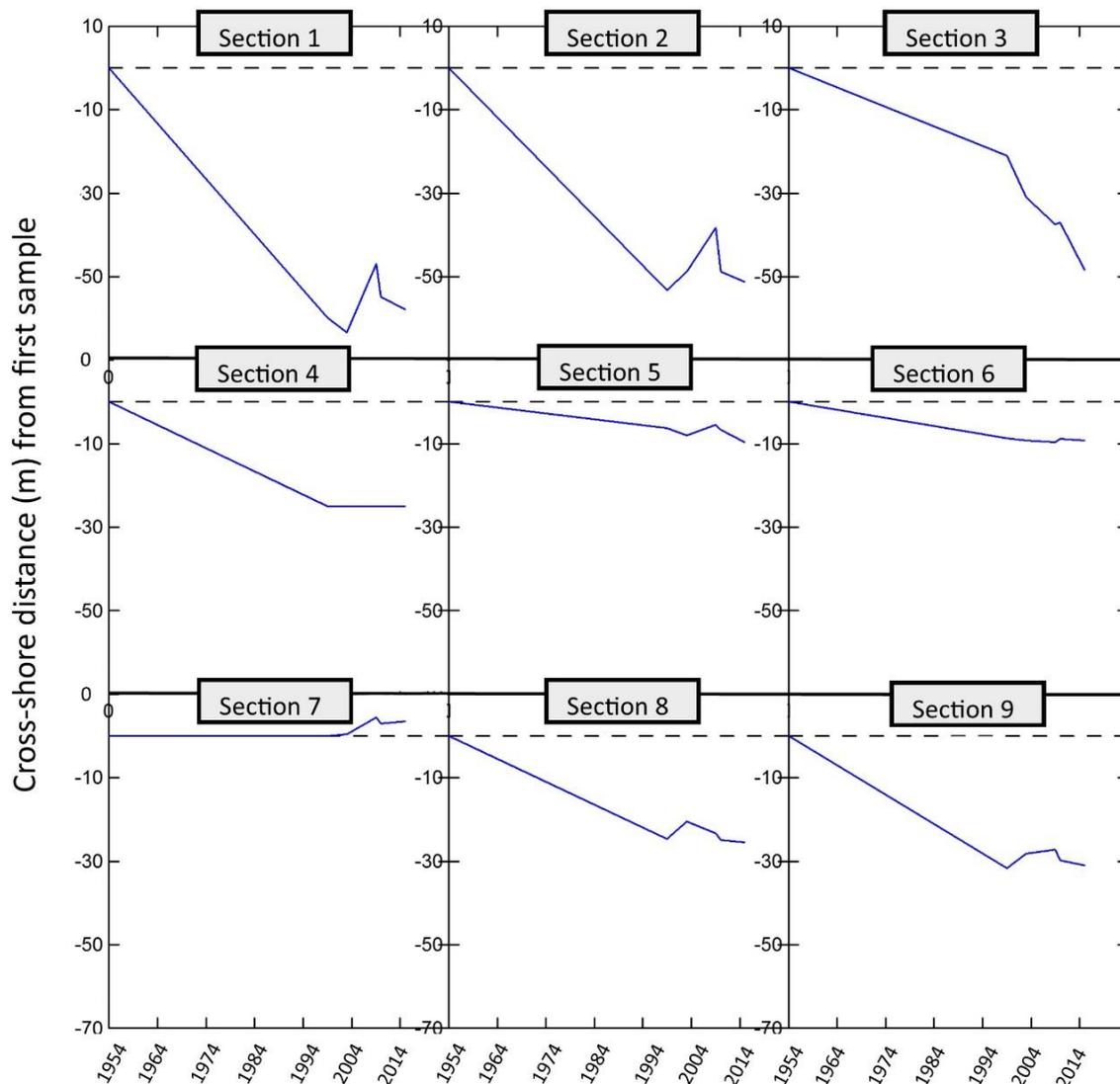


Figure 2 Shoreline time-series for the 9 sectional transects marked in Figure 1. The distance and time origins are from the first (1954) sample. Negative values relate to erosion (shoreline retreat) and positive to accretion (shoreline advance).

Table 1 Shoreline net change and average annual (rate of) change for the 9 measurement sites at Mininoa-Siumu

Section	1954 to 2015		1999 to 2015	
	Net Change (m)	Rate (m/yr)	Net Change (m)	Rate (m/yr)
1	-61.0	-1.0	+6.4	+0.4
2	-50.6	-0.83	+3.7	+0.23
3	-43.3	-0.71	-25.1	-1.57
4	-26.8	-0.44	NA	NA
5	-7.9	-0.13	-1.9	-0.12
6	-9.8	-0.16	-0.5	-0.03
7	+3.7	+0.06	+4.3	+0.27
8	-26.3	-0.43	-2.2	-0.14
9	-31.7	-0.52	+0.3	+0.02

Notes: Green highlighted values refer to statistically significant rates of change at the 80% level, i.e. $p < 0.2$.

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