

Salt Ecology Short Report 029. Prepared by Leigh Stevens for Greater Wellington Regional Council, June 2023.

OVERVIEW

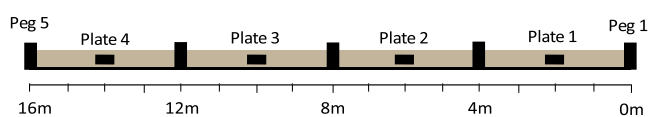
Since 2010, Greater Wellington Regional Council has undertaken annual State of the Environment (SOE) monitoring in Hutt Estuary to assess trends in the deposition rate, mud content, and oxygenation of intertidal sediments. Monitoring is conducted at a single site in the only remaining intertidal flat in the lower estuary (Fig. 1) with the most recent results collected on 9 January 2023 summarised here.



Fig. 1. Location of Hutt Estuary monitoring sites.

METHODS

Estuary sedimentation was measured using the ‘sediment plate’ method, as described in Robertson and Stevens (2010). The approach involves measuring the sediment depth from the surface to the top of each of four buried concrete plates, configured as follows:



Measurements are averaged across each plate (n=3) and used to calculate a mean annual sedimentation rate for the site. As year-to-year sedimentation changes can be highly variable, a 5-year rolling mean sedimentation rate is reported where sufficient data are available.

Table 1. Summary of condition ratings for sediment plate monitoring.

Indicator	Unit	Very Good	Good	Fair	Poor
Sedimentation rate ¹	mm/yr	< 0.5	≥0.5 to < 1	≥1 to < 2	≥ 2
Mud content ²	%	< 5	5 to < 10	10 to < 25	≥ 25
aRPD ³	mm	≥ 50	20 to < 50	10 to < 20	< 10

Condition ratings derived or modified from: ¹Townsend and Lohrer (2015), ²Robertson et al. (2016), ³FGDC (2012) - references in Stevens (2022).

A composite sample of the surface 20mm of sediment is simultaneously collected, and analysed for particle grain size (wet sieve, Hill Labs). This approach allows changes in sediment muddiness to be determined even where there are no changes in sediment depth.

Sediment oxygenation is an ancillary biological health variable that is visually assessed in the field by measuring the depth at which sediments show a change in colour to grey/black, commonly referred to as the apparent Redox Potential Discontinuity (aRPD). Replicate measurements taken adjacent to each plate are averaged and compared to condition ratings of ecological state shown in Table 1.

RESULTS

Sedimentation rate

The overall mean sedimentation rate for the past 10 years (2014-2023) was 1.7 mm/y, reflecting an initial period of erosion, followed by steady sediment accrual from 2016 to 2019, and erosion in 3 of the past 4 years (Fig. 2). The 10-year rate of increase corresponds to a condition rating of ‘fair’ (Table 2). The net mean sedimentation rate over the last 5 years (2019-2023) was -0.2 mm/y, rated as ‘very good’. This contrasts to the 5-year period from 2018-2022 when there was mean accrual of 3.5mm/yr, rated ‘poor’ (Stevens 2022). The change is due to the combined effects of high deposition in 2017-2018 falling outside the current calculation window, and erosion in 2020, 2022 and 2023.

Table 2. Indicator values and condition ratings from the Jan-2023 survey.

Indicator	Site A
Sedimentation rate (last 5 years) ¹	-0.2
Sedimentation rate (last 10 years) ¹	1.7
Mud content (%)	9.0
aRPD (mm)	30

¹ 5yr and 10yr refers to trend period.

The reasons for the temporal variance in erosion and accretion remain uncertain but appear to relate primarily to variability in flow condition at the monitoring site. In the Hutt Estuary, high river flows can cause scouring of the tidal flats, which has been observed, on occasion, during monitoring. The Te Mome Stream channel, which discharges across the tidal flats near the site, also has a localised influence on sediment movement and partially explains the variance between plates within years.

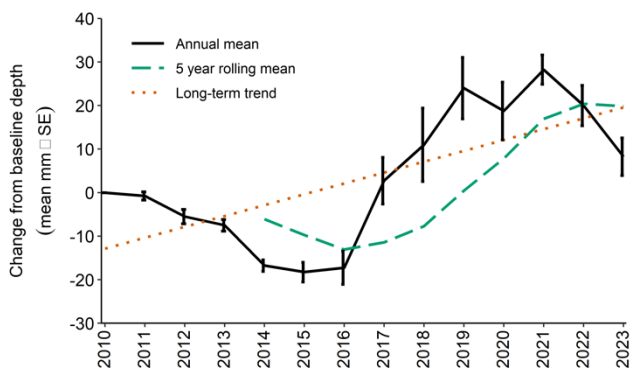


Fig. 2. Change in mean sediment depth over buried plates (\pm SE) relative to baseline year (Jan 2010), Hutt Estuary.

Sediment mud content and oxygenation

Mean sediment mud content in Jan-2023 was 9.0%. This value is the lowest measured mud content to date and corresponds to a condition rating of 'good'. The result is consistent with previous surveys (2015, 2016 and 2020) where periods of sediment erosion removed surficial muddy sediments and correlated with low mud contents.

The average aRPD depth was 30mm in January 2023, a condition rating of 'good' (Table 3). This level of oxygenation is partially maintained by the presence of crabs and burrowing organisms, which turn over surface sediments and create voids that allow air and water to transfer oxygen to underlying sediments, but also by the relatively low mud content meaning seawater (and air at low tide) is able to penetrate interstitial spaces, a process limited in muddy sediments.



Moderately well-oxygenated sandy sediment at Site A.

Table 3. Sedimentation rate, grain size (%) and aRPD (mm) results compared to Table 1 condition ratings.

Year	Sed rate mm/yr	Gravel %	Sand %	Mud %	aRPD mm
2011	-1.0	-	-	-	-
2012	-4.3	-	-	-	-
2013	-2.2	-	-	-	-
2014	-9.1	3.6	74.5	21.9	15
2015	-1.5	10.1	77.6	12.3	15
2016	1.0	8.8	74.8	16.4	8
2017	19.7	5.5	71.3	23.2	13
2018	8.4	7.8	68.4	23.8	15
2019	13.0	9.5	66.7	23.8	20
2020	-5.3	9.1	73.7	17.2	25
2021	10.6	9.8	77.9	12.3	30
2022	-7.4	12.0	70.6	17.4	16
2023	-12.1	5.8	85.2	9.0	30

Note: Grain size results are based on a single composite sample.

CONCLUSIONS

Sedimentation has been variable since monitoring began, with large deposition and erosion events recorded between 2011 and 2023. Over the past 10 years there has been an overall trend of moderate deposition, with net erosion recorded over the past 5 years. The sediment mud content has also been variable but has been trending downwards since 2019, while the moderately shallow and variable aRPD depth has been increasing (improving) at the same time. This tentatively suggests an improvement in sediment condition, although because of the variable sediment deposition and erosion, only tolerant species of infauna are likely to be able to survive on the intertidal flats. It is also noted that while recent years indicate a period of erosion and an improvement in sediment condition, most fine sediment from catchment sources is likely to deposit in subtidal basin areas which are not monitored.

RECOMMENDED MONITORING

Continue annual monitoring of sediment rate, aRPD and grain size to measure intertidal sediment deposition and temporal change. Report results annually via a summary card report, with detailed reporting undertaken ~5 yearly in conjunction with fine scale monitoring.

REFERENCES

- Robertson BM, Stevens LM. 2010. Hutt Estuary: Fine Scale Monitoring 2009/10. Prepared for Greater Wellington Regional Council. 24p.
- Stevens LM. 2022. 2021/2022 Hutt Estuary: Intertidal Sediment Monitoring Summary. Salt Ecology Short Report 014, prepared for Greater Wellington Regional Council, February 2022. 2p.