HUTT ESTUARY: 2019/2020 INTERTIDAL SEDIMENT MONITORING SUMMARY

Salt Ecology Report 056. Prepared for Greater Wellington Regional Council by Leigh Stevens, November 2020.

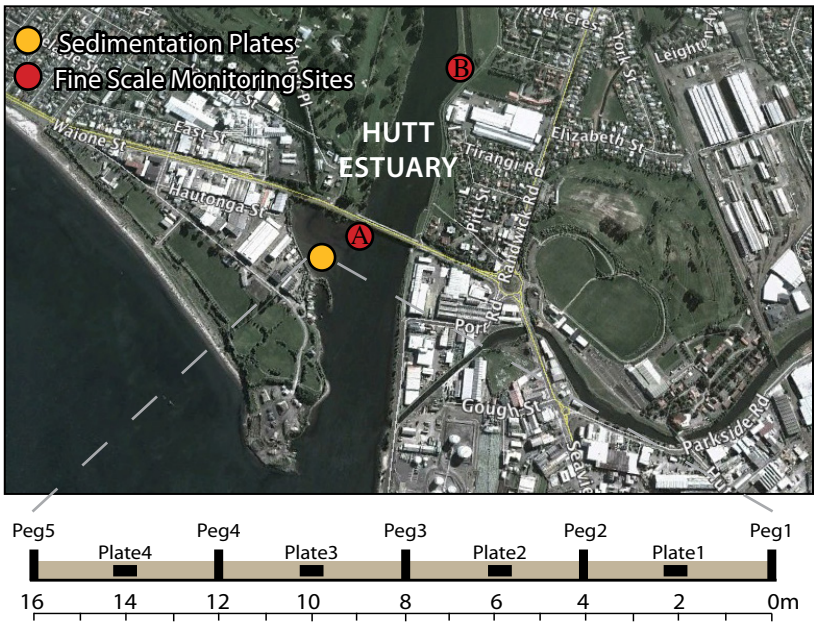
OVERVIEW

Since 2010, Greater Wellington Regional Council has undertaken annual State of the Environment (SOE) monitoring of sediment indicators in Hutt Estuary to assess trends in the deposition rate, mud content, and oxygenation of intertidal sediments. The monitoring site, comprising four buried sediment plates, is located in the only remaining intertidal flat in the lower estuary (see Fig. 1 below for site details). The results of annual monitoring undertaken on 16 January 2020 are summarised in this report card, and a subset of data are also reported from two fine scale monitoring sites.

METHODS

The approach, described in detail previously (Robertson & Stevens 2010), measures changes in the depth of sediment overlying buried concrete plates stabilised on steel waratahs. Plates are positioned at 90° to the river channel and spaced relatively closely together (4m apart) because of the relatively narrow sediment deposition zone. Measurements are made by vertically inserting a measuring probe in the sediment and measuring the depth to the underlying plate, with a straight edge used to average out any minor surface height irregularities. Plate measurements are averaged (n=3) and used to calculate a mean annual sediment rate for the site.

Sediment condition is further assessed by laboratory analysis of grain size (wet sieving with dispersant, 2mm and 63µm sieves, gravimetry - calculation by difference). This allows changes in sediment muddiness to be determined even where there are no changes in sediment depth. Sediment oxygenation, a key measure of biological health, is visually assessed by measuring the apparent Redox Potential Discontinuity (aRPD) depth, the depth at which sediments show a change in colour to grey/black. Results are compared to condition bands (Table 1) developed as part of the NZ Estuary Trophic Index (ETI) to indicate ecological state.



Coordinates of sedimentation pegs and plates

Item	NZTM East	NZTM North
Plate 1	1759101	5433548
Plate 2	1759097	5433548
Plate 3	1759093	5433548
Plate 4	1759089	5433548
Peg 1	1759103	5433548
Peg 2	1759099	5433548
Peg 3	1759095	5433548
Peg 4	1759091	5433548
Peg 5	1759087	5433548

Fig. 1. Location of intertidal sediment plates and fine scale monitoring sites in the lower Hutt Estuary.

Table 1. Summary of subjective condition ratings referred to in the present report.

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

Ratings derived from: [1]Townsend and Lohrer (2015), [2]Robertson et al. (2016b), [3]FGDC (2012).

RESULTS

2010-2020 Sedimentation Rate

Fig. 2 summarises changes in sediment levels since 2010, with raw data appended. There has been an overall mean sedimentation rate of +1.9mm/yr across the 10 years of monitoring, with a rolling mean over the past 5 years of 7.4mm/yr, a condition rating of 'poor'. Fig. 2 shows a consistent decrease in sedimentation from 2010 to 2016, followed by sediment accrual from 2017 to 2019, and another decrease in 2020.

Variation such as this is very much driven by cycles of erosion and deposition, and the timing of sampling in relation to recent flood events has a significant influence on results, with scouring of tidal flats during high river flows clearly obvious at times. 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 relatively high variance between plates within years. Dredging of the river channel in the lower estuary is also likely to exert a strong influence on the sedimentation rate recorded at the monitoring site through the removal of deposited sediment.

Consequently, rather than responding to annual measures, long-term trends should be used to guide monitoring management and decisions.

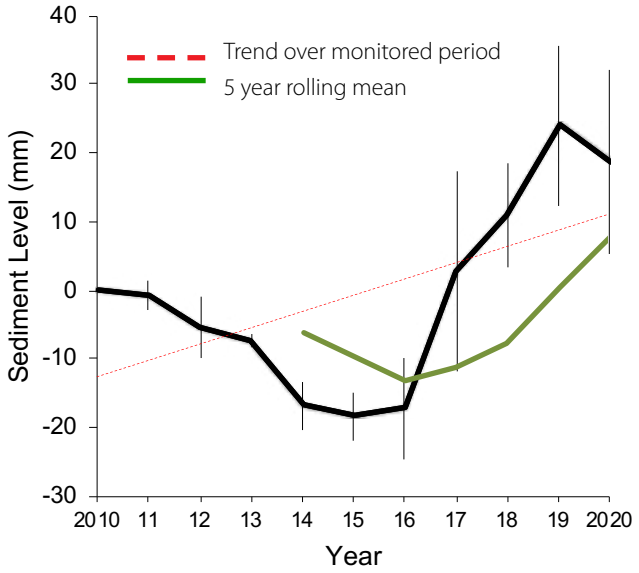


Fig. 2. Change in mean sediment level over buried plates (± annual range), Hutt Estuary, 2010 to 2020.

MEAN SEDIMENTATION RATE	RATING
2010-2020: 1.9 (mm/yr) (SE=0.43)	GOOD
2015-2020: 7.4 (mm/yr) (SE=0.55)	POOR

2020 Sediment Mud Content

Mean sediment mud content in 2020 was 17.2%, a rating of 'fair', and has been relatively consistent since measurements were first taken in 2014 (Figure 3, Table 2). Although there has been no significant change over time, the lowest mud contents correlate with periods of sediment erosion in 2015, 2016 and 2020, likely as a consequence of fine muds being flushed from the interidal flats into adjacent subtidal areas.

2020 Sediment aRPD depth

The average aRPD depth (based on replicate measurements adjacent to each plate) was 25mm

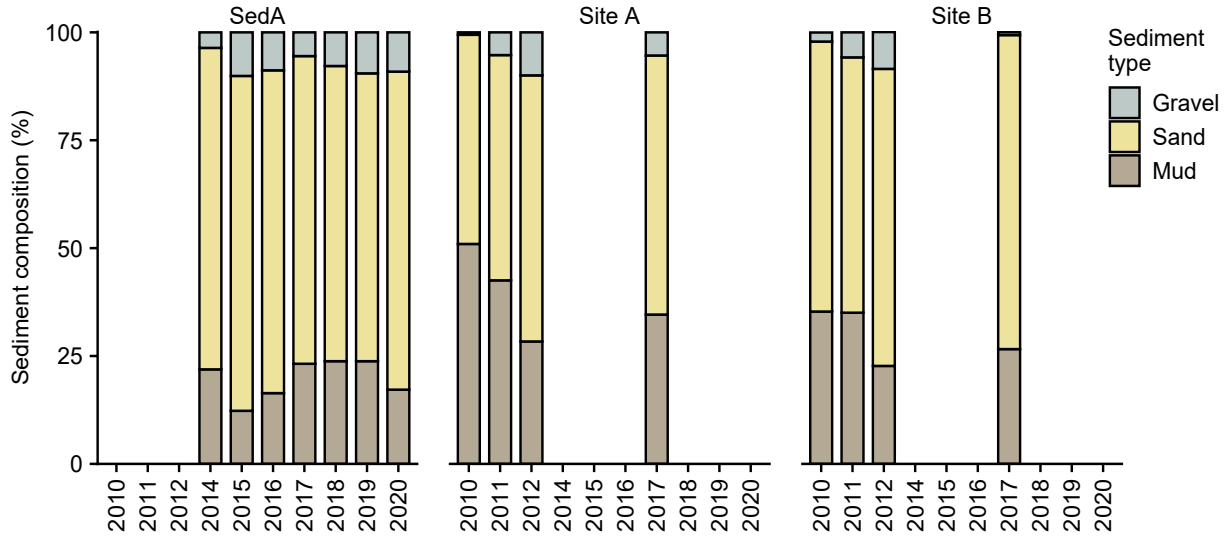


Fig. 3. Sediment mud, sand and gravel content, Hutt Estuary, at the sediment plate site (Sed A) and the two fine scale sites (Sites A and B).

Table 2. Mean grain size and aRPD results for the Hutt Estuary sedimentation plate sites, 2014-2020.

Year	aRPD (mm)	Mud%	Sand%	Gravel%
2014	15	21.9	74.5	3.6
2015	15	12.3	77.6	10.1
2016	8	16.4	74.8	8.8
2017	13	23.2	71.3	5.5
2018	15	23.8	68.4	7.8
2019	20	23.8	66.7	9.5
2020	25	17.2	73.7	9.1

Note: Grain size results are based on a single composite sample collected adjacent to each plate, i.e. 4 sub-samples/ site

which is in the 'fair' condition rating band. This level of oxygenation is partially maintained by the presence of crabs, shellfish (cockles) and macroinvertebrate worms in the surface sediments, turning over the sediment surface and creating voids that allow air and water to transfer oxygen to underlying sediments.

CONCLUSION

The sedimentation rate over the past 10 years shows an overall trend of deposition, a relatively consistent moderately elevated sediment mud content, and a moderately shallow aRPD depth. Consequently the estuary flats remain under pressure from sediment impacts related to poor water clarity and muddy intertidal substrates, with a macrofaunal community likely dominated by mud tolerant species - a common situation in NZ tidal river estuaries.

RECOMMENDED MONITORING

Continue annual monitoring of sediment rate, aRPD and grain size to measure sediment deposition and temporal change. Report results annually via a summary card report, with detailed reporting undertaken five yearly in conjunction with fine scale monitoring, next scheduled for 2022.

Measuring sediment plates in January 2020

Surface sediments were well oxygenated to an average depth of 25mm in January 2020

REFERENCES

FGDC. 2012. Coastal and Marine Ecological Classification Standard Catalog of Units, Federal Geographic Data Committee FGDC-STD-018-2012. 343p.

Robertson BM, Stevens LM. 2010. Hutt Estuary: Fine Scale Monitoring 2009/10. Prepared for Greater Wellington Regional Council. 24p.

Robertson BM, Stevens L, Robertson BP, Zeldis J, Green M, Madarasz-Smith A, Plew D, Storey R, Hume T. Oliver M. 2016b. NZ Estuary Trophic Index. Screening Tool 2. Screening Tool 2. Determining Monitoring Indicators and Assessing Estuary Trophic State. Prepared for Envirolink Tools Project: Estuarine Trophic Index MBIE/NIWA Contract No: C01X1420. 68p.

Townsend M, Lohrer D. 2015. ANZECC Guidance for Estuary Sedimentation. NIWA client report number HAM2015-096, prepared for Ministry for the Environment. 45p.

RAW SEDIMENT PLATE MONITORING DATA 2010-2020

date	plate	depth (mm)	baseline (mm)	Interval (days)	annual adjustment (mm)	annualised change (mm)	change from baseline (mm)
11/4/10	p1	257	257	NA	NA	NA	0
15/1/11	p1	256	257	279	0.8	-1.3	-1
21/2/12	p1	247	257	402	1.1	-8.2	-10
15/1/13	p1	246	257	329	0.9	-1.1	-11
22/1/14	p1	240	257	372	1	-5.9	-17
18/1/15	p1	235	257	361	1	-5.1	-22
23/1/16	p1	237	257	370	1	2	-20
27/1/17	p1	275	257	370	1	37.5	18
21/1/18	p1	293	257	359	1	18.3	36
21/1/19	p1	298	257	365	1	5	41
16/1/20	p1	288	257	360	1	-10.1	31
11/4/10	p2	250	250	NA	NA	NA	0
15/1/11	p2	248	250	279	0.8	-2.6	-2
21/2/12	p2	245	250	402	1.1	-2.7	-5
15/1/13	p2	242	250	329	0.9	-3.3	-8
22/1/14	p2	232	250	372	1	-9.8	-18
18/1/15	p2	234	250	361	1	2	-16
23/1/16	p2	225	250	370	1	-8.9	-25
27/1/17	p2	244	250	370	1	18.7	-6
21/1/18	p2	252	250	359	1	8.1	2
21/1/19	p2	280	250	365	1	28.3	30.3
16/1/20	p2	271	250	360	1	-9.5	21
11/4/10	p3	295	295	NA	NA	NA	0
15/1/11	p3	297	295	279	0.8	2.6	2
21/2/12	p3	290	295	402	1.1	-6.4	-5
15/1/13	p3	289	295	329	0.9	-1.1	-6
22/1/14	p3	276	295	372	1	-12.8	-19
18/1/15	p3	273	295	361	1	-3	-22
23/1/16	p3	278	295	370	1	4.9	-17
27/1/17	p3	292	295	370	1	13.8	-3
21/1/18	p3	295	295	359	1	3.1	0
21/1/19	p3	306	295	365	1	10.7	10.7
16/1/20	p3	318	295	360	1	12.8	23.3
11/4/10	p4	287	287	NA	NA	NA	0
15/1/11	p4	285	287	279	0.8	-2.6	-2
21/2/12	p4	285	287	402	1.1	0	-2
15/1/13	p4	282	287	329	0.9	-3.3	-5
22/1/14	p4	274	287	372	1	-7.8	-13
18/1/15	p4	274	287	361	1	0	-13
23/1/16	p4	280	287	370	1	5.9	-7
27/1/17	p4	289	287	370	1	8.9	2
21/1/18	p4	293	287	359	1	4.1	6
21/1/19	p4	301	287	365	1	8.3	14.3
16/1/20	p4	287	287	360	1	-14.9	-0.3