WAIKANAE ESTUARY: INTERTIDAL SEDIMENT MONITORING SUMMARY, 2016/2017

Prepared for Greater Wellington Regional Council by Leigh Stevens, Wriggle Coastal Management, April 2017

Figure 1. Location of intertidal sediment plates and fine scale monitoring site in Waikanae Estuary.

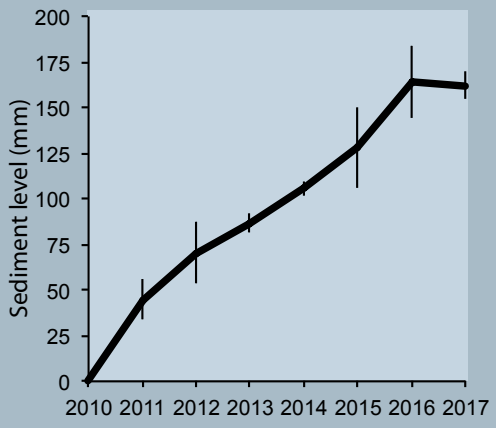

Figure 2. Change in mean sediment level over buried plates (+/- annual range), Waikanae Estuary, 2010 to 2017.

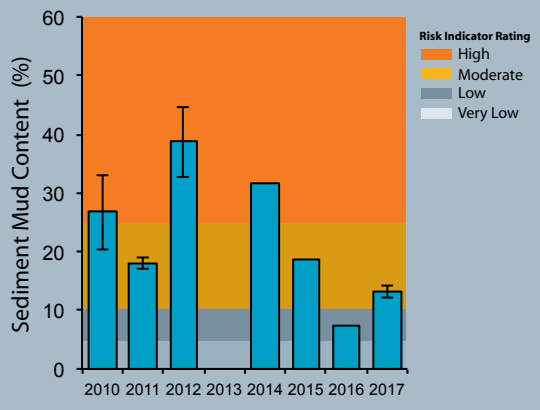

Figure 3. Sediment mud content (+/-SE, n=3), Waikanae Estuary, 2010-2017*.

*2010-2012, 2017 = triplicate composite samples
2014-2016 = single composite samples

This summary card presents the results of monitoring undertaken on 29 January 2017 to track changes to sediment indicators in Waikanae Estuary.

Methods

The depths to four concrete plates buried in intertidal sediment in 2010 were measured to assess the long-term sedimentation rate (Figure 1 - see Robertson and Stevens 2010 for full details). Sediment condition was assessed by measuring grain size and visually assessing the apparent Redox Potential Discontinuity (aRPD) depth, a measure of sediment oxygenation.

Risk Indicator Ratings

To help quickly identify the potential significance of sediment to Waikanae Estuary, "risk indicator ratings" have been proposed (Table 1, see Stevens and Robertson 2014 for further detail) and are part of a suite of indicators being developed to assess the predominant issues affecting NZ estuaries (i.e. eutrophication, sedimentation, disease risk, toxicity and habitat change - Robertson and Stevens 2006, 2010, 2012). For each indicator, relative levels of risk (e.g. very low, low, moderate, high) are assigned based on their relationship with sediment quality. Each rating is designed to be used in combination with relevant information and other risk indicator ratings, and under expert guidance, to assess overall estuary condition in relation to key issues, and to make monitoring and management recommendations.

Table 1. Risk indicator ratings for sedimentation rate, sediment mud content, and RPD depth.

RISK INDICATOR RATING	SEDIMENTATION RATE	MUD CONTENT	aRPD DEPTH
Very Low	<1mm/yr	<5%	Unreliable
Low	>1-2mm/yr	5-10%	Unreliable
Moderate	>2-5mm/yr	>10-25%	0.5-2cm
High	>5mm/yr	>25%	<0.5cm

2010-2017 Sedimentation Rate

Figure 2 and Table 2 summarise sediment level changes since 2010. The overall mean sedimentation rate across the seven years of monitoring is an increase of 23.2mm/yr, a risk rating of "high", with changes in the annual site average ranging from a low of -1.8 (2017) to a high of +45mm/yr (2011). Overall, there is a strong trend of increasing sedimentation with mud deposits a dominant feature of the upper estuary, highlighting ongoing fine sediment deposition on the upper estuary flats.

2017 Sediment Mud Content and aRPD depth

Mean sediment mud content was 13.2% (Table 3, Figure 3), reflecting firm muddy sands comprising a mix of marine sands and terrestrial muds. Average aRPD depth was 2.9cm. Mud content values fall within the "moderate" risk indicator rating, and aRPD in the "low/very low" rating.

Conclusion

The sedimentation rate over the past 7 years shows rapid deposition, and a relatively consistent elevated sediment mud content and shallow aRPD depth. Consequently the upper estuary remains at high risk of sediment related impacts from poor clarity and muddy intertidal substrates, with a macrofaunal community 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, with detailed reporting undertaken 5 yearly in conjunction with fine scale monitoring.

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Table 2. Sediment monitoring results for Waikanae Estuary, January 2010 - January 2017.

SITE	Measured Mean Depth to Sediment Plate (mm)								Change in Sediment Level Over Plate (mm)							SEDIMENTATION RATE 2010-17	
	20/01/10	16/01/11	20/02/12	14/01/13	21/01/14	18/01/15	28/1/16	29/1/17	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	(mm/yr)	RISK RATING
Plate 1	180	238	276	296	315	361	378	383	+58	+38	+20	+19	+46	+17	5	23.2 (SE=2.05)	HIGH
Plate 2	213	261	295	305	324	355	380	374	+48	+34	+10	+19	+31	+25	-6		
Plate 3	231	270	295	310	333	335	392	382	+39	+25	+15	+23	+2	+57	-10		
Plate 4	235	270	274	295	310	319	365	369	+35	+4	+21	+15	+9	+46	4		
Mean Change in Sediment Level (mm/yr)									+45.0	+25.3	+16.5	+19.0	+22.0	+36.3	-1.8		

Table 3. Mean grain size and aRPD results for the Waikanae Estuary sedimentation plate site, 2010 - 2017.

Date	aRPD depth	Mud	Sand	Gravel
2010	3.0 (range 2-3.5)	26.7%	60.7%	0.5%
2011	5.1 (range 3-10)	18.0%	81.3%	0.7%
2012	1.1 (range 1-2)	38.7%	72.7%	0.6%
2013	1.1 (range 1-2)	-	-	-
2014	1.5 (range 1-2)	31.7%	68.0%	0.3%
2015	1.5 (range 1-2)	18.7%	81.0%	0.3%
2016	2.5 (range 2-4)	7.4%	91.7%	0.9%
2017	2.9 (range 2-5)	13.2%	83.8%	3.0%

Note: Grain size results are based on a single composite sample comprising 10 sub-samples collected from the site. Mean RPD depth is derived from 10 replicate measures.

References

Robertson, B.P. 2013. Determining the sensitivity of macro-invertebrates to fine sediments in representative New Zealand estuaries. Honours thesis, University of Victoria, Wellington.

Robertson, B.M. and Stevens, L. 2006. Southland Estuaries State of Environment Report 2001-2006. Prepared for Environment Southland. 45p plus appendices.

Robertson, B.M. and Stevens, L. 2010. Waikanae Estuary: Fine Scale Monitoring 2009/10. Prepared for Greater Wellington Regional Council. 20p.

Robertson, B.M. and Stevens, L. 2012. Tasman Coast: Waimea Inlet to Kahurangi Point, habitat mapping, risk assessment and monitoring recommendations. Prepared for Tasman District Council. 167p.

Location of sedimentation rate monitoring plates in Waikanae Estuary.

Site	NZTM East	NZTM North
Plate 1	1769247	5473369
Plate 2	1769249	5473370
Plate 3	1769252	5473371
Plate 4	1769253	5473371

Measuring sediment plate depths in Waikanae Estuary, January 2017.