WAIKANAE ESTUARY: INTERTIDAL SEDIMENT MONITORING SUMMARY, 2013/2014

Prepared for Greater Wellington Regional Council by Leigh Stevens and Barry Robertson, Wriggle Coastal Management, March 2014

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

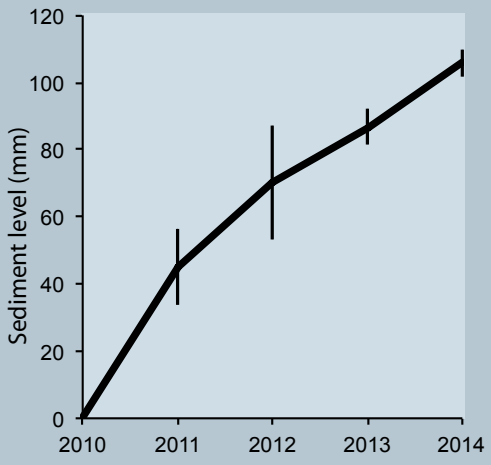

Figure 2. Change in mean sediment level over buried plates (+/- annual range), Waikanae Estuary, 2010 to 2014.

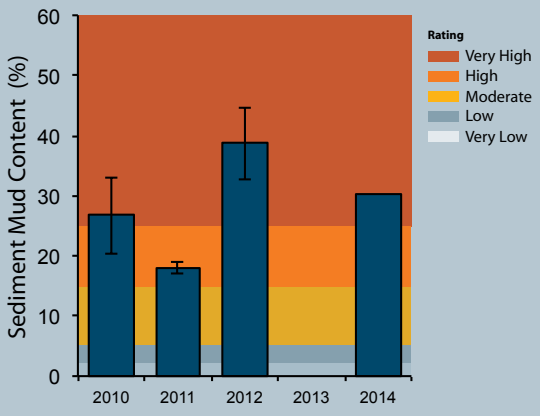

Figure 3. Sediment mud content (+/-SE, n=3), Waikanae Estuary, 2010-12, 2014*.

*2014 = single composite sample

This summary card presents the results of monitoring undertaken on 21 January 2014 to track changes to sediment indicators in Waikanae Estuary. Detailed reporting is scheduled to be undertaken 5 yearly (next due 2017).

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). Redox Potential Discontinuity (RPD) depth and sediment grain size were assessed to indicate sediment condition.

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, 2012, 2013). For each indicator, relative levels of risk (e.g. very low, low, moderate, high, very high) are assigned based on their relationship with water or 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 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*	RPD DEPTH
Very Low	<1mm/yr	<2%	>10cm
Low	>1-2mm/yr	2-5%	3-10cm
Moderate	>2-5mm/yr	>5-15%	1-<3cm
High	>5-10mm/yr	>15-25%	0-<1cm
Very High	>10mm/yr	>25%	Anoxic at surface

* rating revised in 2014 based on Robertson (2013).

2010-2014 Sedimentation Rate

Figure 2 and Table 2 summarise sediment level changes since 2010. Sediment level changes over individual plates range from +4 to +58mm/yr, with the annual site average ranging from +16.5 to +45mm/yr. The overall mean sedimentation rate across the four years of monitoring is an increase of 26.4mm/yr. Although the lower estuary near the open coast remains dominated by clean sands, these results, combined with observations of fresh mud deposits, highlight rapid recent sediment infilling of the upper estuary flats.

2014 Sediment Mud Content and RPD depth

Sediment mud content was 31.7% (Table 3, Figure 3), reflecting soft mud overlying firm muddy sands. Average RPD depth was 1.5cm and has declined since 2010 (Table 3). RPD and mud content fall within the "moderate" and "very high" risk indicator ratings respectively.

Conclusion

The sedimentation rate over the past 4 years showed rapid deposition, and the elevated sediment mud content and shallow RPD depth indicate the upper estuary is 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, RPD and grain size to measure sediment deposition and temporal change on the only significant remaining intertidal flat within the estuary. Report results annually via a summary card, with detailed reporting undertaken 5 yearly in conjunction with fine scale monitoring (next scheduled for 2017).

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Table 2. Sediment monitoring results for Waikanae Estuary, January 2010 - January 2014.

SITE	Measured Mean Depth to Sediment Plate (mm)					Change in Sediment Level Over Plate (mm)				SEDIMENTATION RATE 2010-2014	
	20/01/2010	16/01/2011	20/02/2012	14/01/2013	21/01/2014	2010-2011	2011-2012	2012-2013	2013-2014	(mm/yr)	RISK RATING
Plate 1	180	238	276	296	315	+58	+38	+20	+19	26.4 (SE=3.1)	VERY HIGH
Plate 2	213	261	295	305	324	+48	+34	+10	+19		
Plate 3	231	270	295	310	333	+39	+25	+15	+23		
Plate 4	235	270	274	295	310	+35	+4	+21	+15		
Mean Change in Sediment Level (mm/yr)						+45.0	+25.3	+16.5	+19.0		

Table 3. Mean grain size and RPD results for the Waikanae Estuary sedimentation plate site, 2010 - 2014.

Date	RPD 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%

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.

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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.

Robertson, B.M. and Stevens, L. 2013. Moutere Inlet fine scale monitoring 2012/2013. Prepared for Tasman District Council. 25p.

Stevens, L. and Robertson, B.M. 2014. Whareama Estuary: Intertidal Sediment Monitoring 2013/14. Prepared for Greater Wellington Regional Council. 6p.

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

Sediment plate monitoring in Waikanae Estuary, Jan 2014