coastalmanagement

Whanganui Inlet

Mapping of Historical Seagrass Extent

Prepared for

Tasman District Council

June 2018

Cover Photo: Whanganui Inlet - extensive seagrass beds in the north of the estuary, 2016.

Sparse seagrass in mobile sands near the entrance, 2016.

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by

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EXECUTIVE SUMMARY

To compliment existing broad scale mapping studies In Whanganui/Westhaven Inlet, and to provide an historical context to seagrass changes, Tasman District Council (TDC) contracted Wriggle Coastal Management in 2018 to digitise seagrass extent based on aerial photography flown from 1945-1948.

The approach follows the general broad-scale mapping methods described in the National Estuary Monitoring Protocol (NEMP) (Robertson et al. 2002) and comprised digitising seagrass visible on aerial photos at a scale of 1:1000. Mapping only included seagrass where there was a high degree of confidence in the features mapped, with expert judgement based on detailed first hand knowledge of the estuary, extensive previous mapping experience, and existing GIS seagrass mapping layers, used to discriminate seagrass from other features within the 1945-1948 photo series. The current report provides a brief overview of the extent of dense seagrass present in 1948, and compares the results to other years for which seagrass extent has been mapped - 1990, 2013, and 2016.

Results showed dense (>50% cover) seagrass beds were relatively stable between 1948 and 2013 but declined by 188ha over 65 years, a 21% decrease. Between 2013 and 2016, there was a very rapid and extensive 385ha loss (likely to be one of the single largest recent losses of seagrass recorded in NZ) of dense seagrass in Whanganui Inlet. Because there are no obvious local land use changes within the catchment, there is a possibility that the seagrass is dying back as part of a natural cycle. However, as the seagrass beds are being displaced by soft muds, it is recommended that the potential source of the muds be investigated, and that mapping of seagrass continues at 5 yearly intervals to monitor ongoing change.

BACKGROUND TO WESTHAVEN/WHANGANUI INLET

Whanganui Inlet is the third largest estuary of its type in the South Island and is located 19km southwest of Farewell Spit on the top of west coast of NZ's South Island (Figure 1). It is fed by 4 main streams on the south and east sides, (Mangarakau Drain (mean flow $0.66m^3.s^{-1}$), Mangarakau Stream ($0.48m^3.s^{-1}$), Wairoa River ($0.16m^3.s^{-1}$), and Muddy Creek ($0.59m^3.s^{-1}$) - flow data from NIWA Coastal Explorer) and a large number of smaller streams. A number of other water bodies (e.g. the Kaihoka Lakes and Lake Otuhie) in the immediate vicinity increase the value of the estuary/freshwater complex for wildlife. Much of the estuary catchment is forest (primarily native 91%), with intensive pastoral use at 6%. The road along the southern and eastern estuary margins has resulted in numerous causeways restricting tidal flushing to many of the upper estuary arms.

Baseline broad scale mapping (Davidson 1990) classified the dominant intertidal estuary features as: seagrass (859ha), sandflats (826ha), mudflats (146ha), saltmarsh (96ha), and cobble, gravel and rock fields (27ha). The subtidal zone comprised 769ha (28%) of the estuary area. There has been some historical loss of high value saltmarsh habitat due to reclamation and drainage around margin areas (~60ha), with resulting shoreline modification (e.g. seawalls, bunds, roads) now restricting the capacity of saltmarsh to migrate inland in response to predicted sea level rise.

The estuary is valued for its aesthetic appeal, rich biodiversity, duck shooting, whitebaiting, fishing, boating, walking, and scientific interest. It is a dual protected area with a marine reserve in the southern third and a wildlife reserve over the remaining two-thirds. A RAMSAR application is pending on Whanganui Inlet Mangarakau Swamp and Lake Otuihe. Ecologically, habitat diversity and condition is high. It has almost all of its intertidal vegetation intact, including saltmarsh, as well as dunes, cliffs, islands, rock platforms, underwater reefs, and a well-vegetated terrestrial margin dominated by coastal forest (including kahikatea, pukatea, rata, beech, rimu and nikau palm). Approximately 30 species of marine fish use the inlet at some stage of their life history. It is an important breeding and nursery area for snapper, flatfish, kahawai and whitebait. It is also important for birdlife (particularly waders), and is connected to large areas of relatively unmodified wetland, freshwater streams and terrestrial vegetation (Davidson 1990).

Whanganui Inlet has largely avoided major human impacts and consequently has few threats. Potential stressors assessed by Robertson and Stevens (2012), include:

- Potential for excessive muddiness if runoff from intensive landuse or forest clearance is poorly managed. Climate change (increased storms) is expected to exacerbate these issues.
- Loss of high value saltmarsh caused by impending sea level rise if inland migration of beds is not facilitated.
- Changes in biological communities as a result of climate changes to sea pH and temperature (e.g. loss of larger shelled invertebrates).
- Other lesser stressors include; a partially modified terrestrial margin, presence of causeways, increased population pressure and margin encroachment (wildlife disturbance, predator introductions, habitat loss), and invasive species (e.g. Pacific oyster, iceplant).

The estuary is part of Tasman District Council's (TDC's) coastal State of the Environment (SOE) monitoring programme with fine scale monitoring of the dominant habitat in the estuary undertaken in December 2015, 2016 and 2017. It is recommended that Whanganui Inlet be monitored every 5-10 years and the results used to help determine the extent to which the estuary is affected by major estuary issues both in the short and long term.

INTRODUCTION

Located 19km southwest of Farewell Spit at the top of the west coast of NZ's South Island, Whanganui Inlet is a large (2741ha), relatively unmodified, shallow, well-flushed, seawater-dominated, tidal lagoon type estuary that is open to the sea via a narrow entrance mouth (Figure 1).

The dominant habitats within the estuary were mapped as part of a comprehensive study of the estuary undertaken by the Department of Conservation in 1989 (see Davidson 1990). Broad scale habitat mapping of the estuary was repeated in 2016 (see Stevens and Robertson 2017) as part of a wider regional state of the environment monitoring programme being undertaken by Tasman District Council (TDC). To compliment these existing studies and to provide an historical context to seagrass changes, in 2018 TDC contracted Wriggle Coastal Management to digitise seagrass extent based on aerial photography flown from 1945-1948.

The approach follows the general broad-scale mapping methods described in the National Estuary Monitoring Protocol (NEMP) (Robertson et al. 2002). Rectified black and white photos provided by TDC (Pete Inwood) were imported into ArcMap 10.5 where visible seagrass at a scale of 1:1000 was digitised as shapefiles using a Wacom Cintiq21UX drawing tablet. Expert judgement was used to discriminate seagrass from other features within the 1945-1948 photo series. This was based on extensive previous experience undertaking broad scale mapping, the use of existing GIS seagrass mapping layers and field photos of the estuary, and detailed first hand knowledge of the estuary itself.

Because seagrass cover is difficult to accurately map at low densities, historical mapping has only included seagrass where there is a high degree of confidence in the features mapped, in this case seagrass beds with >50% cover. Seagrass beds with <50% cover would have been present in 1948 and it is reasonable to assume their extent would have been similar to that mapped in 1990 (~45ha).

The current report provides a brief overview of the extent of dense seagrass present in 1948, and compares the results to other years for which seagrass extent has been mapped - 1990, 2013, and 2016.

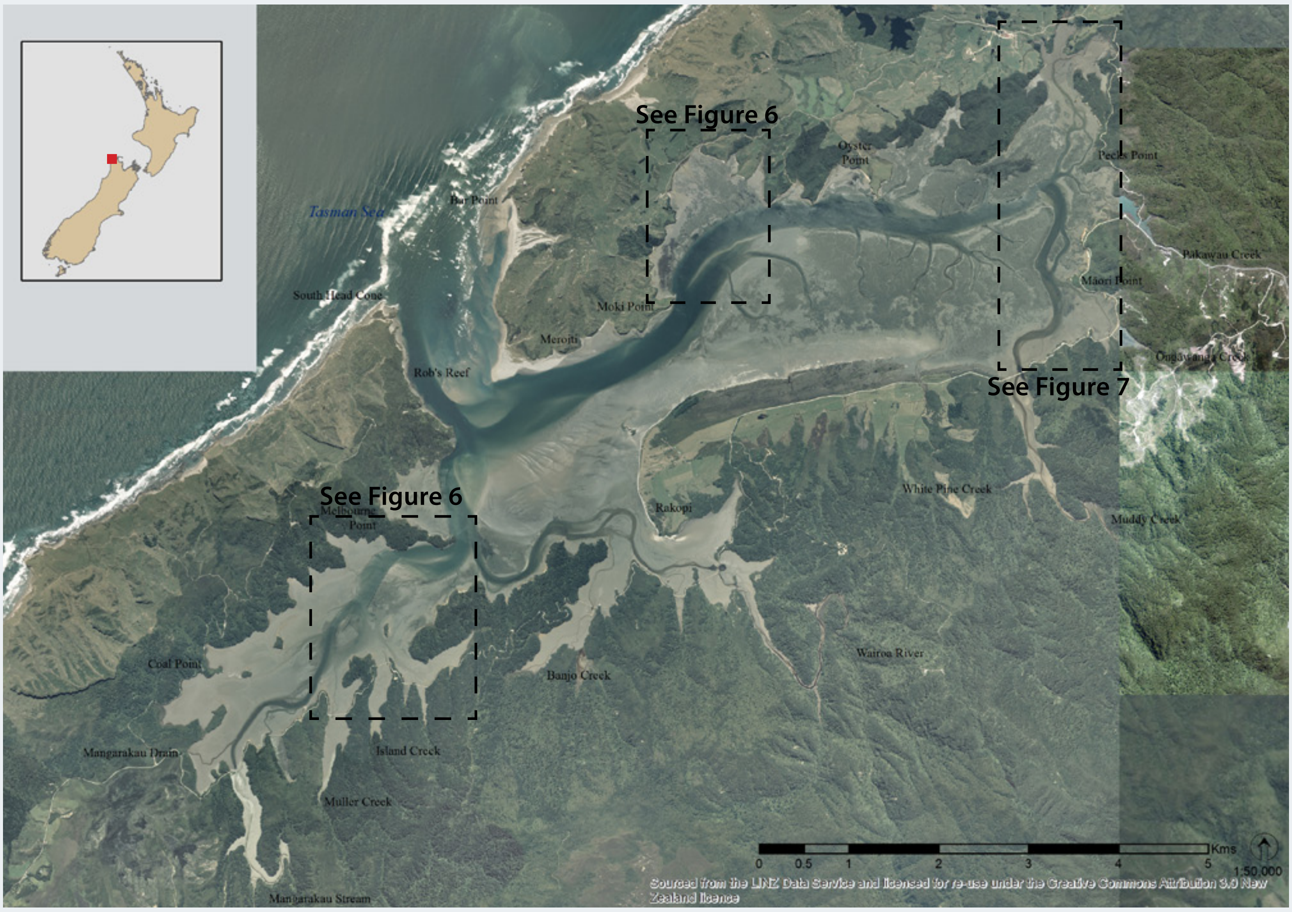

Figure 1. Whanganui Inlet, northwest Nelson. Insets refer to location of temporal photo sequences.

RESULTS

The mapped extent of intertidal seagrass in Whanganui Inlet is summarised in Table 1 and shown in Figures 2-5.

Table 1. Summary of dense (>50%) intertidal seagrass cover, Whanganui Inlet, 1948, 1990, 2013 and 2016.

Percentage Cover	1948		1990		2012/13		2016	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
50-80% cover	79.9	4.1	46.9	2.4	68.6	3.5	18.4	0.9
>80% cover	821.7	42.1	769.2	39.4	645.3	33	310.5	15.9
	902	**46.1**	**816**	**41.8**	**714**	**36.5**	**329**	**16.8**

NOTE: % of estuary is calculated based on an intertidal estuary area of 1954ha

In 1948 dense (>50%) intertidal seagrass covered 902ha (46%) of the estuary. Large and contiguous beds dominated in the northern arm, while cover was patchier but still widespread on the eastern side of the central basin and southern arm (Figure 2). This represents a very extensive coverage of intertidal seagrass for a shallow intertidally dominated estuary, both in percentage terms, and particularly in total hectares.

Davidson (1990) undertook a very extensive assessment of the estuary and produced a series of extensively ground truthed and detailed baseline maps of key estuary features including seagrass cover and density. Seagrass cover from this work has been digitised and is presented in (Figure 3). Despite mapping from historical photos having obvious limitations, the high accuracy of the mapping work undertaken in 1990 enabled detail in the 1990 photos to be compared to the 1948 photos to validate features and assess subsequent dense seagrass change with a relatively high level of accuracy. This comparison showed that between 1948 and 1990, dense seagrass cover had reduced by 86ha (10%) to 816ha. The most noticeable losses had occurred on the eastern side of the central and southern arms, but these losses were offset by increases in the seagrass between Moki Point and Oyster Point in the northern arm where previously patchy beds had become more contiguous.

At this point in time, Davidson (1990) reported that much of the seagrass was growing in soft muds, and while the location of muds was not specifically mapped, the majority was located in the northern arm, with the central basin near the entrance characterised by higher flushing and generally more mobile sandier sediments.

Mapping of the estuary using 2013 aerial photos (Figure 4), coupled with extensive ground truthing, recorded 714ha (37%) of dense (>50%) intertidal seagrass in the estuary. This still represents a very significant and extensive coverage of seagrass. The extent of dense seagrass loss between 1990 and 2013 was 102ha (13%). The location of the most significant changes were similar to those between 1948 and 1990 with increasing fragmentation and loss of seagrass beds in the southern arm and in the eastern end of the northern arm. It was also apparent that seagrass density was starting to diminish in the large beds of the northern arm and with fragmentation of the beds becoming evident. The seagrass loss in the 23 year period between 1990 and 2013 was larger than in the 42 year period between 1948 and 1990, indicating an acceleration of seagrass decline. Combined, the loss of 188ha of seagrass between 1948 and 2013 reflects a 21% decrease, an average loss per year of ~0.3%.

Repeat mapping of the estuary using 2016 aerial photos (Figure 5), coupled with extensive ground truthing, recorded 329ha (17%) of dense (>50%) intertidal seagrass in the estuary. This represents a very dramatic reduction of 385ha of dense (>50%) intertidal seagrass in the estuary, a 54% reduction, over the three year period from 2013 to 2016. The most significant changes occurred in the northern arm of the estuary where extensive areas of soft mud are now present where seagrass previously flourished, and remaining seagrass beds are being significantly impacted by fine mud deposition. This is evident in the smothering of seagrass beds in mud, fragmentation of previously contiguous beds, and localised erosion along the edges of fragmented beds.

Figures 6 and 7 present a series of temporal photos to highlight the transition in seagrass at specific locations in the estuary in 1948, 1972, 2013 and 2016.

The loss of 573ha of dense seagrass since 1948 represents a 64% loss, with ~70% of this loss occurring in the three years between 2013 and 2016. Although such a dramatic and rapid decline in seagrass is not linked to any obvious local land use changes within the catchment, it is likely to be one of the single largest recent losses of seagrass recorded in NZ.

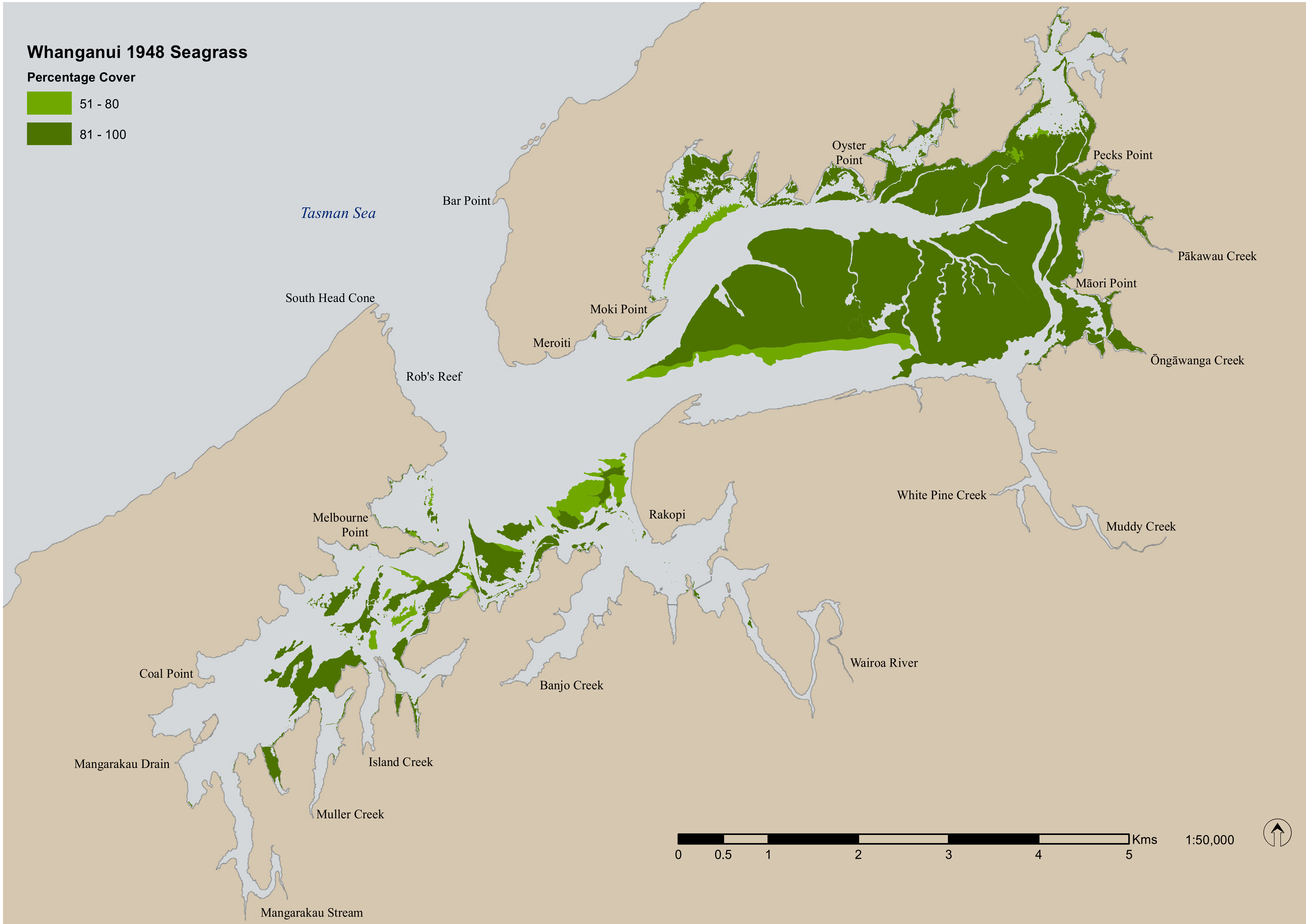

Figure 2. Map of intertidal seagrass cover - Whanganui Inlet, 1948.

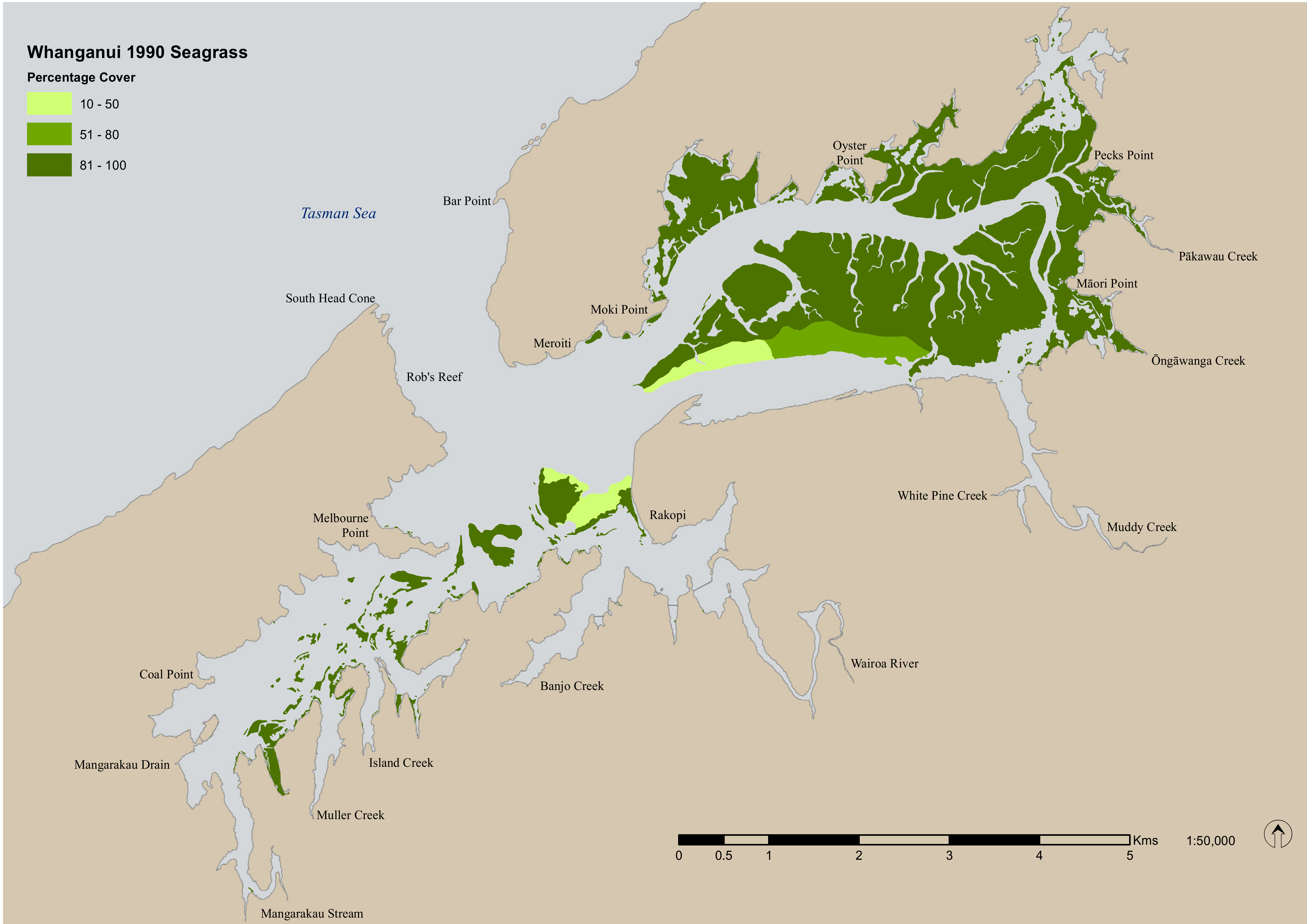

Figure 3. Map of intertidal seagrass cover - Whanganui Inlet, 1990. (Redrawn from Davidson et al. 1990)

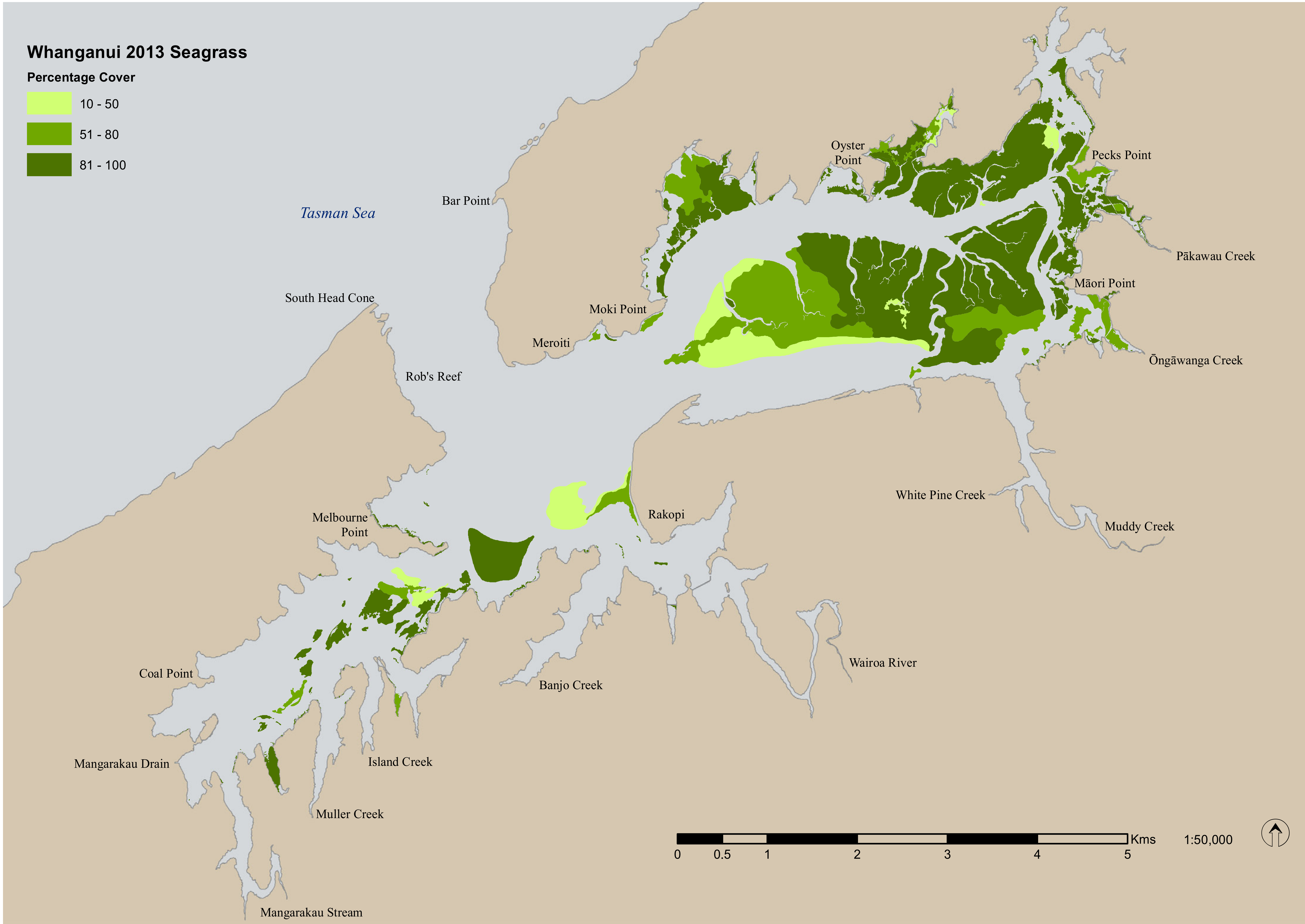

Figure 4. Map of intertidal seagrass cover - Whanganui Inlet, 2013.

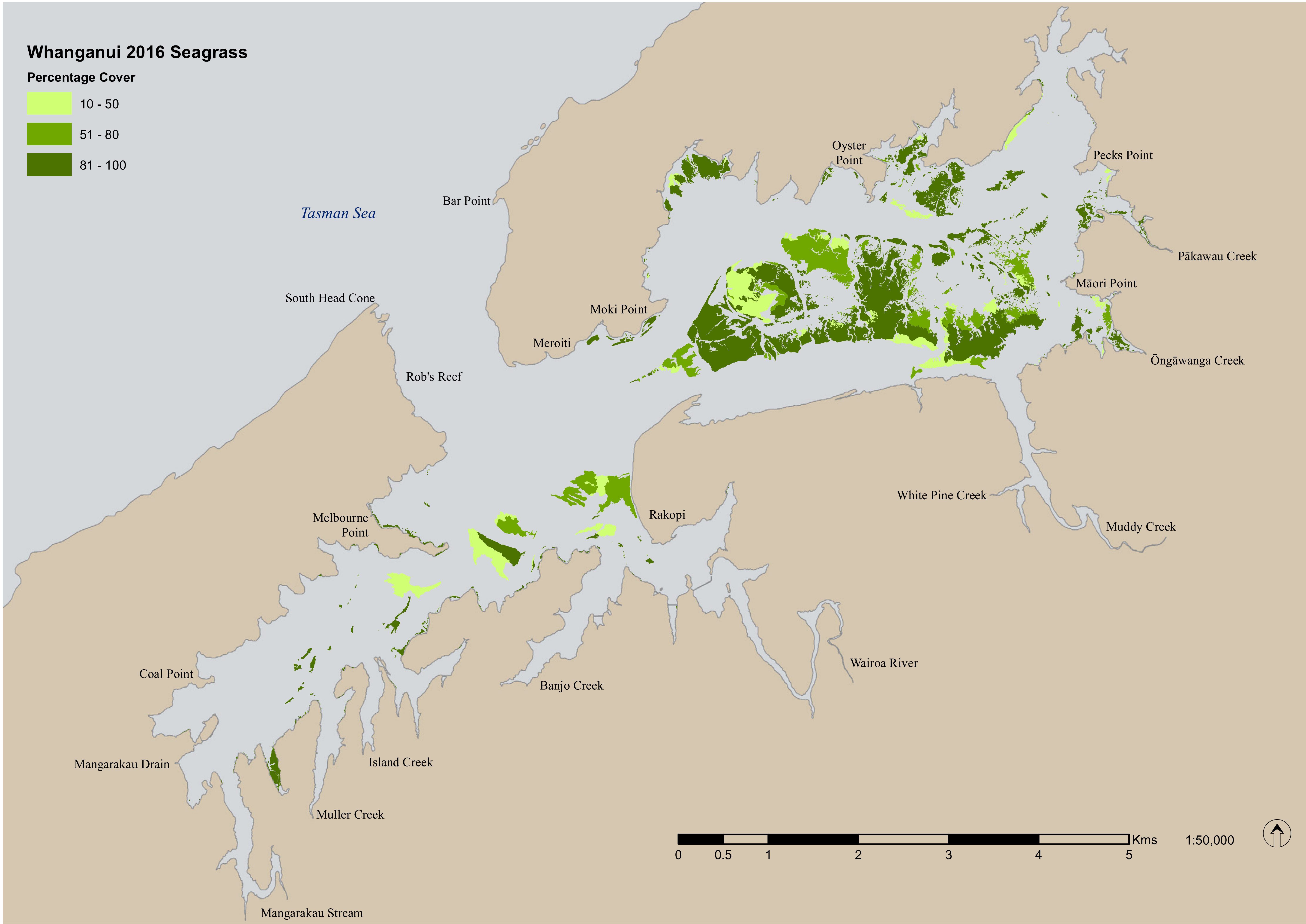

Figure 5. Map of intertidal seagrass cover - Whanganui Inlet, 2016.

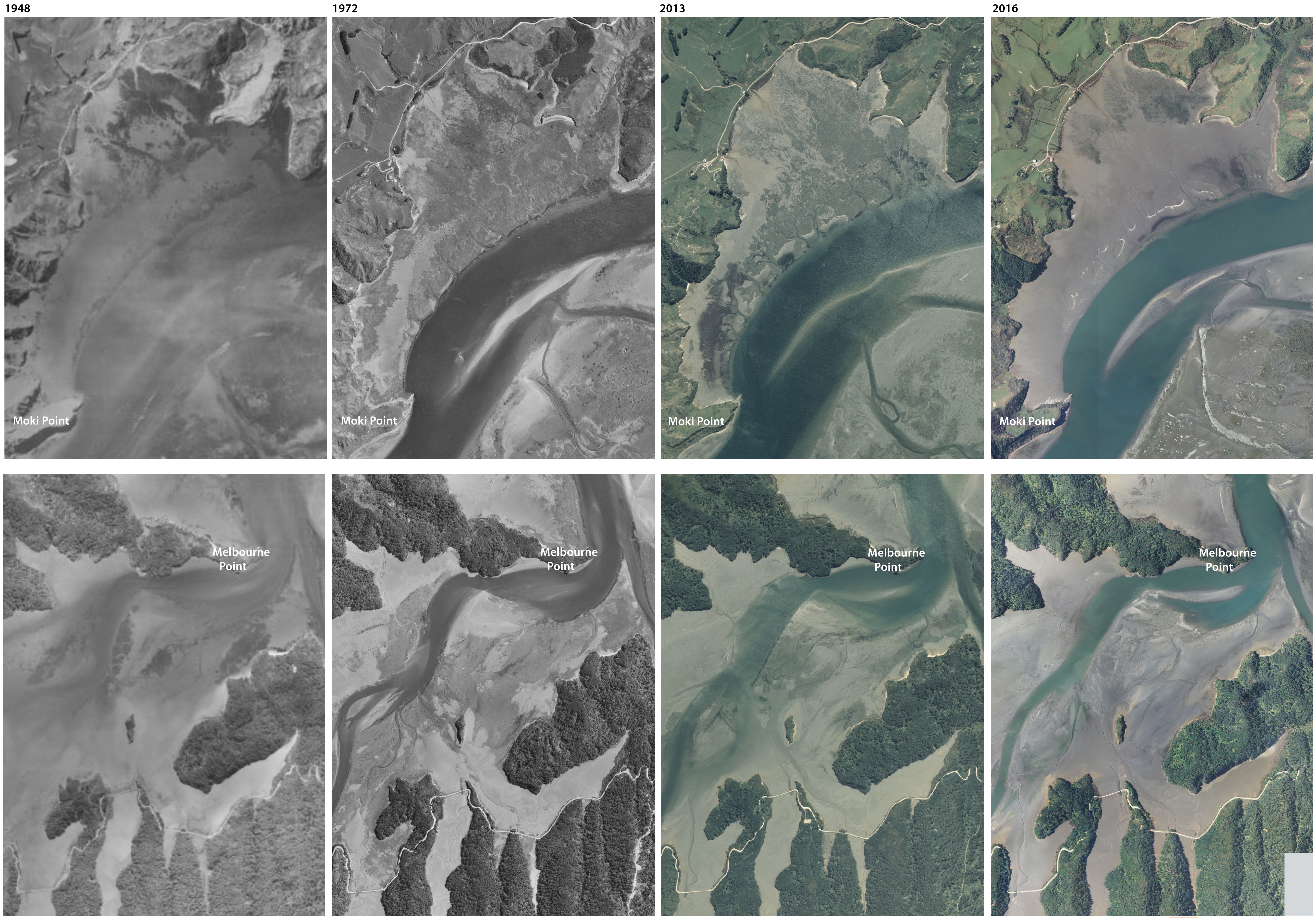

Figure 6. Aerial photos illustrating changes in seagrass cover in the central north (top) and southwest (bottom) of Whanganui Inlet, ~1948, 1972, 2013, 2016 (see Figure 1 for site location).

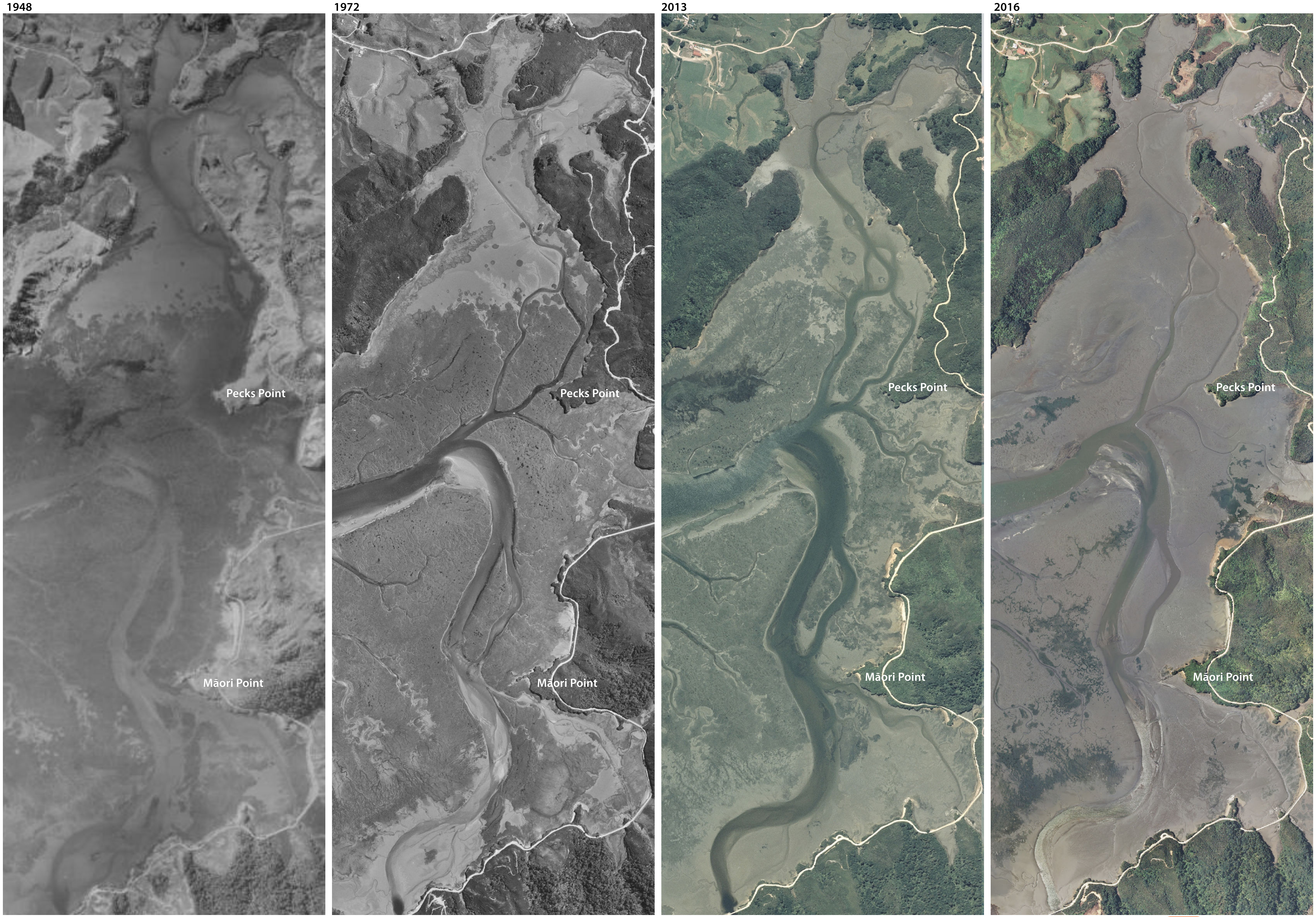

Figure 7. Aerial photos illustrating changes in seagrass cover in the eastern end of Whanganui Inlet ~1948, 1972, 2013, 2016 (see Figure 1 for site location).

SUMMARY AND CONCLUSIONS

Whanganui Inlet is a relatively unmodified estuary set within a catchment dominated by native forest. It supports very extensive areas of seagrass, but also has large areas dominated by muds (Stevens and Robertson 2017). Mapping of historical seagrass extent showed dense (>50% cover) seagrass beds were relatively stable between 1948 and 2013 but declined by 188ha over 65 years, a 21% decrease. Between 2013 and 2016, there was a very rapid and extensive 385ha loss (likely to be one of the single largest recent losses recorded in NZ) of dense seagrass in Whanganui Inlet. Because there are no obvious local land use changes within the catchment, the recent seagrass losses are unlikely to be caused by activities under the management of TDC, and there is a possibility that the seagrass is dying back as part of a natural cycle.

The key consequence of seagrass loss and increased muddiness is a reduction in the ecological value of the estuary, particularly a reduced capacity to assimilate sediment and nutrient inputs, and a loss of habitat for birds, fish and shellfish. Increased soft mud extent since 1990, and the large area of soft mud in the estuary, means it is a significant issue and macrobenthic ecology will be compromised in muddy areas.

Because the majority of the catchment surrounding the estuary is in native forest (~91%), the primary source of fine sediment causing excessive estuary muddiness, and potentially seagrass loss is unclear. While it is almost certainly terrestrial sediment delivered to the estuary due to catchment erosion, the timing of inputs, and the source e.g. local inputs such as landslides caused by localised high rainfall events or inputs contributed by West Coast catchments or coastal erosion, are unknown.

In response to the combined issues of muddiness and seagrass loss, it is recommended that the potential source of the muds be investigated, and that mapping of seagrass continues at 5 yearly intervals to monitor ongoing change. As an initial step it is recommended that natural and current state sediment inputs to the estuary be estimated to determine the likely local catchment contribution (and the extent of human influenced change within this), and an assessment be made of whether fine sediment inputs from outside the local catchment (i.e. coastal inputs from West Coast sources) require assessment. A range of forensic approaches to sediment source tracking are available for the latter component.

It is recommended that TDC seek to have forensic sediment source tracking and seagrass loss studies undertaken as part of university based science research (e.g. PhD study), or as part of nationally funded science initiatives e.g. National Science Challenges.

ACKNOWLEDGEMENTS

This survey and report has been undertaken with help from the staff of Tasman District Council, in particular, the support of Pete Inwood and feedback of Trevor James (TDC) was much appreciated.

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Eastern end of the northern arm, June 2016