

Estuarine vegetation survey - Purangi Estuary

Prepared by:
Meg Graeme M.Sc (Marine Science)
Natural Solutions – Marine and Terrestrial Ecologists Ltd

For:
Waikato Regional Council
Private Bag 3038
Waikato Mail Centre
HAMILTON 3240

November 2012

Document #: 2309487

Approved for release by:
Peter Singleton

Date April 2014

Disclaimer

This technical report has been prepared for the use of Waikato Regional Council as a reference document and as such does not constitute Council's policy.

Council requests that if excerpts or inferences are drawn from this document for further use by individuals or organisations, due care should be taken to ensure that the appropriate context has been preserved, and is accurately reflected and referenced in any subsequent spoken or written communication.

While Waikato Regional Council has exercised all reasonable skill and care in controlling the contents of this report, Council accepts no liability in contract, tort or otherwise, for any loss, damage, injury or expense (whether direct, indirect or consequential) arising out of the provision of this information or its use by you or any other party.

Estuarine Vegetation Survey

Purangi Estuary

November 2012

Prepared for Waikato Regional Council



Estuarine Vegetation Survey – Purangi Estuary, November 2012

Report prepared for:

Resource Information Group
Environment Waikato
PO Box 4010
HAMILTON EAST

Report prepared by:

Meg Graeme M.Sc (Marine Science)
Natural Solutions – Marine and Terrestrial Ecologists Ltd
RD 2
COROMANDEL 3582
Ph: (07) 866 0770
Email: natural.solutions@wave.co.nz

Report submitted:

29 November 2012

Reference:

Natural Solutions Contract Report 12/109

Acknowledgements:

Natural Solutions would like to acknowledge the support received for this project from the following people: Richard Glass, Malene Felsing and Catherine Beard of Waikato Regional Council and Robert Kuchlein for field assistance.

Disclaimer:

While every effort has been made to ensure the accuracy of information in this report, no liability is accepted for errors of fact or opinion, or for any loss or damage resulting from reliance on, or the use of, the information it contains. This report has been prepared for Waikato Regional Council and may only be disclosed to third parties with the prior consent of Waikato Regional Council.

CONTENTS

1. INTRODUCTION	1
2. METHODOLOGY	2
2.1. WETLAND VEGETATION CLASSIFICATION	2
3. RESULTS	5
3.1. SITE DESCRIPTIONS	5
3.2. BIRDS	17
3.3. THREATS	17
4. DISCUSSION AND RECOMMENDATIONS	19
5. BIBLIOGRAPHY	20
6. APPENDIX A – PHOTO WAYPOINTS	22

TABLE OF FIGURES

Figure 1: Map of Purangi Estuary with points of interest and photo points.....	9
Figure 2: View of mangroves beneath a pohutukawa fringe near the entrance of the Purangi Estuary (TRB).	10
Figure 3: Large mangroves (ranging 5-8m tall) in an embayment along the TRB of the harbour upstream of the island.	10
Figure 4: A view of the upper tidal reaches of the Lees Road stream catchment showing the rocky bedrock with a mix of short mangroves, ribbonwood, sea rush, oioi, saltwater paspalum.	11
Figure 5: A fence line cutting across a small indent of the harbour leaving mangroves, rushland and saltmarsh ribbonwood on the ungrazed side and humped areas with sea meadow and rushland on the grazed side.	11
Figure 6: An old fence line cutting across an arm of the harbour shows the effect historic grazing has had on the estuarine vegetation communities. Mature mangroves, rushland and saltmarsh ribbonwood are present on the un-grazed side whereas only juvenile mangroves are present on the historically grazed side with rushland.	12
Figure 7: Here the harbour edge has been in-filled and the incomplete fence line did not stop stock gaining access to the harbour edge. Evidence of pugging and grazing of rushland and mangroves was found in this locality.....	12
Figure 8: Looking along a stopbank and drain that separates the inland harbour edge from the main harbour. Grazed and pugged sea rush, slender clubrush, remuremu, glasswort and saltwater paspalum are present within the paddock while healthy saltmarsh ribbonwood, rushland and mangrove communities are found seaward of the paddock.	13
Figure 9: A large mangrove near the head of Diggers Hill that is about 7m tall. Oysters were common on the pneumatophores of these trees at the mouth of the embayment.	14
Figure 10: A severely pugged and grazed edge of the harbour.....	15
Figure 11: A view over a mixed coast spear grass /saltwater paspalum community near the boat ramp that also has African ice plant present. A mixed glasswort / saltwater paspalum community is found seaward and along the landward edge is oioi and some saltmarsh ribbonwood.	16

1. Introduction

A 1997 pilot study of Whangamata, Wharekawa, and Otahu estuaries determined that it is feasible to map vascular estuarine vegetation from aerial photography together with field surveys. The success of this work encouraged Environment Waikato to continue with this method. The estuarine vegetation of Tairua, Coromandel, Te Kouma, Manaia, Whitianga, Port Waikato, Raglan, Aotea, Kawhia, Otama, Whangapoua, Kennedy Bay harbours and the inner Firth of Thames have since been surveyed and mapped. Of these harbours, Whangamata, Wharekawa, Otahu, Tairua, Coromandel, Te Kouma, Manaia, Whitianga, Port Waikato, Raglan and Aotea have been re-surveyed to determine changes in vegetation communities over time.

The vegetation that has been mapped is within the Coastal Marine Area (CMA) and includes the spatial cover of mangrove, seagrass, sea meadow, saltmarsh and estuarine weed communities. The results of the estuarine vegetation surveys are included in Environment Waikato's Global Information System (GIS) database, and are used for State of the Environment investigations and assessing resource consent applications that may affect estuarine vegetation.

This report details the results from the survey of estuarine vegetation in Purangi Estuary. Comments are included about the estuarine vegetation present, the threats to native estuarine vegetation communities, and other field notes of interest. This report accompanies the estuarine vegetation community GIS layers of the survey site.

2. Methodology

The field survey was undertaken over 2 days on the 12th October and the 14th November 2012. The survey was undertaken using a combination of boating and walking. The same methodology for mapping saltmarsh, mangrove, seagrass and weed communities was followed as that previously used to map Coromandel Peninsula estuaries (e.g. see Graeme, 2010b). A personal digital assistant (PDA) was loaded with 2007 aerial photographs (WRAPS2007) of the survey area, and coded polygons were drawn directly onto the PDA aerial photographs to define the spatial extent of wetland vegetation types as they were ground-truthed in the field. The use of colour pen notations on hard copy aerial photographs were reserved (but not used) as a backup for when there were instrument problems or the weather made using the PDA difficult (e.g. sun exposure made it too difficult to see the PDA screen clearly in the field).

The upper saltwater influence is usually indicated by the upstream limit of oioi, saltwater paspalum or saltmarsh ribbonwood. The limit of these plants determined the inland/upstream extent of the survey.

Field notes were made of estuarine wetland characteristics and their vulnerability to particular threats.

2.1. Wetland vegetation classification

Estuarine wetland vegetation of the Waikato Region is split into four groups:

1. **Saltmarsh** - a multi-species community in which three sub-communities are distinguishable in the Waikato Region. They are:
 - a) 'Rush/sedge community' – This is generally sea rush (*Juncus kraussii* subsp. *australiensis*), oioi (*Apodasmia similis*), and generally only common on the West Coast, three-square sedge (*Schoenoplectus pungens*). Marsh clubrush (*Bolboschoenus fluviatilis*) is commonly found up streams and rivers at the upper estuarine limit in some harbours, although it is not generally mapped¹ within this survey as it is a species of brackish-freshwater.
 - b) 'Saltmarsh ribbonwood community' - Saltmarsh ribbonwood (*Plagianthus divaricatus*) dominates this zone, although rushes are often common giving a patchy appearance compared with the uniformity of the 'rush/sedge community'. Small areas of sea primrose (*Samolus repens*), remuremu (*Selliera radicans*), the coast spear grass (*Austrostipa stipoides*) and glasswort (*Sarcocornia quinqueflora*) can also be present.

¹ Except where marsh clubrush is intermingled with oioi and is too difficult to separate out for mapping

- c) **'Sea meadow community'** - This is devoid of tall plants such as rushes and saltmarsh ribbonwood, with the exception of coast spear grass. The sea meadow community can include sea primrose, remuremu, glasswort, slender clubrush (*Isolepis cernua*), and arrow grass (*Triglochin striata*), and in more brackish areas bachelor's button (*Cotula coronopifolia*), leptinella (*Leptinella doica*) and sharp spike-sedge (*Eleocharis acuta*).
2. **Mangrove** (*Avicennia marina* subsp. *australasica*) – This is usually a monospecific community although seagrass, spartina (*Spartina* spp.), saltwater paspalum (*Paspalum vaginatum*) and sea meadow beds can sometimes be found underneath mature mangrove stands.
3. **Seagrass** (*Zostera capricorni*) – This is usually a monospecific community, and is the vegetation which occurs at the lowest level in the tide.
4. **'Weed community'** - In the Waikato Region the most significant estuarine weeds are saltwater paspalum and spartina. Both of these grasses generally grow in the open estuary and trap sediment, greatly increasing the harbour's infilling rate. These weeds also compete with the native wetland communities.

There are other weed species (such as tall fescue (*Schedonorus phoenix*)) which can tolerate a degree of salt influence but for clarity of mapping they have not been included in the surveys due to their presence above the spring high tide mark.

Table 1 lists common estuarine plant species (and their associated 'estuarine vegetation community') mapped during the survey.

Mixed mapping categories are used to indicate the occurrence of 'mixed' vegetation communities. Saltwater paspalum in particular is spreading and mixing with rush/sedge, sea meadow and saltmarsh ribbonwood communities. Where vegetation was found under the canopy of mangroves (e.g. seagrass or saltwater paspalum under mangroves) this was mapped as a 'mixed' community.

Saltwater paspalum is known to co-exist with spinifex (*Spinifex sericeus*) however mapping of saltwater paspalum stops once spinifex is present as it is then determined to be an 'open coastal' rather than 'estuarine' environment.

Table 1: Estuarine plant species found in Purangi Estuary

Common/Maori name	Scientific name	Estuarine Vegetation Community
arrow grass	<i>Triglochin striata</i>	sea meadow
coast spear grass	<i>Austrostipa stipoides</i>	sea meadow
glasswort	<i>Sarcocornia quinqueflora</i>	sea meadow
mangrove	<i>Avicennia marina</i> subsp. <i>australasica</i>	mangrove
oioi	<i>Apodasmia similis</i>	rush/sedge
remuremu	<i>Selliera radicans</i>	sea meadow
saltmarsh ribbonwood	<i>Plagianthus divaricatus</i>	saltmarsh ribbonwood
saltwater paspalum *	<i>Paspalum vaginatum</i>	weed
seagrass	<i>Zostera capricorni</i>	seagrass
sea primrose	<i>Samolus repens</i>	sea meadow
sea rush	<i>Juncus kraussii</i> subsp. <i>australiensis</i>	rush/sedge
shore lobelia	<i>Lobelia anceps</i>	sea meadow
slender clubrush	<i>Isolepis cernua</i>	sea meadow

* denotes an exotic species

3. Results

Site locations within the estuary are shown in Figure 1 as well as the position of the photos that are referred to in the site descriptions below.

3.1. Site Descriptions

The estuarine vegetation in Purangi Estuary is described clockwise from the harbour mouth.

The first estuarine vegetation encountered along the true right bank (TRB) of the estuary mouth were a few mangroves found in sheltered indents and along the pohutukawa-lined edge (Figure 2). This mangrove fringe became continuous further upstream and widened out to surround a **large island**. The island was covered with coastal scrub as well as pine trees, cotoneaster, honeysuckle and wild grape. A large area of saltmarsh ribbonwood dominated the northern end of the island. A banded rail was heard here. Bands of rushland and sea meadow were common around the southern end. A large band of rushland and saltmarsh ribbonwood was also found within the extensive mangal to the north east of the island. The mangroves generally extended directly up to the mainland edge, with only the isolated small community of rushland, sea meadow or saltmarsh ribbonwood found along the inland edge. There were a lot of introduced garden species invading the native riparian edge including ladder fern, ivy, wattle, tree privet, loquat, smilax, Mexican daisy. A couple of banded rail were heard in the mangroves. A few patches of seagrass were found under the tall mature mangrove canopy. A mangrove near the island was estimated to be almost 10m tall.

Moving upstream around the **headland** there was little estuarine vegetation along the more exposed coastal edge until the shelter of the next embayment. This small embayment was filled with mangroves (Figure 3) and had some saltmarsh ribbonwood and rushland along the eastern side. There was a gravelly outwash at the head of the embayment with mature mangroves growing on the outwash sediments. The riparian margin was native bush with old wilding pines.

Around into the next **narrow but deeper embayment** there was a large mangal along the outer TLB with oysters and tubeworms amongst the seaward pneumatophores. The sediment seemed to have quite a high sand content. There was a mixture of age classes within the mangal with gaps within the larger trees often filled with 1-2m tall plants. There was however a lack of seedlings. Saltwater paspalum was found where the next mangal moved away from the coastal edge leaving a more open zone along the land edge. It was unclear whether stock from a nearby paddock had access here. Ribbonwood was commonly found lining the land edge and another small area of saltwater paspalum was found where a stream entered the harbour and stock fencing was hard up against the harbour edge. A wide band of rushland extended along the foreshore and up behind the last mangal before the stream mouth. At the stream mouth the rocky bedrock became exposed and a mix of scattered short mangroves, sea rush, oioi and large areas of saltmarsh ribbonwood and saltwater paspalum was found (Figure 4). The TLB of the embayment was characterised by large mangals with bands of rushland and saltmarsh ribbonwood in behind. A fence across a small indent allowed stock to graze and pug the harbour edge resulting in an unnatural edge to the extent of mangroves and saltmarsh ribbonwood on the ungrazed side and humped areas with sea meadow (remuremu, slender clubrush and sea primrose) and rushland on the grazed/pugged side of the fence (Figure 5).

The pugged edge extended inland into a small unfenced manuka and freshwater rush/sedge wetland. Some more saltwater paspalum was found out near the point. Titiko were common.

A band of mangroves continued around the **coastline towards the next embayment** with a thick fringe of young mangroves supporting oysters, barnacles and little black mussels. Within the wide embayment, a large mangal covered the tidal flats. The northern side of the embayment had signs of what looked like pig rooting in the CMA and goat or sheep prints were found on the flats. The **head of the embayment** supported large rushland and saltwater paspalum communities. New riparian fencing now keeps stock out of the harbour. An old fence line cutting across the northern head defined an artificial distribution of palatable estuarine vegetation (Figure 6). Mature mangroves, rushland and saltmarsh ribbonwood were found on the ungrazed side and rushland, saltwater paspalum and some young mangroves were found on the historically grazed side. Only one saltmarsh ribbonwood plant was noted on the historically grazed side compared to their more common occurrence along the landward edge where stock grazing has not occurred. Saltwater paspalum was found mixed with rushland and remuremu. There had been some planting along the newly fenced off riparian edge. A banded rail was heard calling from the mangroves. Moving out of the **northern head of the embayment**, saltmarsh ribbonwood started to fringe the harbour edge again. A large rushland community was found in a small indent with saltwater paspalum present either side. The rushland and saltmarsh ribbonwood communities stopped up towards the top of the southern head before the mangroves end and saltwater paspalum became dominant. Scattered saltmarsh ribbonwood, rushland and saltwater paspalum lined the coastal edge behind a band of mangroves that extended around into the Purangi River arm.

The **Purangi River arm** channel was lined by mangroves with bands of saltmarsh ribbonwood along the landward edge and scattered patches of rushland. Isolated clumps of slender clubrush and shore lobelia were also noted. A number of pines had been felled or had blown into the CMA along the TRB riparian edge making access difficult. The mangrove edge quite often extended up to a *Baumea juncea* sedge edge which was not mapped. The riparian edge quite often had red matipo growing along it as well as some planted flax. Privet and wattle were common too. The mangroves in along the landward edge became progressively shorter up the arm while the mangroves out along the channel were still around 5-6m tall. Further along the landward edge a large wide band of rushland was mapped composed predominantly of oioi but with some sea rush along the seaward edge. Sea primrose and remuremu were noted with the oioi. Upstream of the wide rushland there was an area of exposed bed rock where a stream disgorged. The harbour edge and associated freshwater wetland was fenced within the paddock here. Pugged sea rush, oioi, saltmarsh ribbonwood, sea primrose and remuremu were noted within the paddock. Mangroves extended up to the fence but not landward of it. Seaward of the fence was also bands of saltmarsh ribbonwood and patches of sea primrose mixed with oioi and mangroves. The **next embayment** with pines on each point had bands of saltmarsh ribbonwood and patches of sea meadow and rushland. There was an area of short mangroves within the embayment backed by large trees further out. A banded rail was heard and juvenile fish noted in the creek. Prickly moses (*Racosperman verticillata*) was common along the harbour edge here. A few plants of smilax were noted under the two pine trees on the upstream point. More privet and prickly moses were found. The next small indent was filled with mangroves and had more saltmarsh ribbonwood and a patch of rushland. The mangroves started to get taller again as the channel banks narrowed upstream.

Bands of rushland and sea meadow were the only other estuarine vegetation apart from mangroves along the coastline until the beginning of the large rushland at the **mouth of the Purangi River**. At the river mouth the estuarine vegetation communities became a mosaic

reflecting the patchwork of bed heights from the outwash deposits and freshwater input. Mangroves were found in low-lying areas and together with Mercer grass (*Paspalum distichum*) on higher outwash ridges. Some of the higher outwash ridges were covered in pasture grasses, gorse, wattle and flax. There were large areas of saltmarsh ribbonwood and rushland on the upper TLB. The river flats then narrowed and only a mangrove and some rushland were noted further upstream along the river edge.

Down **along the TLB** was another mixed area of mangroves, saltmarsh ribbonwood and rushland with a number of waterway fingers. This may have been an old path of the river and historically attempts may have been made to stopbank and drain the area. Seagrass was found in places under the mangroves in the side channel fingers.

Further downstream where the extensive TLB mangal begins there was a large patch of sea rush backed by scattered patches of saltmarsh ribbonwood. The riparian edge was predominantly pine and wattle with a native shrub understory. The mangroves were 2-3m tall. Further along the rushland thinned out but there were still scattered saltmarsh ribbonwood and sea meadow patches along the landward edge until the rushland then widened again into a stream embayment. The mangal continued to widen, filling the flats out to the channel edge.

Downstream of the embayment farmland bordered the harbour edge with no fencing or vegetated riparian margin. The mangroves generally extended directly up to the land edge leaving room for only thin patches of sea meadow communities, saltmarsh ribbonwood and rushland along the edge. The inland mangroves are short (~1m tall) but tree height increases out towards the channel. **Around the headland** there is an impounded area of water where geese were found. A large band of saltwater paspalum lined the landward edge with rushland and some saltmarsh ribbonwood. The land edge was fenced from here but with a limited riparian buffer. Saltmarsh ribbonwood and some sea meadow (remuremu and slender clubrush) lined the coastline around to another stream mouth. Here however the coastal edge had been in-filled and the fence line stopped short of the stream. Stock had access around the end of the fence and had caused severe localised pugging and grazing within the CMA, affecting communities of sea rush, oioi, saltmarsh ribbonwood, bachelors button and mangroves (Figure 7). Fencing was also lacking further along the coastline allowing a larger harbour area to be affected by stock pugging, tracking and grazing. Saltmarsh ribbonwood and rushland widen out around the corner and were fronted by scattered short mangroves. The seaward edge of the sea rush and oioi band was also characterised by sparse plants compared with the dense rushland further inland. Further north there was a large area of rushland that has been separated from the main harbour flats by a drain and stopbank. The inland rushland was grazed within the paddock and saltwater paspalum was present (Figure 8). Saltmarsh ribbonwood was only present on the seaward side of the drain where stock access was restricted. Short sparse mangroves continued to characterise the inner mangal with larger trees along the seaward margin and side creek. A patch of mixed sea primrose and short mangroves was found south of the creek near the stopbank. Rushland and mangroves continued along the harbour edge north of the drained and stop-banked area but thinned out and disappeared towards the head of Diggers Hill.

Diggers Hill provided a wilding pine/regenerating native bush back-drop to the harbour edge. Around Diggers Hill there was a large embayment filled with mangroves. The outer mangroves were large reaching around 7m high (Figure 9). A fragmented fringe of saltmarsh ribbonwood was found between the mangroves and the forested edge of the embayment. Patches of rushland were also present. The saltmarsh ribbonwood thickened out towards the beginning of the pasture edge until a fence line was reached that cut across the inland edge of the

harbour. This fence line defines a straight boundary between the mangroves and saltmarsh ribbonwood and an area of grazed sea rush and oioi mixed with arrow grass, bachelors button, sea primrose and remuremu. Nearby, Figure 10 shows the extent of pugging and damage to the harbour vegetation from stock access from the neighbouring paddock. Along the inland edge there was pugged bachelors button mixed with sea rush which graded into a pugged sea rush zone and then into a zone of dead mangroves. Further seaward where the mud became deeper (and presumably access by stock was more difficult) the mangroves were healthy. Around the corner there was a large area of exposed bedrock within the mangrove zone. Landward, a wide band of rushland and saltmarsh ribbonwood extended around the coastal edge. A small area of estuary was fenced within the paddock with some mixed rush and sea meadow. The rushland then widened out towards the **mouth of a stream** and extended inland into a freshwater wetland. Mixed areas of sea rush and mangroves were found on the stream outwash sediments as well as flax, wattle, pampas and exotic grasses. Moving along the TLB, the rushland band then petered out and the mangal generally extended right up to the land edge. The land edge was covered in pines and regenerating native scrub. The road was close to the harbour edge and an area of dumped rubbish including tyres was found within the harbour. There was a small rocky island in the middle of the mangal with a fringe of saltmarsh ribbonwood, sea meadow and rushland. As the mangal narrowed towards the mouth of the bay there was another patch of rushland and scattered bands of saltmarsh ribbonwood along the land edge.

The mangrove band became thin and patchy along the coastal **edge upstream of and opposite the large island**. The seaweed *Hormosira* was noted with the mangroves. Bands of rushland were found either side of the dinghy launching site. Saltwater paspalum became prevalent from the launching site all the way along the TLB to the main boat ramp. The sea meadow species – glasswort, sea primrose and coast spear grass were found either by themselves or mixed with saltwater paspalum. Scattered saltmarsh ribbonwood plants were found from the dinghy site down to a small drained creek mouth. A small section of the harbour edge was fenced within a paddock. A mangrove community occurred at the mouth of this small creek and saltwater paspalum extended at least 50m inland up the drain. Saltwater paspalum lined most of the exposed coastline around into the second to last indent, mixed in places with rushland and sea meadow. Cotoneaster was common along the land edge and an evergreen buckthorn bush was noted. Agapanthus became common nearer the housing. Some saltmarsh ribbonwood and sea meadow communities were found at the head of this indent, often mixed with saltwater paspalum. The coastline is very eroded around to the last indent and no estuarine vegetation was present. Saltwater paspalum again dominated the last indent and mixed with a wide band of sea meadow (including remuremu, sea primrose, glasswort and coast spear grass) (Figure 11). Saltmarsh ribbonwood, rushland and flax occurred at the head of the indent. A band of saltwater paspalum extends from the boat ramp out along the exposed coastline of the harbour entrance.

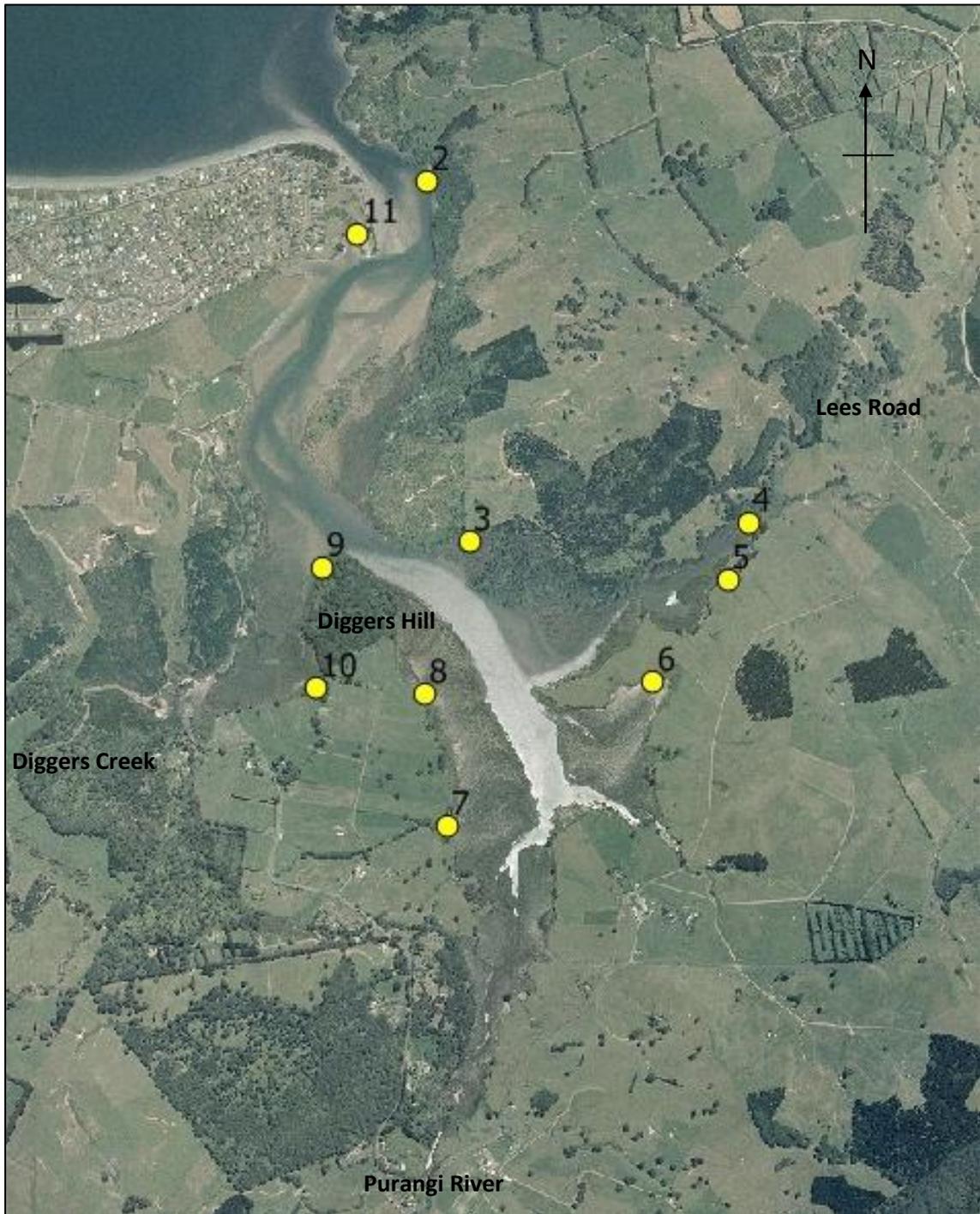


Figure 1: Map of Purangi Estuary with points of interest and photo points.



Figure 2: View of mangroves beneath a pohutukawa fringe near the entrance of the Purangi Estuary (TRB).



Figure 3: Large mangroves (ranging 5-8m tall) in an embayment along the TRB of the harbour upstream of the island.



Figure 4: A view of the upper tidal reaches of the Lees Road stream catchment showing the rocky bedrock with a mix of short mangroves, ribbonwood, sea rush, oioi, saltwater paspalum.



Figure 5: A fence line cutting across a small indent of the harbour leaving mangroves, rushland and saltmarsh ribbonwood on the ungrazed side and humped areas with sea meadow and rushland on the grazed side.



Figure 6: An old fence line cutting across an arm of the harbour shows the effect historic grazing has had on the estuarine vegetation communities. Mature mangroves, rushland and saltmarsh ribbonwood are present on the un-grazed side whereas only juvenile mangroves are present on the historically grazed side with rushland.



Figure 7: Here the harbour edge has been in-filled and the incomplete fence line did not stop stock gaining access to the harbour edge. Evidence of pugging and grazing of rushland and mangroves was found in this locality.



Figure 8: Looking along a stopbank and drain that separates the inland harbour edge from the main harbour. Grazed and pugged sea rush, slender clubrush, remuremu, glasswort and saltwater paspalum are present within the paddock while healthy saltmarsh ribbonwood, rushland and mangrove communities are found seaward of the paddock.



Figure 9: A large mangrove near the head of Diggers Hill that is about 7m tall. Oysters were common on the pneumatophores of these trees at the mouth of the embayment.



Figure 10: A severely pugged and grazed edge of the harbour.



Figure 11: A view over a mixed coast spear grass /saltwater paspalum community near the boat ramp that also has African ice plant present. A mixed glasswort / saltwater paspalum community is found seaward and along the landward edge is oioi and some saltmarsh ribbonwood.

3.2. Birds

Birds seen/heard during the estuarine vegetation survey:

Banded rail
Black-backed gull
Kingfisher
Little shag
Mallard duck
Paradise duck
Pied oystercatcher
Pied shag
Welcome swallow
White faced heron

3.3. Threats

The health of the Purangi estuarine vegetation communities is threatened by the invasive grass saltwater *paspalum* and lack of protection from farming activities.

Saltwater *paspalum* can establish over a wide tidal range and it competes with all estuarine vegetation communities except seagrass. Field observations indicate that thick bands of undisturbed rushland can withstand the invasion of saltwater *paspalum*. These thick bands of rushland in turn usually protect saltmarsh ribbonwood and sea meadow communities in behind from saltwater *paspalum* invasion. However, thin or disjunct bands of rushland, exposed sea meadow and saltmarsh ribbonwood communities are all vulnerable to invasion by saltwater *paspalum*. Saltwater *paspalum* sends out long runners which climb through rushes or up saltmarsh ribbonwood and the grass becomes so dense that it overwhelms the native vegetation. Saltwater *paspalum* also establishes in open mudflat areas changing the benthic communities of open flats and affecting water flows.

Saltwater *paspalum* is not yet established throughout the Purangi Estuary. The spread of saltwater *paspalum* is enhanced by disturbance events, which in the Purangi Estuary is mainly stock tracking and pugging. Stock tracking through rushland and saltmarsh ribbonwood communities provides open areas that allow saltwater *paspalum* to establish and spread out from. Fragments can also be transported around the estuary by animal hooves.

Farming activities cause the other concerns. Most of the farmland around the Purangi Estuary is well fenced to keep stock out of the harbour and its margin, except for a few small areas. , there is However a ~200m stretch of harbour that is still actively grazed within a paddock immediately south east of Diggers Point. The other threat to the estuarine vegetation from farming is drainage and infilling activities. Drainage changes the hydrology of the sediments affecting the habitat suitability for estuarine plants and allowing weeds to establish. Infilling results in the physical loss of estuarine vegetation under the fill and also causes disturbance to the surrounding vegetation. Very little drainage and infilling within the CMA were noted during this survey and these activities become less of an issue as the harbour margins are fenced and protected.

The 2007 aerial shows the large rushland and saltmarsh ribbonwood communities on the TRB at the mouth of the Purangi River had been damaged by vehicle tracks leading from the farmland.

4. Discussion and Recommendations

An analysis of the results of this survey will provide an overview of the composition of estuarine vegetation within Purangi Estuary based on the 2007 aerial photos. This data will also provide a baseline for any future surveys to show changes in vegetation communities over time.

No large sea grass beds were found in the Purangi Estuary but small isolated patches were mapped in association with mangroves. Large dense mangals were a feature of the estuary. Large areas of rushland were limited to the upper arms. Large rushland communities were also found along the foreshore south east of Diggers Point but the health of these communities was compromised by the adverse effects of stock access (tracking, pugging, grazing and weed transferral). The only significant saltmarsh ribbonwood communities were found at the mouth of the Purangi River, along the foreshore south east of Diggers Point and a small community at the mouth of Diggers Creek. Otherwise saltmarsh ribbonwood bushes and sea meadow patches were scattered all around the harbour's upper foreshore.

Saltwater paspalum is a significant threat to the ongoing health and integrity of the estuary's vegetation communities. Saltwater paspalum has not yet established extensively throughout the estuary, and could be controlled.

Most of the farmland around the Purangi Estuary is well fenced to keep stock out of the harbour and its margin, except for a few small areas which could be easily rectified. The ~200m stretch of harbour that is still grazed immediately south east of Diggers Point needs fencing and weed control to restore the estuarine vegetation there.

A limitation associated with this survey was the poor quality of the aerial photo provided on the PDA.

5. Bibliography

- Graeme, M. 1997: *Estuary Vegetation Survey Pilot Study: Whangamata, Otahu, Wharekawa*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 1998a: *Estuary Vegetation Survey: Coromandel & Tairua Harbours*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 1998b: *Estuary Vegetation Survey: Te Kouma & Manaia Harbours*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 1999: *Estuary Vegetation Survey: Whitianga Harbour*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 2005: *Estuarine Vegetation Survey: Port Waikato*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel. Environment Waikato Technical Report 2005/41.
- Graeme, M. 2005: *Estuarine Vegetation Survey: Raglan*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel. Environment Waikato Technical Report 2005/44.
- Graeme, M. 2005: *Estuarine Vegetation Survey: Kawhia*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel. Environment Waikato Technical Report 2005/42.
- Graeme, M. 2005: *Estuarine Vegetation Survey: Aotea*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel. Environment Waikato Technical Report 2005/43.
- Graeme, M. 2006: *Estuarine Vegetation Survey: Inner Firth of Thames*. Report prepared for Environment Waikato. Contract report 06/062, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel. Environment Waikato Technical Report 2006/40.
- Graeme, M. 2007: *Estuarine Vegetation Survey: Whangamata Harbour and Otahu Estuary*. Report prepared for Environment Waikato. Contract report 07/067, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel. Environment Waikato Technical Report 2007/25.
- Graeme, M. 2008a: *Estuarine Vegetation Survey: Tairua Harbour*. Report prepared for Environment Waikato. Contract report 08/075, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel. Environment Waikato Technical Report 2008/52.
- Graeme, M. 2008b: *Estuarine Vegetation Survey: Wharekawa Harbour*. Report prepared for Environment Waikato. Contract report 08/077, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel. Environment Waikato Technical Report 2008/40.
- Graeme, M. 2008b: *Estuarine Vegetation Survey: Manaia Harbour*. Report prepared for Environment Waikato. Contract report 08/078, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 2008c: *Estuarine Vegetation Survey: Waikawau Estuary*. Report prepared for Environment Waikato. Contract report 08/081, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.

- Graeme, M. 2008c: *Estuarine Vegetation Survey: Whitianga Harbour*. Report prepared for Environment Waikato. Contract report 08/085, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 2009: *Estuarine Vegetation Survey: Coromandel & Te Kouma Harbours*. Report prepared for Environment Waikato. Contract report 09/088, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 2010a: *Estuarine Vegetation Survey: Otama Estuary*. Report prepared for Environment Waikato. Contract report 10/092, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 2010b: *Estuarine Vegetation Survey: Whangapoua Harbour*. Report prepared for Environment Waikato. Contract report 10/095, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 2011: *Estuarine Vegetation Survey: Port Waikato*. Report prepared for Environment Waikato. Contract report 11/103, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 2012: *Estuarine Vegetation Survey: Raglan (Whaingaroa) Harbour*. Report prepared for Environment Waikato. Contract report 12/104, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. 2012: *Estuarine Vegetation Survey: Kennedy Bay*. Report prepared for Environment Waikato. Contract report 12/108, Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Graeme, M. & Kendal, H. 2001: *Saltwater Paspalum (Paspalum vaginatum) – a weed review*. Report prepared for Environment Waikato. Natural Solutions – Marine & Terrestrial Ecologists Ltd., Coromandel.
- Johnson, P. and P. Brooke. 1998: *Wetland Plants in New Zealand*. Manaaki Whenua Press, Lincoln, New Zealand.

6. Appendix A – Photo waypoints

Figure number	GPS Longitude	GPS Latitude
2	175.7617	-36.8371
3	175.7635	-36.8475
4	175.7735	-36.8467
5	175.7728	-36.8484
6	175.7703	-36.8514
7	175.7630	-36.8558
8	175.7621	-36.8520
9	175.7583	-36.8484
10	175.7582	-36.8519
11	175.7592	-36.8387