Appendix E

Cooks Beach Erosion and Mitigation Ecological Report 2019

4SIGHT CONSULTING

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THAMES COROMANDEL DISTRICT COUNCIL

Cooks Beach Erosion Mitigation Ecological Report 2019

Prepared for Thames Coromandel District Council

May 2019

REPORT INFORMATION AND QUALITY CONTROL

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1 INTRODUCTION

The Purangi river estuary at the southern end of Cooks Beach is a small estuary with significant areas of intertidal habitat, mangrove and saltmarsh.

The Thames Coromandel District Council (TCDC) is applying for resource consent to extract sand from an intertidal sand flat within the estuary near its mouth and also from an intertidal delta just outside its mouth. The sand is to be used to nourish an area of eroding beach and dune at the southern end of Cooks Beach. This is intended to reduce risk to public infrastructure and private property and rebuild a functional foredune system to provide buffering against potential future erosion.

4Sight Consulting Ltd (4Sight) have been contracted by TCDC to carry out an ecological survey to document the current ecological values of the proposed borrow and deposit sites and to identify the potential ecological sensitivity of the adjacent habitat. Conclusions are drawn as to the potential ecological effects of the proposed sand management.

This report presents the results from an ecological survey of the macroinvertebrate communities at the sites of interest conducted by 4Sight on the 5th & 6th March 2019.

2 METHODS

2.1 Survey Rationale

The proposed locations for sand removal and deposition (Figure 1) were predetermined by a 4Sight coastal processes scientist in consultation with an experienced 4Sight marine scientist. At the outset it was determined that, apart from a small sub channel (secondary blind channel) of the seaward delta, sand would only be removed from, and relocated to, mid to high shore zones. It is anticipated this approach would minimize, and probably avoid, risk to the more biodiverse areas of benthic macroinvertebrates including edible shellfish species, that are typically more prevalent in the mid to low shore.

Therefore, and to verify the appropriateness of the above approach, ecological sampling was mostly focussed on these lower shore areas and the adjacent shallow subtidal habitat.

Comprehensive macroinvertebrate sampling was undertaken and these samples have been archived should a more detailed analysis of invertebrate communities be required at some point in the future.

Proposed borrow areas were assessed visually and by limited sampling to confirm the expected broad ecological and habitat values.

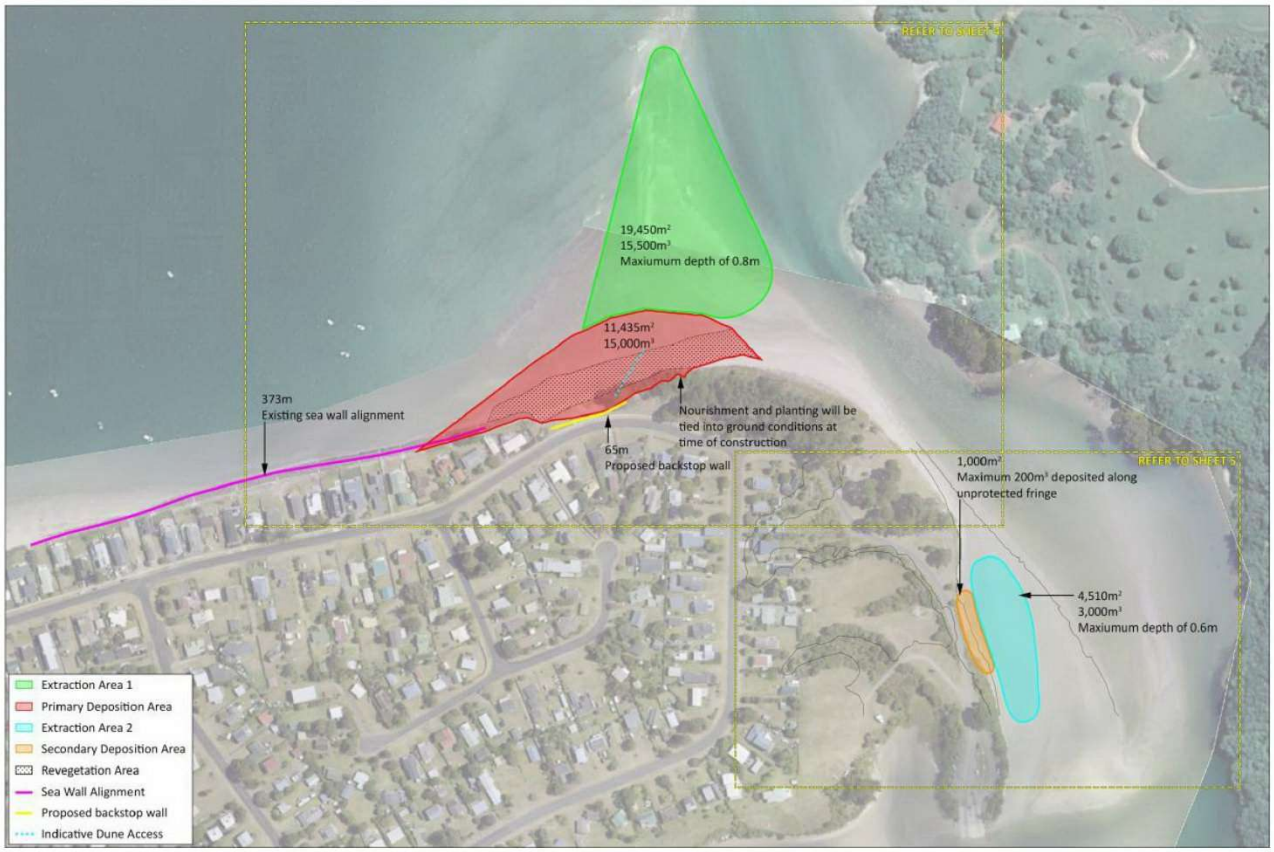

Figure 1: Plan of sand extraction and deposition areas

2.2 Benthic Macroinvertebrate Sampling

Invertebrates were sampled from along each of the 50m transects, as identified in Figure 2. A 15cm wide x 15cm deep PVC core (volume 0.265 m^2) was used to collect benthic samples at six randomly selected distances along each transect (See Appendix A: for sample locations). All invertebrates within each core sample were retained to a sieve size of 500µm (and as noted were archived).

Edible bivalve shellfish species, in particular pipi (*Paphies australis*) and cockles (*Austrovenus stutchburyi*) both of which inhabit estuarine environments, and tuatua (*Paphies subtriangulata*) which inhabit more open coastal environments, were assessed as to their density and size frequency. These are the species most likely of interest to stakeholders in a project of this nature.

Sampling sites are recorded as:

- Cooks Beach sub-channel: Sub-channel cores 1-6;
- Delta low intertidal: Delta cores 1-6;
- Estuary low intertidal: Estuary low cores 1-6; and
- Estuary mid intertidal: Estuary mid cores 1-6.

The beginning of each transect was fixed with a GPS point. These coordinates are presented in Appendix B: The location of each transect is shown in Figure 2.

At the sub-channel and delta sites, twelve to fifteen additional cores (~ 15cm W x 15cm L x 15cm D; volume of 0.338 m^2) were collected using a spade to collect enough shellfish to allow estimation of the population size frequency distribution.

All cores were visually assessed as to their relative biomass, abundance and diversity of invertebates. All samples have been archived should further analysis be required.

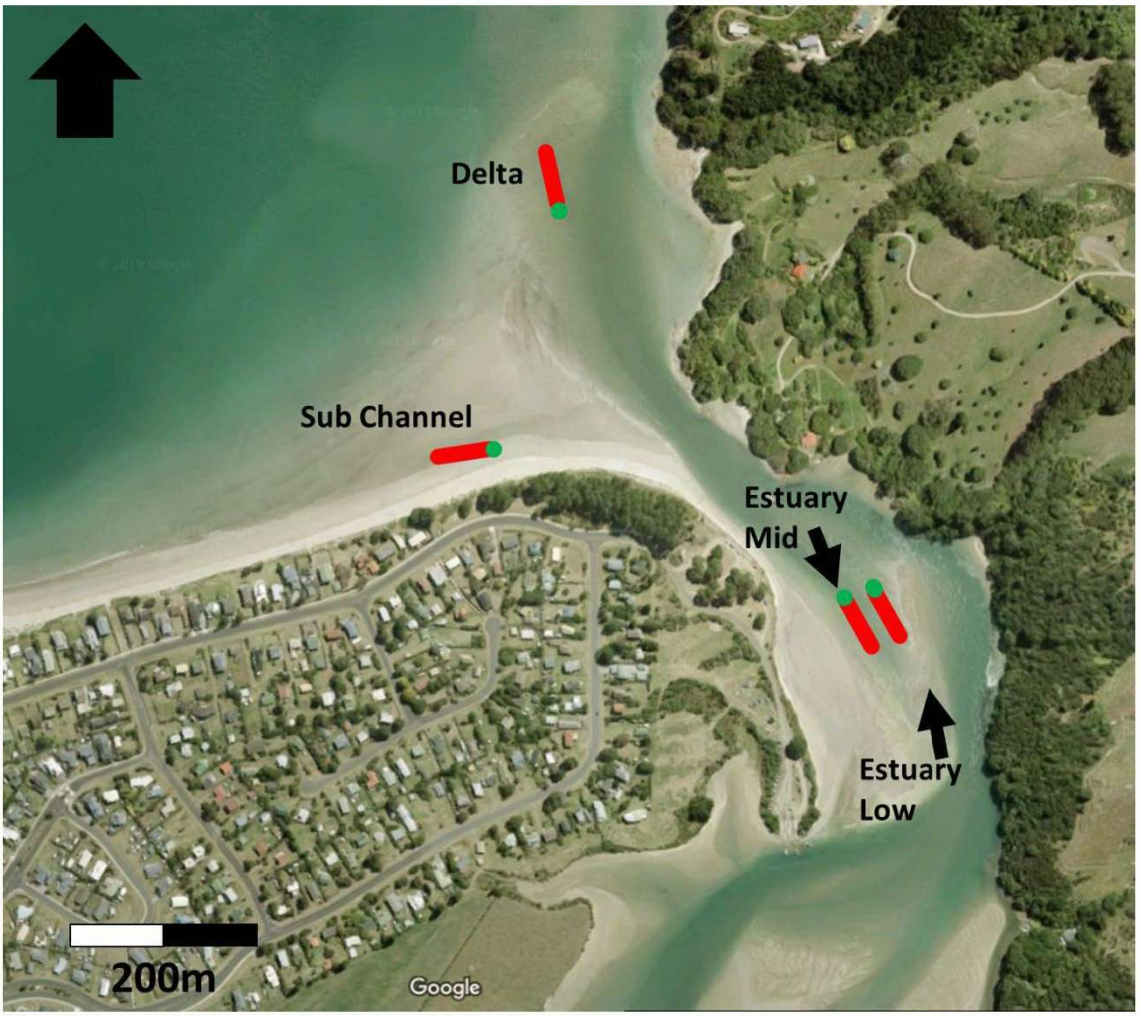

Figure 2: Plan showing approximate location of survey transects with the green dot indicating the start point.

2.3 Visual Surveys

Visual inspections were undertaken of:

- estuary sub-tidal channels;
- estuary high intertidal sand flat (sand extraction area two, Figure 1);
- mid intertidal flats of the delta (sand extraction site 1, Figure 1); and,
- the high shore area on Cooks Beach comprising a portion of the sand deposition site and the adjacent eroded sand dunes.

A general plan of the survey areas is provided in Figure 3.

Figure 3:General plan of survey areas discussed in this report

3 RESULTS

3.1 Macroinvertebrates

3.1.1 Cooks Beach sub-channel

A total of 63 tuatua at an estimated density of 15.6/m^2 were sampled from within the Cooks Beach sub-channel. The average shellfish size was 22.97 ± 1.07 mm (SEM). Tuatua between 15-20 mm in size were the most frequent size class sampled. No individuals larger than 50 mm in size were recorded (Figure 4). The tuatua population consisted of small individuals at a low density. Near MLWS at the western (seaward) end of the channel, tuatua density increases and larger shellfish (> 40 mm) occur.

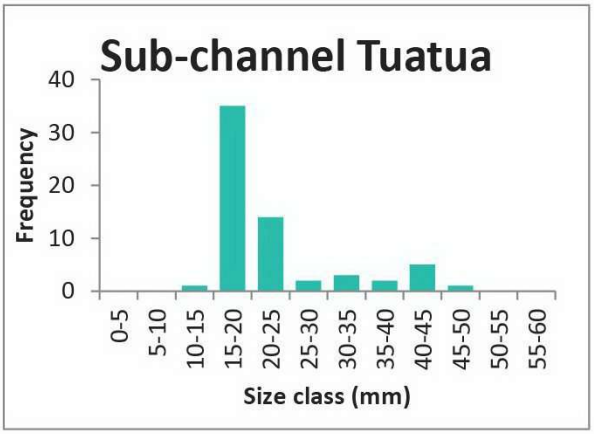

Figure 4: Size frequency distribution of tuatua sampled at the Cooks Beach sub-channel site

Inspection of the cores indicated that the there is limited other macroinvertebrate infauna.

3.1.2 Cooks Beach delta low intertidal area

Pipi, were recorded at this site, reflecting its still sheltered and predominantly estuarine aspect. Tuatua were not found at this location. 23 pipi at an estimated density of 5.7/m^2 were recorded from the delta transect. The average shellfish size was 44.41 ± 1.96 mm (SEM). Pipi between 50-55 mm in size were the most frequent size class sampled. No individuals larger than 60 mm in size were recorded (Figure 5).

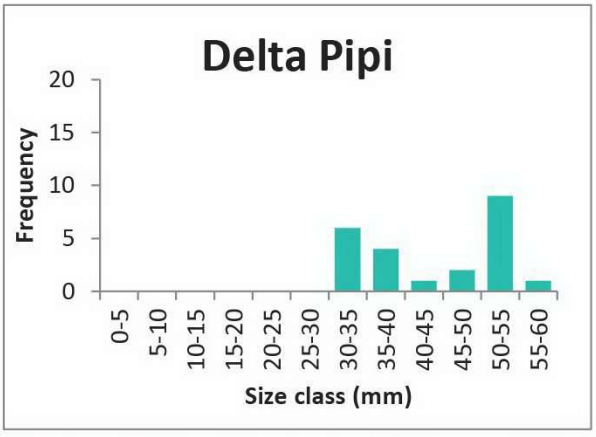

Figure 5: Size frequency distribution of pipi sampled at the estuary delta site

Inspection of these cores indicated that the other macroinvertebrate infauna at the delta site was also limited.

3.1.3 Estuary mid-Intertidal area

A total of 44 pipi at an estimated density of 165.9/m^2 were sampled along the estuary mid intertidal transect. The average shellfish size was 32.25 ± 0.84 mm (SEM). Pipi between 30-35 mm in size were the most frequent size class sampled. No individuals larger than 50 mm in size were recorded (Figure 5).

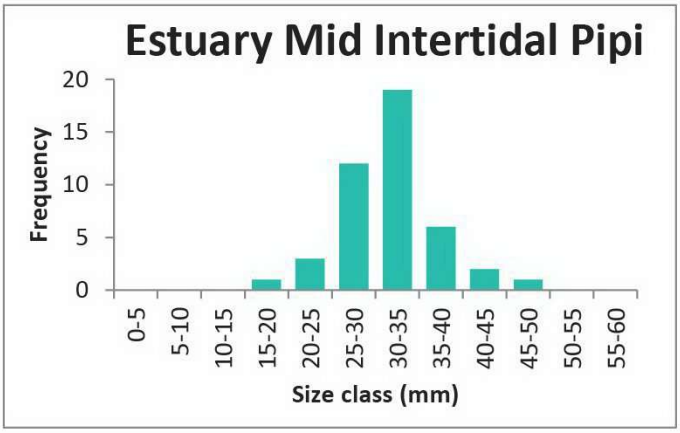

Figure 6:Size frequency distribution of pipi sampled at the estuary mid intertidal site

Three other bivalve species were also present but in low abundance, including wedge shell (*Macomona illiana*), cockle (*Austrovenus stutchburyi*) and nut shell (*Nucula hartvigiana*). The mudflat topshell (*Diloma subrostrata*) and the native predatory whelk (*Cominella glandiformis*) were also recorded.

3.1.4 Estuary low Intertidal area

A total of 28 pipi at an estimated density of 105.6/m^2 were sampled along the estuary low intertidal transect. The average shellfish size was 37.8 ± 1.43 mm (SEM). Pipi between 35-40 mm in size were the most frequent size class sampled. No individuals larger than 55 mm in size were recorded (Figure 7).

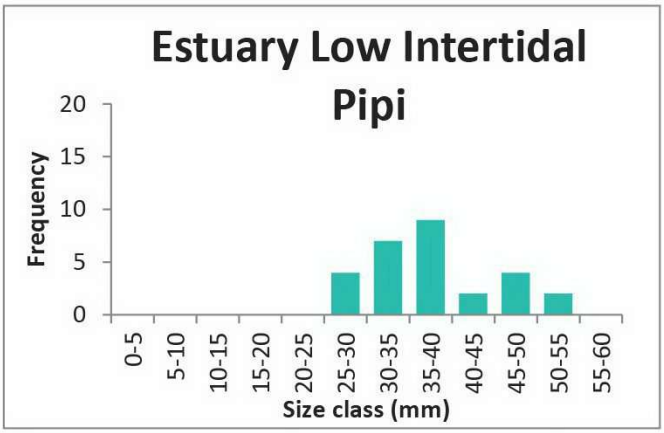

Figure 7: Size frequency distribution of pipi sampled at the estuary low intertidal site

Other bivalves again included nut shell and a single rock oyster (*Saccostrea glomerata*). The mudflat topshell and one whelk (*Cominella adspersa*) were also recorded. No cockles were found in this low shore area.

3.2 Visual Surveys

3.2.1 Estuary sub-tidal channel

The sub-tidal estuary channel comprised a predominantly sand and shell hash substrate with a few small discrete patches of rocky reef along the true right bank. Fish were observed in the channels and dense stands of native macroalgae inhabited the rocky reefs.

Vegetation on the true right bank of the estuary was predominantly mixed coastal broadleaf/pōhutukawa forest (Figure 8).

Figure 8: Section of Purangi river estuary showing a portion of the subtidal estuary channel bordered by mixed coastal broadleaf/pōhutukawa forest in the background.

3.2.2 Estuary high intertidal sandflats

The intertidal sandflat comprising sand extraction area two (Figure 1), is an elevated platform approximately 1 - 2 m above the tidal channel bed (Figure 9).

Brief visual inspections confirmed there is little biota in these zones. There is likely to be small crustacea such amphipods and isopods.

The sand within such higher shore areas is exposed for an extended period between tides. Relative to lower shore and subtidal zones, this limits opportunities for colonisation and use of the higher shore areas by biota. Typically,

biodiversity and density are lower further up the shore and shellfish, if present at all, are of a smaller size. This too is the case at this site.

Figure 9: High intertidal sandflat on the true left bank of Purangi river estuary. Looking upstream.

3.2.3 Extraction area two - bank vegetation

The vegetation on the true left bank of the estuary, approximately two metres behind the proposed extraction area two, comprised a mixed native/exotic floral community. Wiwi, knobbly club rush (*Ficinia nodosa*) and pohuehue (*Muehlenbeckia complexa var. complexa*) formed the dominant vegetation cover with rauparaha, shore bindweed (*Calystegia soldanella*) and pōhutukawa (*Metrosideros excelsa*) also present. A more degraded floral community occurred in several areas, with blackberry (*Rubus sp.*), kikuyu (*Cenchrus clandestinus*) and montbretia (*Crocosmia x crocosmiiflora*) being the dominant species present (Figure 10).

Figure 10: Typical vegetation occurring on the banks of the Purangi river estuary behind the proposed sand extraction area two.

3.2.4 Delta intertidal sandflats

The delta sand extraction area one (Figure 1) is unconsolidated sand which is probably highly mobile. Other than around the low intertidal edges, the delta does not support an obvious benthic infaunal or epifaunal community. As for the estuary high shore areas, it is likely that a range of small crustacea and bivalves occur.

3.2.5 Cooks Beach sand deposition area and sand dune vegetation

The proposed sand deposition area comprises the majority of the Cooks Beach sub-channel and the beach above this, extending inland to the eroded sand dunes bordering Captain Cook Rd (Figure 1). As noted, other than small crustacea, the beach area (Figure 11A) supports limited infauna.

Beyond the beach, the face of the eroded portion of dunes forms a vertical scarp predominantly devoid of vegetation. Behind this, on the more stable area above, a mixture of exotic herbaceous weeds and grasses are the only vegetation present (Figure 11B). To the south of the main erosion area a pine glade occupies the upper dune area. To the north of the main erosion area, prior to the private seawall, is a small portion of sand dune (~100m^2) inhabited by native dune vegetation, including sand-binding species pingao (*Ficinia spiralis*) and spinifex (*Spinifex sericeus*) and pohuehue (*M. complexa var. complexa*) (Figure 11C).

Figure 11: Cooks Beach sand deposition and dune erosion area

3.2.6 Birdlife

The presence of coastal and wading birds and their use of sandy estuarine shores can be an important consideration in projects of this nature. This is particularly so if there are high tide roost sites or low shore feeding areas within or adjacent to the works area.

The lower areas of the estuarine sandflat were observed being utilised by a number of native bird species at the time of survey. Variable oystercatchers (*Haematopus unicolor*), red-billed gull (*Chroicocephalus novaehollandiae*) and southern black-back gulls (*Larus dominicanus*) were observed at the lower intertidal areas and channel edge.

At the low tidal zones of the delta, variable oystercatchers (*H. unicolor*) and red-billed gull (*C. novaehollandiae*) were observed foraging (Figures 11 a and d). Variable oystercatcher (*H. unicolor*) and white-fronted tern (*Sterna striata*) were also observed roosting/resting on the mid intertidal sandflats within sand extraction area one over the low tide period.

No discrete high shore roosting sites were observed but it is likely that birds utilise the elevated sand/shell banks and upper shoreline to roost and rest at times.

4 EFFECTS ASSESSMENT OF PROPOSED SAND MANAGEMENT

4.1 Estuary Sub-tidal Channel

Shallow estuary sub-tidal channels, being typically of higher ecological value, are potentially at risk as a result of physical works of this nature if they are directly affected by activity such as machinery movement or excavation. They can also be affected by subsequent shifts in estuarine substrates due to changed morphodynamics. Channel biota may also be affected by increased turbidity associated with losses of finer sediment fractions from disturbed material and the exposure of new (deeper) horizons of potentially finer substrate in areas of excavation. Other effects can include localised reduction in water column oxygen if anaerobic sediments are exposed in the nearby sediments during excavation.

In the case of the proposed works, such direct physical effects can be avoided by separation of the works area from the low shore and subtidal channels.

The site survey indicated that the sediments to be removed are clean sands. The coastal process assessment indicates that newly exposed substrates will also be sandy. Therefore, adverse water quality effects such as increased turbidity or reduced oxygen are most unlikely.

Avoidance of such potentially adverse effects has been achieved in similar projects (4Sight Consulting Ltd 2017), and particularly by ensuring the sand extraction does not remove sand to a vertical level that would compromise the location or structure of the sub-tidal channels.

Juvenile eels and whitebait can migrate into freshwater environments, from the sea, from late winter to early summer and will pass through the lower estuary at some point. Increased turbidity is known to affect banded kokopu (one of the whitebait species) migratory behaviour (Richardson et al. 2001), however it has little effect on other migratory species.

Given the short-term nature of the works and the fact that any localised turbidity will be rapidly diluted and likely to dissipate to normal background levels within one or two tidal cycles, any turbidity related effects on migratory native fish species are most unlikely. Relative to the likely catchment scale effects on turbidity generated in estuary waters following significant rainfall events, such small-scale intermittent turbidity, if it occurs, is likely to be insignificant from an ecological perspective.

4.2 Intertidal Areas

4.2.1 Cooks Beach sub-channel

The limited biota within the Cooks Beach sub-channel that will be covered by sand due to the replenishment in this zone, will be lost.

This is a minor effect given the low diversity, abundance and biomass of the benthic community in the sub channel.

A higher density of tuatua and larger individuals, were recorded only at the western (seaward) end of the sub channel near low water. This area, which is likely to host a more stable bed of tuatua, is outside the footprint of the deposition zone and should not be affected.

4.2.2 Delta mid intertidal and estuary high intertidal sandflats

Excavation of these substrates will remove the limited biota in the short term.

Post excavation, these zones will be at a lower tidal elevation, and they should be rapidly recolonised by at least the same or similar species or phylogenetic groups. Any subsequent ecological values will be no less than the current state.

More likely, this recolonization of the lowered sandflat should result in a benthic macroinvertebrate community of greater diversity and biomass than presently exists. As noted previously in this report, substrates lower on the shore usually contain more biota because they inundated for a longer period relative to upper shore zones.

It is not anticipated there would be issues with odour either due to exposing the new intertidal substrate, or from the decay of organisms. There is insufficient biomass in the existing biota for there to be any concern over odour. Also, the sand to be recovered is clean and there is not expected to be significant anaerobic sediment exposed by the excavation. Any odour post sand extraction should be of a 'low level' and dissipate over a few tidal cycles.

4.2.3 Delta low intertidal and Estuary mid-low intertidal area

As noted, these zones have elevated ecological values compared to higher shore areas due to greater biomass, diversity and abundance of the benthic community. Edible-sized shellfish are confined to these lower parts of the shore.

Provided the works footprint avoids the mid to low shore there should be not be other than minor adverse ecological effects, if any, on these adjacent zones.

4.2.4 Estuary banks adjacent to extraction area two

The banks of the estuary adjacent to sand extraction area two are inhabited by a mixed native/exotic floral community. A native wiwi/pohuehue stand forms the dominant vegetation over most of the site. Several pōhutukawa (Threatened, Nationally Vulnerable) are also present. The vegetation may also provide habitat for native birds, lizards and other biota. Considering both the floral and habitat values of this site, it is regarded as having moderate to high ecological value.

No works are proposed within this vegetation. Care should be taken to ensure that sand extraction does not alter the physical characteristics of the bank margin, for example by increased risk of future undercutting of the bank. This will require an adequate buffer between the excavation margin and the bank and remaining beyond the dripline of any pōhutukawa to avoid potential root damage.

Provided there is adequate buffer, and a stable beach slope on this zone, there should be no adverse effects on the identified ecological values of this part of the site.

4.2.5 High shore deposit area and existing 'dunes'

The high shore area on Cooks Beach that is to receive the excavated sand from the estuary and delta is likely to host a sparse community of small arthropods, such as sand hoppers. This biota lives in a highly dynamic habitat. Any short-term losses to that community are expected to be quickly restored once the project is completed.

The existing 'dunes' are predominantly vegetated by exotic herbaceous weeds and grasses and pine trees. Any loss of this vegetation is not important from an ecological perspective.

At the northern end of the eroding dunes is a small area of native dune vegetation including pingao (At Risk – Declining). Care should be taken to avoid impacts on the native vegetation in this area. This can primarily be achieved by excluding machinery from the area and ensuring any sand 'overspill' onto the plants is kept to a minimum (i.e. less than 20 cm total depth). If this is not achievable, any losses should be remediated by planting of equivalent vegetation to adequately offset the losses incurred, as determined by a suitably qualified ecologist.

On this basis effects on the ecological values of this part of the site should be minor.

4.2.6 Beach and Estuary Access

Provided transporting and relocating sand to the sand deposition zone is done with due care in terms of creating the access onto the open beach, and there is remediation of impacts on existing dune binding vegetation where disturbance is unavoidable, then any effects should be minor.

4.2.7 Birdlife

Birdlife may be temporarily disturbed during the term of the works. Such effects should be minor as the machinery activity will be restricted to small areas at any particular time and there will in any event be separation distance between the works footprint and the mid to low shore zones where bird feeding is most concentrated.

There does not appear to be any high shore roosting or resting site or habitat that will be adversely affected by the works.

Provided adequate separation distances are maintained between the works and the low shore areas, and a buffer is maintained between the bank vegetation and excavation area two, any effects on bird life should be temporary and minor.

'Restoration' of what are currently more elevated sandy intertidal areas to a lower shoreline profile as a consequence of excavation, should in a short period provide more rather than less feeding opportunities for birdlife once those zones are recolonised by marine invertebrates.

5 RECOMMENDATIONS

The following recommendations are made:

i. Machinery is excluded from the low shore margins and adjacent tidal channel.

ii. In both sand extraction area one and two, sand is extracted from just below the MHWS mark to a maximum depth of 0.6m, as referenced in DWG.AA4637.Sh1234 (Appendix D:).

iii. Sand extraction should be managed to ensure there is no change to the structure or location of the sub-tidal channels.

iv. There is a 'buffer' maintained (and potentially enhanced) adjacent the estuarine bank vegetation at extraction area two. This could be achieved by maintaining the slope of the existing narrow beach and potentially also adding sand to this upper shore zone to widen and elevate the existing beach.

v. Exclude machinery from the vegetated dune area and limit sand overspill onto existing plants to a target of less than 20 cm depth.

vi. Remediate any areas containing dune plants that are affected by machinery access to the beach and replant such areas if necessary.

vii. If deposition is to occur during the peak bird nesting season (September to February), then the beach should be checked by a suitably qualified ecologist for active bird nests prior to depositing sand. If active nest sites are identified, a management plan to minimise disturbance to nesting birds should be designed and implemented.

viii. The extent of the allowable works zone is clearly identified on a plan prior to work starting and is marked out by flags and if possible programmed into machinery (via GPS). This should be done on a current high-resolution aerial photograph (if available) or as a joint inspection at the site involving at least the contractor, the ecologist and the coastal scientist.

6 OVERALL CONCLUSION

It is concluded that the proposed sand management should not result in adverse effects on the identified ecological values of the estuary, beach or dunes, provided the recommendations proposed in this report are adopted.

Ecological values in the proposed sand extraction areas are limited. These areas should naturally remediate to a similar or greater ecological value in terms of habitat, biodiversity and biomass.

No significant habitat or populations of edible shellfish will be adversely affected.

The loss of the Cooks Beach sub-channel represents a minor adverse ecological effect. This is a dynamic environment and the current ecological values of the site likely represent a transient state. The proposed works will return the area to a state similar to its recent historical condition.

Ecological effects on the high shore of Cooks Beach and adjacent dune vegetation due to the proposed sand deposition will be minor but some localised remediation of disturbed indigenous dune plants may be required.

Overall, it is concluded that provided the above recommendations are put in place, any adverse ecological effects should be minor, and for most part limited to the duration of the works programme.

7 REFERENCES

4Sight Consulting Ltd. 2017. Matapouri Sand Management Ecological Report.

Richardson, J., D. K. Rowe, and J. P. Smith. 2001. Effects of turbidity on the migration of juvenile banded kokopu (Galaxias fasciatus) in a natural stream. New Zealand Journal of Marine and Freshwater Research 35:191–196.

Appendix A:

Location of 50m transect core samples

Transect	Metres from start
Cooks Beach sub-channel (cores 1-6)	5, 7, 18, 19, 35, 41
Delta (cores 1-6)	2, 4, 21, 25, 36, 37
Estuary low intertidal (cores 1-6)	2, 4, 19, 23, 40, 41
Estuary mid intertidal (cores 1-6)	6, 8, 18, 23, 37, 42

Appendix B:

50m transect survey site way-points

Waypoint	Description	Latitude (WGS84)	Longitude (WGS84)
WP1	Start of Cooks Beach sub-channel transect	-36.836071°	175.756108°
WP2	Start of delta transect	-36.833967°	175.756842°
WP3	Start of estuary low tide transect	-36.837237°	175.760467°
WP4	Start of estuary mid tide transect	-36.837373°	175.760275°

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Appendix C:

Tuatua and Pipi Size Frequency Data

Cooks Beach sub-channel tuatua size frequency data

Size class (mm)	*Frequency*
0-5	0
5-10	0
10-15	1
15-20	35
20-25	14
25-30	2
30-35	3
35-40	2
40-45	5
45-50	1
50-55	0
55-60	0

Delta - Pipi size frequency data

Size class (mm)	*Frequency*
0-5	0
5-10	0
10-15	0
15-20	0
20-25	0
25-30	0
30-35	6
35-40	4
40-45	1
45-50	2
50-55	9
55-60	1

Estuary low intertidal – pipi size frequency data

Size class (mm)	*Frequency*
0-5	0
5-10	0
10-15	0
15-20	0
20-25	0
25-30	4
30-35	7
35-40	9
40-45	2
45-50	4
50-55	2
55-60	0

Estuary mid intertidal – pipi size frequency data

Size class (mm)	*Frequency*
0-5	0
5-10	0
10-15	0
15-20	1
20-25	3
25-30	12
30-35	19
35-40	6
40-45	2
45-50	1
50-55	0
55-60	0

Appendix D:

DWG.AA4637.Sh1234