COASTAL MONITORING

One of Northland's most treasured natural resources is our expansive, diverse and beautiful coastline, over 3000 kilometres in total. The Northland Regional Council produced a Regional Coastal Plan, which became operative in 2004. This plan outlines the rules and regulations regarding what people may and may not do, in terms of activities that can have an impact on coastal areas.

As our coastline is so large and valued it is not surprising that the Northland Regional Council carries out a considerable amount of coastal monitoring in a range of areas such as recreational beach bathing quality, estuarine monitoring, coastal hazard monitoring and implementation of a coast care programme. Check out the **performance targets** (refer page 22) to find out which community outcomes in the Long Term Council Community Plan relate to coastal monitoring.

In 2005-06 58 coastal sites were monitored for 12 weeks over summer for the **recreational bathing water quality** (refer page 3) monitoring programme to assess the suitability of water quality for recreational use. In general, water quality in most of Northland's nearshore coastal waters comply with microbial water quality guidelines for recreational use. However, following heavy rainfall water quality tends to decline in some areas and can remain compromised for several days. At open coast locations water quality tends to be less affected by rainfall than that at estuarine or harbour locations, where contaminants may become concentrated under conditions of limited tidal flushing.

Concurrently to the recreational bathing programme samples from 17 sites were also analysed to assess **recreational shellfish gathering water quality** (refer to page 6). The water quality at most areas sampled did not comply with the water quality guidelines for recreational shellfish gathering, with the exception of Ruakaka near surf club, Waitangi Bridge, Te Haumi River and Taipa. These results are indicative only, as samples were only collected for 12 weeks in summer from the water in recreational gathering areas not the shellfish themselves. However it does give us a good idea of the potential risks in Northland for recreational shellfish gatherers.

In February 2006 the Regional Council assisted with a Ministry for the Environment project which involved resurveying for **antifouling co-biocides** (refer to page 8) at selected sites in Northland. This followed on from the 2003 national survey. Measurable concentrations of the co-biocide Diuron was found at sites of high density moorings, while there was no Irgarol 1051 detected at the selected sites in Northland.

In 2005-06 the coastal team implemented the **Estuarine Monitoring Programme** (refer to page 9), using the national Estuarine Monitoring protocols, in Whangarei Harbour and Ruakaka Estuary. This involved monitoring of both fine and broad scale habitat

characteristics such as faunal and floral composition, nutrient sampling, sediment particle size and the proportion of different habitat types including substrate type and vegetation cover. Results indicate that both estuaries are moderately enriched with low to moderate microalgal mat development. Sand was the dominant substrate for both estuaries, while faunal and floral abundance and extent was relatively variable for the two estuaries.

With over 3000 kilometres of coastline and 30 coastal settlements, Northland's exposure to **tsunami hazard** (refer page 13) is high. However, there are several critical unknowns about tsunami hazard such as the record of historic/pre-historic events and significance of tsunami generating sources. In 2005-06 a comprehensive literature review of the historic tsunami record for the Northland region and a ground truthing field assessment of representative sections of the Northland coastline, with sediment coring in selected areas, were undertaken by National Institute of Water and Atmospheric Research (NIWA) staff with contributions from ArchResearch and the Regional Council.

The **beach-profile monitoring programme** (refer page 15) was continued in 2005-06 to provide information on the positional stability (i.e. eroding, equilibrium, accreting) of the foreshore and foredune at selected coastal areas. For the majority of east coast sites, results tend to indicate that foredunes have continued to accrete sand and grow seaward under the existence of favourable 'dune building' conditions, which have tended to dominate since the easterly storms in July 2000. The exception is those areas where historically the foredune complex has been extensively modified and native foredune vegetation removed. A storm event in September 2005 affected several coastal areas in Northland.

In response to increased pressure from coastal development, hazard management issues and the establishment of coast care groups, the Northland Regional Council has sought to develop a **coast care programme** (refer page 19). The aim of this programme is to enable communities to better understand coastal processes and initiate protection, restoration and enhancement of dune ecosystems through the establishment and resourcing of community based coast care groups. The photograph below demonstrates the damage humans can have on coastal dunes showing vehicle damage to dunes on the West Coast.

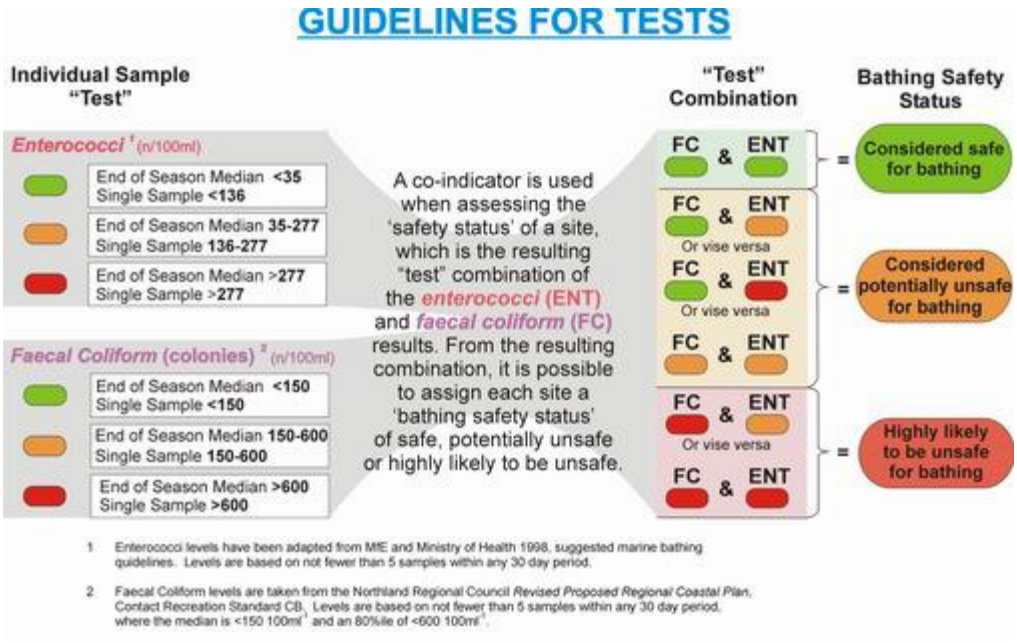
Recreational Bathing Water Quality

The Northland Regional Council implements the recreational bathing programme every summer during the peak bathing season to assess nearshore coastal water quality, in terms of microbial risk to human health. Contamination of nearshore coastal waters may result from various sources including sewage leaks, septic tank seepage, sewage discharges from boats, contaminated stormwater and diffuse run-off from the land. The Regional Council's responsibility is to carry out routine surveillance monitoring. These results are forwarded to the District Councils and Northland Health, who then carry out follow up sampling as required and warn the public of any bathing sites that may be unsuitable for recreational use.

The bathing programme including site selection, methods, follow up and guideline values, is based on the '*Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas'* developed by the Ministry for the Environment and Ministry of Health. These guidelines are available under publications on the Ministry for the Environment's website: www.mfe.govt.nz. In general, samples were collected on a weekly basis from each site and analysed for concentrations of two indicator bacteria, enterococci and faecal coliform. These are indicative of pathogen levels and therefore the potential risk of illness to recreational users.

Guidelines for Marine Bathing Water Quality in Northland

The guidelines below show how the results of the water quality tests are combined to determine the 'bathing safety status' at each site. An elevated concentration of both enterococci and faecal coliform occurring at one site is considered more indicative of a significant water quality issue than only one being elevated.



Summary of 2005-06 results

In 2005-2006 Northland Regional Council carried out surveillance monitoring at 58 marine bathing sites throughout Northland for 12 weeks from late November 2005 to mid February 2006. The microbiological results from the 2005-06 bathing season are summarised below. Refer to **Appendix one** for the maps showing the results of the 12 weeks of sampling.

Matapouri
The water quality complied with the bacteriological guidelines for recreational bathing on all occasions for the beach sampling site. However, non-compliances were detected in the estuary on four occasions.

Tutukaka
The water quality at Church Bay proved problematic, with a period of non-compliance for five weeks in a row. This was investigated by Council and results indicated contamination occurring from the rural catchment. Pacific Bay and Kowharewa Bay complied with the bacteriological guidelines on all but one occasion each.

Ngunguru
Non-compliances were detected in Ngunguru estuary on five separate occasions in the 2005-06 bathing season.

Oakura, Ohawini and Teal Bay (Ngawai Bay)
The water quality within the Oakura and Ohawini embayments complied with the bacteriological guidelines for recreational bathing on all occasions. While four non-compliances with the bacteriological guidelines for recreational bathing were recorded for Teal Bay.

Taipa/Mangonui Harbour
The water quality at Taipa and Cable Bay and Coopers Beach complied with the bacteriological guidelines for recreational bathing on most occasions. Five non-compliances were detected for Coopers Beach. The semi-brackish waters associated with these samples, as indicated by reduced salinities, indicates influence from the adjacent Coopers Beach stream.

Whangarei Heads
The water quality at McLeod Bay, Taurikura and Urquharts Bay complied with the bacteriological guidelines for recreational bathing on most occasions.

Pataua
The water quality within the lower Pataua Estuary and Pataua North beach complied with the bacteriological guidelines for recreational bathing on most occasions.

Bay of Islands
The water quality within and adjacent to Russell, Paihia, Opua and the Kerikeri and Te Puna Inlets complied with the bacteriological guidelines for recreational bathing on all occasions in 2005-06. There is some concern that samples may have been collected in deeper than 0.5 m on some sampling occasions, which may have skewed the data positively towards compliance.

Hokianga Harbour
The water quality of the Hokianga Harbour at Omapere, Opononi and Horeke complied with the bacteriological guidelines for recreational bathing on most occasions. Rawene was non-compliant with the guidelines for half of the sampling events.

Kaipara Harbour
The water quality within the Kaipara Harbour, at Pahi and Kellys Bay complied with the bacteriological guidelines for recreational bathing on most occasions. Tinopai was quite different, with numerous non-compliances. Many of these non-compliances were correlated with semi-brackish waters present during sampling.

Ruakaka, Waipu, and Langs
The water quality at Ruakaka Estuary failed to comply with the guideline on seven occasions. However, the brackish waters associated with the samples (7 samples with salinity < 20 ppt) question the validity of this site in the marine recreational bathing programme.

The Ruakaka beach site had three non-compliances, possibly resulting from influence of plume from Ruakaka River. While Waipu and Langs Beach were compliant on most occasions.

Mangawhai
The overall water quality within the lower Mangawhai Estuary complied with the bacteriological guidelines for recreational bathing on most occasions. There was only one occasion when the FC and ENT levels exceeded the guideline.

Overall Summary
In general, water quality in most of Northland's nearshore coastal waters comply with microbial water quality guidelines for recreational use. However, following heavy rainfall water quality tends to decline in some areas and can remain compromised for several days. At open coast locations water quality tends to be less affected by rainfall than that at estuarine or harbour locations, where contaminants may become concentrated under conditions of limited tidal flushing.

All sites monitored during the 2005-06 summer will remain for next year's marine bathing programme. A review of all marine sites, which will involve grading sites following the protocols set out in the *'Microbial Water Quality guidelines For Marine and Freshwater Recreational Areas'* will be done in the next 2 years.

Recreational Shellfish Gathering Water Quality

Water quality monitoring for the purpose of assessing the suitability of microbial water quality for recreational shellfish gathering was undertaken at a number of popular recreational shellfish gathering sites during the 2005-06 summer. This monitoring was done concurrently with the marine recreational bathing water quality programme.

This programme involved testing concentrations of faecal coliform bacteria in coastal waters at popular shellfish gathering sites. Seventeen individual sites were monitored at weekly intervals for up to 12 separate occasions from late November 2005 to mid February 2006.

Guidelines for Recreational Shellfish Gathering Water Quality

The guideline for recreational shellfish gathering water quality is a median faecal coliform count not exceeding 14 per 100 ml over a shellfish-gathering season and not more than 10% of samples exceeding 43 per 100 ml. Non-compliance with either of these parameters indicates that the water is not suitable for the purpose of recreational shellfish gathering.

Summary of Results

The results from the 2005-06 monitoring programme indicate that water quality at most areas sampled did not comply with the water quality guideline for recreational shellfish gathering, shown in red in the table below.

Area	Median FC (per 100ml (MPN))	% of samples exceeding 43 FC per 100 ml	No. of Samples Collected	Guideline compliance
Ngunguru	15	17	12	Fail
Oakura - mid	4	18	11	Fail
Oakura - north	6	17	12	Fail
McLeod Bay	7	17	12	Fail
Taurikura	3	25	12	Fail
Urquharts	1	33	12	Fail
Pataua	30	42	12	Fail
Waitangi	6	0	12	Pass
Te Haumi River	2	0	12	Pass
Tinopai	300	58	12	Fail
Kelly's Bay	5	25	12	Fail
Ruakaka	4	9	11	Pass
Mangawhai	8	36	11	Fail
Pahi	17	27	11	Fail
Taipa	2	9	11	Pass
Coopers Beach	9	36	11	Fail
Cable Bay	4	27	11	Fail

Of the 17 sites sampled four sites exceeded the median faecal coliform limit of 14 per 100 ml and 13 sites had more than 10% of samples that exceeded a faecal coliform count of 43 per 100ml. Four sites; Ruakaka at surf club, Te Haumi River, Waitangi Bridge and

Taipa, had 100% compliance with the water quality guidelines for recreational shellfish gathering in the 2005-06 season.

It is acknowledged that these results are indicative only, as they were not collected over an entire shellfish-gathering season (which would be year round in Northland) and more samples are required to have reasonable certainty in testing for compliance with the standard. Nevertheless, these data provide a reasonable snapshot of the suitability of water-quality for recreational shellfish gathering purposes in the areas assessed.

Resurvey of Antifouling Co-Biocides

The NRC assisted, by way of sample site selection and sample collection, in the 2006 resurvey of antifouling co-biocides in New Zealand coastal waters. The survey, and reporting, was done by Carol Stewart for the Ministry for the Environment and followed up from the 2003 national survey of levels of the antifouling co-biocides; Irgarol 1051 and Diuron, in New Zealand's coastal waters and sediments.

In Northland, samples were collected on 9 February 2006 from the following coastal sites; Parua Bay jetty in Whangarei Harbour, Town Basin marina in Whangarei and Doves Bay Marina in the Bay of Islands. Samples were also collected from the following freshwater sites for comparison; Kapiro Stream at Purerua Road, Wairoa Stream at Cobham Road and Raumanga Stream in Whangarei.

Northland's coastal results were consistent with findings elsewhere in New Zealand for the 2006 survey. That is, measurable concentrations of the co-biocide Diuron were found at sampling sites within areas of high density mooring (i.e. Marinas) and Irgarol 1051 was not detected at any of the sampling sites. Overall contamination of these co-biocides in Northland's coastal waters was considered to be a problem of limited extent.

For more information contact Ministry for the Environment and quote the following report: '*Antifouling co-biocides in New Zealand coastal waters: 2006 resurvey*' produced by Carol Stewart for the Ministry for the Environment.

The photo below is the Town Basin Marina in Whangarei, one of the sampling sites used in the 2006 resurvey.

Estuarine Monitoring

In the 2005-06 summer Northland Regional Council commenced Estuarine Monitoring, following the national Estuarine Monitoring Protocol (EMP), in Ruakaka Estuary and Whangarei Harbour.

There are two main components of the EMP; fine scale assessment of seabed habitat and broad scale mapping of intertidal habitat. The fine-scale assessment uses analyses of a range of characteristics relevant to estuarine condition, such as faunal and floral composition, nutrient and contaminant status and seabed sediment grain size. This fine-scale component is typically undertaken annually for three to five years to gain sufficient baseline data, and thereafter at three to five yearly intervals. The broad-scale mapping determines the proportion of different habitat coverage within the estuary. The broad scale component is done using existing aerial imagery and GIS techniques, which is ground truthed and this is repeated at every five to ten years.

The main deliverables from the implementation of the EMP are:
- Baseline assessment of estuarine sediment and ecological health.
- Baseline assessment of habitat composition of estuaries.
- Continued assessment of changes in estuarine health, based on the above factors.
- Provision of quantitative data from which informed decisions can be made on the management of estuarine areas and activities impacting on the health of these.

Fine Scale Habitat Monitoring

Sampling sites and parameters
One sampling site was selected at Ruakaka, representative of the small scale of the estuary, whereas, three sampling sites were selected in Whangarei Harbour, representative of the harbour's greater size and complexity.

At each sampling site one 60m x 30m sampling station was established in soft-sediment (sand/mud) habitat in the mid to low intertidal zone. Each station was divided into 12 equal sized plots and samples collected for the following:
- Sediment core profiles (redox layer)
- Percentage of macroalgae cover
- Chlorophyll a
- Benthic microalgae
- Sediment physical and chemical analyses (eg: Particle size, Nutrients, Trace metals)
- Epifauna and infauna

The photograph (right) shows a NRC staff member carrying out epifaunal sampling in the Ruakaka Estuary sampling station.

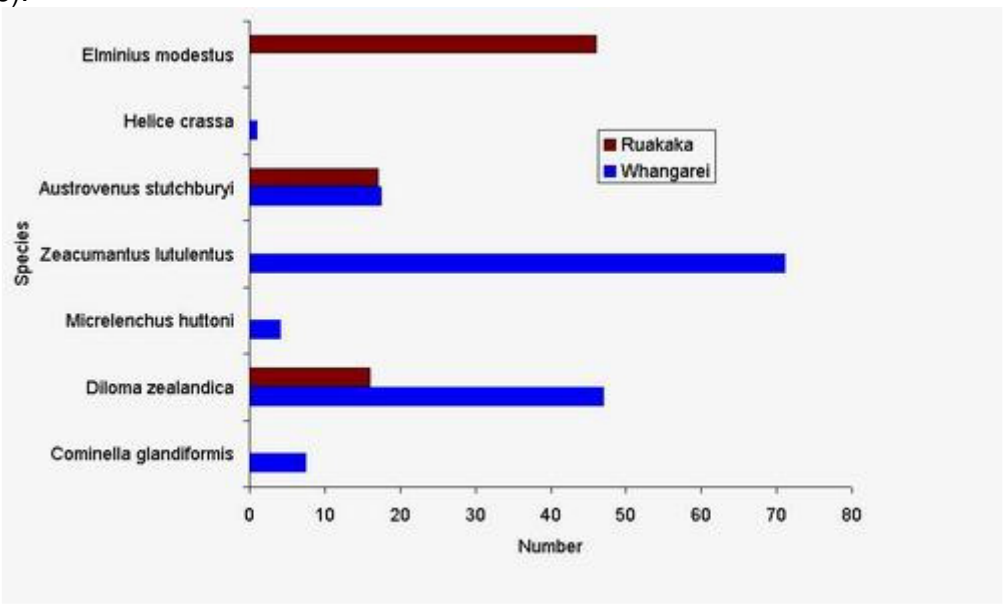
Summary of results
In both Whangarei and Ruakaka estuaries there were no significant macroalgae beds observed, although *Ulva lactuca* (sea lettuce) was present in strandlines. Concentrations of sediment chlorophyll *a* indicated low to moderate microalgal mat development. Sand was the dominant sediment in both Whangarei and Ruakaka, making up 91.4% and 97.5% of the total sediments on average respectively. The redox layer ranged between 5 to15 mm in the Whangarei sampling stations and 10 to 20 mm in the Ruakaka sampling station (an example of the redox layer is shown in the photograph below).

The levels of nutrients in sediments in both estuaries indicate that they are both moderately enriched, particularly with respect to Nitrogen (TN). Trace metal levels were all below ANZECC-low effect level guideline values (refer to table 3.5.1 of the ANZECC guidelines 2000). These results indicate that nutrient enrichment could be a key pressure on the health of the estuarine environments sampled.

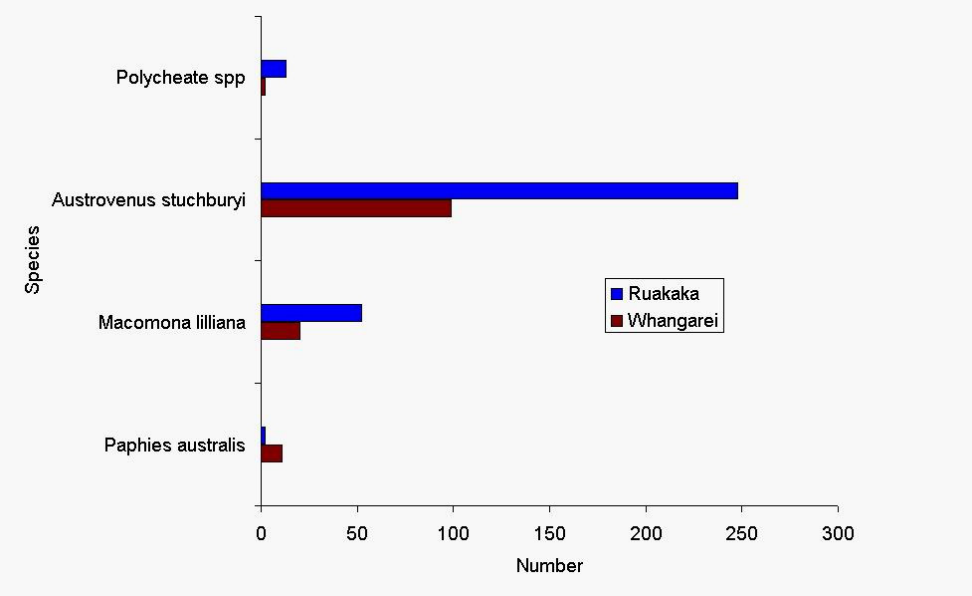
Comparison of average physico-chemical characteristics of sediments from the two estuaries sampled in this study (n=10).

	TN mg/kg	**TP** mg/kg	**Cd** mg/kg	**Cr** mg/kg	**Cu** mg/kg	**Ni** mg/kg	**Pb** mg/kg	**Zn** mg/kg	**Chl *a*** mg/kg	**%Mud** %
ANZECC LOW	NA	NA	1.5	80	65	21	50	200	NA	NA
ANZECC HIGH	NA	NA	10	370	270	52	220	410	NA	NA
Whangarei	690	199.5	0.01	5.8	1.32	2.2	1.5	13.3	16.8	7.2
Ruakaka	1080	91.7	0.01	4.9	0.4	1.4	.82	6.9	12.1	3.1

The mean abundance of epifauna was reasonably variable between estuaries. The most abundant species in the three Whangarei sampling stations was the Gastropod *Zeacumantus lutenlentus* (koeti/horn shell) and to a lesser extent *Diloma zealandica* (mudflat topshell). By contrast the most abundant species in Ruakaka Estuary was *Elminius modestus* (estuarine barnacle) followed by the bivalve *Austrovenus stutchburyi* (cockle).



Infaunal species richness and abundance was dominated by bivalves in both estuaries sampled during 2005-06. Cockles (*A. stutchburyi*) were the most abundant followed by wedge shells (*Macomona lilliana*) and pipi's (*Paphies australis*). Small numbers of polycheates (worms) were also identified.



Broad Scale Habitat Mapping

Broad scale habitat mapping was done for each estuary to assess and index habitat coverage in the estuaries. This was done by using a combination of aerial photographs and ground truthing these by walking and boat. Results from this assessment are placed in to GIS to represent habitat coverage and determine abundance and diversity.

Ruakaka Estuary

The mapping of the intertidal habitats in the Ruakaka Estuary showed that the dominant habitat cover was water, followed by firm sand in the mid and upper reaches of the estuary to mobile sand in the lower reaches.

The most abundant vegetative habitat in the upper reaches was *Avicennia marina var. resinfera* (mangrove). There is anecdotal evidence (confirmed by old aerial photos) that the extent of mangroves has increased in the last thirty years within the upper reaches. The remaining habitats were rushland, dominated by *Leptocarpus similis* (oioi/jointed wire rush) and to a lesser degree *Juncus krausii* (wiwi/sea rush), which dominated the margins of the middle reaches. The lower reaches were lacking intertidal vegetation. There were minor areas of scrubland, herbfield and macro algae beds. The photo below shows marshmeadow in Ruakaka Estuary.

An example of the map output from this broad scale mapping for Ruakaka Estuary is available on the NRC website as a pdf file in the coastal section of the 2005-2006 Annual Monitoring Report.

Whangarei Harbour

Due to the large scale and diversity of the Whangarei Harbour, the digitisation of intertidal habitats has not yet been completed. However an outline of the findings to date is presented below.

The survey of the intertidal habitat of the Whangarei Harbour indicated a relatively broad range of habitats, dominated in the upper harbour by mangrove scrubland, de-vegetated substrate and a mixture of remnant rushland. The remnant rushland was largely due to stock damage as a consequence of unfenced coastal margins, as is the case in the photo below. The substrate in the upper reaches was dominated by a mixture of soft mud/sand.

A feature of the southern side of the harbour stretching from One Tree Point to Mangapai is the sand/shell banks. They were dominated by oioi, wiwi and scrubland featuring *Plagianthus divaricatus* (saltmarsh ribbonwood), *Meuhlenbeckia complexa* (pohuehue/ wire vine) and in some cases *Ulex* spp. (gorse). Parts of these banks were also dominated by herbfields with the dominant vegetation consisting of *Sarcocornia quinqueflora* (ureure/glasswort), remuremu and to a lesser degree *Samolus repens* (maakoako/sea primrose).

The lower reaches were dominated by subtidal water and intertidal margins dominated by mostly firm sandy beaches with rocky headlands. Mangroves dominated some parts of the lower reaches (e.g. Parua Bay), while *Metrosideros exelsa* (pohutukawa) dominated many of the sandy shores. The photo below shows herbfield habitat in Whangarei harbour.

Tsunami Hazard

With over 3000 kilometres of coastline and 30 coastal settlements, Northland's exposure to tsunami hazard is high. However, there are a number of critical unknowns about tsunami hazard such as the record of historic/pre-historic events and significance of tsunami generating sources.

As a basis to further understanding these unknowns, National Institute of Water and Atmospheric Research (NIWA) were engaged to investigate these factors, with a view to using the information gained from this study for modelling of shoreline tsunami wave height and inundation for Northland's coastal settlements in coming years.

Tsunami Hazard Assessment Baseline for the Northland Region

A comprehensive literature review of the pre- and post-historic tsunami record for the Northland region and a ground truthing field assessment of representative sections of the Northland coastline, with sediment coring in selected areas, were undertaken by NIWA with contributions from ArchResearch (Bruce McFadgen) and Northland Regional Council (Bruce Howse and Clarie Nyberg).

The post-historic record shows that there have been four moderate tsunami inundation events on Northland's east coast in the last 150 years. Whilst the paleo-tsunami record indicates there has been at least one large event, or a series of large closely-spaced events, in the last 600 years.

The full report '*Tsunami hazard assessment baseline for the Northland region*' by Change-Goff and Goff (2006) is available on the NRC website as a pdf file in the coastal section of the 2005-06 Annual Monitoring Report.

Key findings from the comparison of the historic and paleo-tsunami records indicate:

- Distant events from South America generate moderately large tsunamis along the east coast. The most recent in 1960, prior to the coastal development 'boom' in Northland.

- Regional tsunami events from other sources, such as Indonesia and the north, are poorly or not at all represented.

- Four moderate events in the historic record indicate a return period of one in every 37.5 years for the east coast. There is insufficient data to calculate a return period for the north or west coasts.

- One composite paleo-event limits the development of return periods for large events. Data from sediment cores extracted as part of this project will assist with our understanding in this matter.

From this work a generalised summary of hazard and risk for the region was proposed. That is, a moderate hazard and risk is suggested for most of the northwest and east coast, a high hazard and moderate risk for the north, and a low hazard and risk for the west.

The photograph shows a Paleo-tsunami deposit up to about 35 metres amsl at Tom Bowling Bay.

Tsunami source study

NIWA were commissioned by Northland Regional Council, Auckland Regional Council, Environment Waikato and Environment Bay of Plenty to undertake a tsunami source investigation.

The most significant tsunami generating sources were identified and wave-height at shoreline modelled at a regional scale for a large generational event. These included a distant source from South America, distant/regional tsunamis from the Solomon Sea and New Hebrides areas, a subduction zone event along the Tonga-Kermadec Trench. Selected local sources were also identified and modelled for Northland, namely submarine landslides near Three Kings Islands and northeast of North Cape and a slump of the continental shelf near the Rapuhia Scarp.

A subduction zone event along the Tonga-Kermadec Trench represented the most significant tsunami source, with water elevation at shoreline exceeding 5 metres for a 'maximum event' scenario. Other distant/regional scenarios for South America, Solomon Sea and New Hebrides sources generated water elevations at shoreline around three metres. Of note, was that the Northland region records the highest elevations from all distant/regional sources, with a marked signal also noted along the western shoreline.

Modelling of local sources indicated water elevation at shoreline exceeding 10 metres at a number of locations, although maximum elevations were more spatially restricted to near the area of generational source than those for regional/distant source events.

The distant/regional scenarios modelled indicated that the Paleotsunami evidence for Northland could not have been deposited as a result of these scenarios, showing that unknown or poorly studied local sources were the cause.

Beach Profile Monitoring

The beach-profile monitoring programme continued in 2005-06. This programme was established to provide information on the positional stability (i.e. eroding, equilibrium, accreting) of the foreshore and foredune or cliff at selected coastal areas. Data gathered from this programme is necessary to better understand the dynamics of Northland's coastline assisting the Council and community in assessing the suitability and effect of developments in and adjacent to coastal areas. It is also used for the delineation of coastal hazard zones.

The programme involves surveying the position of the toe of the foredune with a differential global positioning system and surveying one or more cross sectional profiles of the foreshore and foredune complex at each beach. The programme was designed to provide coverage of a number of key 'monitor' beaches in the region. The monitoring is either done twice a year in summer and winter, once every two years or after events that cause substantial changes to the position of the shoreline such as storms and landslides. The table below shows what beaches are monitored, for how long they have been monitored and the frequency of monitoring.

Number on map	Beach	Number of profiles	Record commenced	Proposed frequency
1	Mangawhai	6	2000	Twice per annum
2	Bream Bay	6	1976	Twice per annum
3	Pataua	2	1998	Every 2 years
4	Wellingtons (Whangaumu)	1	1998	Every 2 years
5	Ngunguru	1	1998	Every 2 years
6	Matapouri	4	1st Section 1998	Twice per annum
7	Whananaki	1	1998	Twice per annum
8	Te Mimiha	1	1999	Every 2 years
9	Teal (Ngawai)	1	1999	Every 2 years
10	Oakura	1	1998	Every 2 years
11	Ohawini	1	1998	Every 2 years
12	Te Ngarie	1	2002	Every 2 years
13	Tauranga	1	2002	Every 2 years
14	Taupo	1	1999	Twice per annum
15	Hihi	1	1999	Every 2 years
16	Coopers	1	2003	Every 2 years
17	Cable Bay	1	2003	Every 2 years
18	Taipa	1	1990	Twice per annum
19	Tokerau	2	1990	Every 2 years
20	Rangiputa	3	1999	Every 2 years
21	Ahipara	2	1999	Every 2 years
22	Omapere	6	2002	Twice per annum
23	Glinks	1	1994	Twice per annum
24	Pouto	8	1989	Twice per annum

The photographs below of Bream Bay on the east coast of Northland highlight how the foredune can change. The left photo was taken in July 2000 following a period of sustained onshore winds that caused substantial erosion to a number of east coast beaches, while the photo on the right is from December 2005 following a period of calmer conditions enabling formation of incipient foredune and accumulation of sand on the beach.

For the majority of east coast sites, results tend to indicate that foredunes have continued to accrete sand and grow seaward under the existence of favourable 'dune building' conditions, which have tended to dominate since the easterly storms in July 2000.

The exception is those areas where historically the foredune complex has been extensively modified and native foredune vegetation, such as pingao and spinifiex, removed. The foredunes of these areas have largely disappeared and lost the ability to retain sand and rebuild during favourable conditions. This causes the cut part, of the cut and fill cycle (the erosion and accretion cycle), to dominate, resulting in net negative retreat of the foredune. Examples of these areas include Tauranga Bay beach (shown in the photo below), parts of the Omapere foreshore, although this case is further affected by inappropriate coastal structures interfering with sand transport, Waipu Cove and the estuarine end of Matapouri Beach.

Tauranga Bay is an example of a beach with a highly modified foredune as shown in the photograph below (March 2004). The foredune continues to show net negative retreat due to modification of the dune complex, exclusion of suitable native foredune vegetation and lack of appropriate pedestrian access to the beach.

LIVING IN THE COASTAL HAZARD ZONE

Case Study: The September 2005 Storm

During 18 - 19 September 2005 large perigean-spring tides coincided with a moderately-intense low-pressure weather system, which brought strong winds. The tide height at Port Taranaki was predicted to be 3.9 metres, where as Mean High Water Spring is 3.5 metres at Port Taranaki. Barometric pressure in Dargaville was recorded as 983 hPa, compared with a mean pressure of 1014 hPa. Strong winds were recorded with mean peak winds of 48 km/hr and a maximum wind gust of 105 km/hr.

The low pressure and wind forcing caused a moderate storm surge setup which caused localised inundation and erosion at a number of, predominantly west coast, locations.

Substantial erosion occurred to the Ahipara foreshore north of the Wairoa Stream, with erosion of between 5 - 10 metres. Localised coastal inundation also caused temporary flooding of the road and low-lying properties. The photographs below shows Ahipara during the storm (left) and an area affected by inundation and erosion (right).

Substantial erosion also affected the Omapere foreshore, with differential erosion of between 1 - 4 metres on average along most of the Omapere foreshore. At least one dwelling was put at direct risk from this event with the concrete foundation overhanging the edge of the eroded dune scarp, as shown in the photograph below.

The east coast settlements were less affected by this low-pressure weather system due to the lower wave energy on the east coast. Nevertheless, there were some localised effects, including the failure of the Pyle Road seawall at One Tree Point, Whangarei Harbour. Some erosion also occurred at the Rangiputa shoreline, as result of this embayed east coast settlement's westerly facing aspect.

So what is the Council doing about it?

Following the storm several meetings were organised with local communities that were concerned and/or affected by the consequences of the event.

A public meeting, organised by the NRC, was held in Omapere on 25 October 2005 to discuss the erosion of the Omapere foreshore and management options and issues. The meeting was well attended by a representative cross section of 80 people from the local community. A presentation outlining what we know about the Omapere Beach system, examples of management options, including pros and cons of each, an explanation of rules and regulations was given and attendees were invited to discuss 'where to from here' with management of the beach. The community voiced a number of differing opinions as to what management actions should be implemented. From this meeting a Society, comprised mostly of local community members, was setup to consider options for managing the erosion of the Omapere foreshore. The Society has continued to meet on a regular basis, with support from the NRC, and is currently in the position of investigating the most appropriate short-term and long-term management options for the foreshore.

A similar meeting, although on a smaller scale, was held at Ahipara on 18 October to discuss management options for those properties affected by erosion near the Wairoa Stream. The meeting was well attended by the affected beachfront property owners. The outcome from the meeting was that the affected beachfront community wish to implement a 'low impact' solution to the erosion, with also some consideration to the reconstruction of a groyne to train the river. The NRC has continued to liaise with a number of the affected property owners over the management of the foreshore in this area, with initial management options currently being considered.

Coast Care Programme

In many places the coast is the first line of defence between the land and the sea with dune systems providing an effective buffer protecting land and infrastructure from coastal erosion and flooding. Since habitation by humans, and particularly within the last 150 years, the dune environment has been degraded through inappropriate coastal development, farming practices, the introduction of pest species, sand extraction and damage by pedestrians and vehicles. The photographs below are an example of coastal development impacting on a dune system, showing Paihia Waterfront in 1953 (left) and in 2006 (right).

In areas where the front of the dune (foredune) has been extensively modified and native vegetation such as pingao and *Spinifex* sp. have been removed, the dunes have lost their ability to rebuild such as at Tauranga Bay shown in the left photo below. Loss of sand from the dune system over time leads to long term retreat of the foredune. When the sea threatens land and infrastructure the typical response has been to armour the coastline with hard materials such as rocks, concrete rubble, steel and iron which lowers the beach profile causing the high tide beach to be lost and subsequently degrading natural character such as at Rangiputa in the right photo below.

In response to increased pressure from coastal development, hazard management issues and the establishment of coast care groups, the Northland Regional Council has sought to develop a coast care programme. The aim of this programme is to enable communities to better understand coastal processes and initiate protection, restoration and enhancement of dune ecosystems through the establishment and resourcing of community based coast care groups.

Coast care is not a new concept with groups being established in Australia since the 1980's and in New Zealand since 1993. The fundamental concept of coast care is to enable volunteers to become involved with the management and protection of the coast bringing people, organisations and the environment together. Projects undertaken by coast care groups include dune rehabilitation, fencing, signage, beach access, weed management, pest control, planting, public education, beach clean ups and general

awareness of coastal issues. The photographs below show work that has been carried out at Matapouri Bay, including planting, fencing to protect the dunes, a walkway and signage to educate beach users.

Already some coast care groups and District Councils have been effective in protecting and restoring dune systems in Northland as in the Matapouri Bay example above. The Glinks Gully Protection Society have concentrated their efforts in restoring the back dune area, by inviting the community along to planting days. Further up the coast, members of the Hua Rakau Ki Omamari Trust have established a nursery where native plants are grown and then planted on the foredune and back dune. The trust members have protected the dune plants by constructing brush fences, erecting signage and carrying out pest management. The trust is now concentrating on the restoration of the Omamari Stream to improve water quality.

On-going coastal erosion at Omapere Beach has seen the formation of the Hokianga Harbour Foreshore Restoration Society. The society aims to protect land and infrastructure from coastal erosion while maintaining a high tide beach for recreational use. The society is currently working with the local residents, the Regional Council and Far North District Council to facilitate an appropriate solution to erosion issues.

Residents at Waipapakauri, faced with sand inundation by a dune blow out, have constructed a walkway over the dunes to Ninety Mile Beach, erected signage and fences and planted pingao plants on the seaward side of the dune. Members of the Kaimaumau Coastal Reserve Group have begun to develop Far North District Reserve land at Kaimaumau by clearing some pest plant species and planting suitable back dune plant species. This group also aims to restore the compromised dunes by the reserve by recontouring the dune face, planting and fencing, erecting signs and developing a parking area on the reserve. The group is also working on the protection and enhancement of the Kaimaumau Wetland which is recognised as one of New Zealand's significant indigenous wetlands.

The photographs below show coast care work that has been carried out at Waipapakauri (left) and Omamari beach (right).

Work continues with the Mangawhai Harbour Restoration Society to stabilise the spit, keeping the main channel open and improving harbour water quality. The Society is also growing and planting pingao and *Spinifex* sp. on Mangawhai spit and controlling, in conjunction with DOC, pests which threaten the New Zealand Fairy Tern and native plant species.

These societies, trusts and community groups are only a small number of Northlanders carrying out independent dune restoration on the coast. For more information on coast care groups operating in your area or to register your existing coast care group please contact the Coastal Care Coordinator.

Performance Targets

To continue to develop and implement a prioritised state of the environment monitoring programme based on the Regional Policy Statement and regional plans by:

- Carrying out sampling and reporting on summer coastal and freshwater bathing water quality

- Supporting and contributing to the development and implementation of coastal hazard management strategies, by the collection and provision of coastal hazard and processes information and advice to the communities of affected areas.