# Ohiwa Harbour Sediment and Mangrove Management Plan

Prepared by Tim Senior, Mike Houghton (Opotiki District Council), Malcolm Donald and John Douglas

Environment Bay of Plenty
Operations Publication 2009/05
October 2009

5 Quay Street
P O Box 364
Whakatane
NEW ZEALAND

ISSN:1176 5550

*Working with our communities for a better environment*
*E mahi ngatahi e pai ake ai te taiao*

Environment Bay of Plenty
REGIONAL COUNCIL

# The Ohiwa Harbour Catchment Sediment and Mangrove Management Plan

Operations Publication 2009/05
ISSN: 1176 5550

October 2009

Environment Bay of Plenty
5 Quay Street
P O Box 364
Whakatane 3158
NEW ZEALAND

Prepared by Tim Senior, Mike Houghton (Ōpōtiki District Council), Malcolm Donald and John Douglas

Cover Photo:
Ohiwa Harbour taken from Onekawa

# Executive Summary

The Ohiwa Harbour Catchment Sediment and Mangrove Management Plan has been prepared on behalf of the Ohiwa Strategy Co-ordination Group to give effect to some of the actions proposed in the Ohiwa Harbour Strategy concerning increasing sedimentation and mangrove spread in the harbour. This Strategy identified these two issues as being of considerable concern to the community for their detrimental effects on the health of the harbour. While this plan deals with the two issues separately, they are inextricably linked. The Plan is thus divided into two parts.

## Part 1: The Ohiwa Harbour Catchment Sediment Management Plan

This includes an assessment of the land resources of the Ohiwa Harbour catchment and their uses. It provides a guide for future sustainable land management work to improve the harbour's water quality, reduce sediment generation and protect of biodiversity.

The land resources of the catchment have been analysed using the Land Resources Inventory (LRI) technique and field assessment. This provides information on the soils, land cover, land use, major streams, erosion risk, nutrients and bacteria sources. Increased sediment, nutrients and bacteria adversely affect aquatic life and recreational use in the harbour.

The land resource assessment provides the basis for recommendations for improving sustainable land management which focus on options for forestry and farm management to reduce sediment generation, protect remnant indigenous vegetation and riparian margins for nutrient and sediment control purposes.

Despite much stream fencing in recent years, there are still 49.3 km of major waterways in need of measures to exclude stock. There are 6,959 ha of pasture on Land Use Capability (LUC) class 6 and 7 land on which soil conservation measures are necessary to reduce erosion. There are 3,016 ha of plantation forestry on LUC class 6 and 7 land which also requires management to reduce sediment generation. The catchment also contains 4,311 ha of indigenous forest cover; every effort should be made to promote its long term protection and integrity.

The following are the key recommendations for implementation over the next five years:

- Promote the change in land use to forest type vegetation for all LUC class 7 land in the catchment.
- Continue fencing to prevent stock access to waterways currently unfenced.
- Continue stream bank stabilisation works (Japanese walnut removal, revegetation and stabilising works) for the major streams.
- Ensure culverts or bridges replace stock crossings through streams.
- Promote spaced soil conservation planting on all LUC class 6 land.
- Promote the maintenance of suitable pasture cover, fertiliser regimes and stock types on all farmed LUC class 6 land.
- Continue the retirement and protection of indigenous forest, particularly those with high ecological values.
- Provide education for large forestry and farm woodlot operations, including in conjunction with any afforestation promotion.
- Ensure forestry consents are correctly applied and monitored. Promote the use of the Forestry Operators Accreditation System (FOAS).

- Promote farm planning and provide sustainable land management information to landowners.

## Part 2: The Ohiwa Harbour Mangrove Management Plan

This provides some background to the spread of mangroves in the Ohiwa Harbour and provides a rationale and a recommended process to manage their spread subject to the wishes of the community.

The reasons behind the widespread community concern about mangroves may be summarised as follows:

- While it is acknowledged that mangroves are indigenous plants, their recent and accelerated spread in the Ohiwa Harbour is due largely to various factors that are a result of human induced changes in land use in the greater Ohiwa catchment.
- That their accelerated spread within the harbour is impacting on the harbour environment, indigenous habitats and biodiversity.
- That their accelerated spread within the harbour is having a negative effect on recreational, cultural and amenity values within the harbour.

The mangrove is an indigenous plant which will only survive in the intertidal zone of estuaries in Northern New Zealand. It is part of a habitat type which is very different from the sandflats which have traditionally dominated the harbour. It has only been present in the Ohiwa harbour in very small numbers until the last 30 or 40 years, during which time it has expanded rapidly, encroaching on sandflat habitat. The reasons for this spread are largely due to human activities in the harbour catchment which have resulted an increased quantity of sediment and nutrients into the harbour, considerably speeding up an otherwise natural process of harbour infilling. Mangroves thrive in the soft nutrient rich sediment which is the result of this sedimentation.

It is important therefore that any attempt to manage mangrove spread must be accompanied by efforts to minimise the sediment load of the tributary streams which feed the harbour and which are described in part 1.

This Plan explains the necessary process to be undertaken by the community to manage mangrove spread. This process will involve the formation of an appropriate group, the development of a widely supported action plan, the application for a resource consent and the implementation of the action plan. While Environment Bay of Plenty has no mandate to be directly involved in the removal of mangroves itself, it is able to offer considerable assistance at all stages of the above process. Environment Bay of Plenty is the consenting authority but is also able to support community driven initiatives.

It is important to note that the Ohiwa Harbour Strategy supports the development of mangrove management plans.

# Contents

# Part 1: Ohiwa Harbour Catchment Sediment Management Plan

## 1.1 Introduction

This is a study of the physical resources of the Ohiwa Harbour catchment, including the Nukuhou River catchment. The analysis achieved with this study will provide focus for sustainable land management work into the future to reduce the effects on the harbour, water quality, loss of soil and protection of biodiversity. A major focus of the study is on sediment generation.

The harbour has a land catchment area of 172 $km^2$. The estuary area is 26 $km^2$ and has 56 km of margin length. There are 17 major streams draining the catchment, leading to the harbour with the Nukuhou Stream being the largest. The total length of major streams in the Ohiwa Harbour catchment is approximately 128.5 km.

Paragraph 1.4 provides a catchment assessment of the land resources in the Ohiwa Harbour catchment: land use capability assessment, soils, land use/land cover, waterways and erosion risk. The types of erosion in the catchment associated with the land uses, followed by nutrients and bacteria in water are discussed in this chapter.

A large part of the assessment is based on geospatial analysis of the Ohiwa Harbour catchment using aerial photography and land resource inventory datasets. A number of maps have been produced. For ease of assessing the catchment it has been broken down to four land management suites; steep hill country, moderate hill to rolling hill country, alluvial plains and dunes.

The assessment of the land resources in section 1.4 provides the basis for section 1.10 – Catchment Management. Recommendations and land resource management techniques are given for the major land uses/resources in the catchment.

## 1.2 The key issue

The primary environmental issue for the harbour is the increased level of sediments, nutrients and bacteria entering waterways, which eventually find their way into the Ohiwa Harbour.

**Why are sediment, nutrients and bacteria an issue?** Increased sediment loads, nutrients and faecal material reduce water quality. This reduction in water quality adversely affects shellfish beds, fish and bird habitat, aquaculture, swimming and recreational use.

Sedimentation also promotes mangrove growth; this is further discussed in Part 2 of this report.

An example of sedimentation inputs is shown below, a slip at a gully head on the Ngāti Awa Farm which has occurred after heavy rainfall in the Ohiwa Harbour catchment. Although this is an example of an extreme event, during the 2004 high intensity rain events, the slip has taken out a large area of productive valley floor.


*Figure 1 Slip at gully head on the Ngāti Awa Farm in the Ohiwa harbour.*

## 1.3 Introduction to Ohiwa Harbour land management suites

The catchment can be divided into four main land management suites: steep hill country, rolling hills, alluvial plains and coastal dunes. Their relation to soils and LUC is discussed next in section 1.4.

**Steep hill country**

The steep hill country, accounts for 28% of the catchment. The largest proportion of this is in exotic or indigenous forest cover at 75% which provides a long term sustainable land use. The balance of the steep hill country 25% is in pasture. There is considerable pressure to convert large tracts of exotic forest land to pasture such as has happened to the Kererutahi forest.

*Figure 2 – Steep hill country at Kereutahi*

*Figure 3 – Rolling hills / moderately steep hill country*

**Rolling hills / moderately steep hill country**

The rolling hills occupy 59% of the catchment. The land use comprises a mix of pasture (55%) and mix exotic/indigenous cover (45%). The pasture land form is sheep and beef within the catchment and is generally farmed in a sustainable manner. However, mass movement erosion such as soil slip can occur, particularly with high intensity rain fall events.

*Figure 4 – Alluvial plains in the Nukuhou River catchment*

**Alluvial plains**

The low lying alluvial plains make up 11% of this catchment and are located on the wide flat valley floors in the upper catchment or on drained land near the Ohiwa Harbour margins. This is the dairy farmed land in the catchment. It is characterised by a high water table and susceptible to flooding with the many drains and streams in close proximity. For this study the areas of wetland, open water and salt marsh have been included in this suite.

*Figure 5 – Dunes on the Ōhope spit*

**Dunes**

The dunes make up less than 1.5% of the catchment area and comprise the Ōhope spit and the Ohiwa Harbour spit at the harbour mouth entrance. These are characterised by sand dunes covered in spinifex and pingao and other dune vegetation.

The Ōhope Golf Course and residential development is situated on this land suite also.

## 1.4 Catchment assessment

### 1.4.1 Land use capability assessment

Land Use Capability (LUC) is a classification of land to show the potential for sustainable use. Initially a survey is carried out mapping geology, soils, slope, erosion and vegetation. The LUC is then derived by considering management constraints that would apply to any particular area of land. The LUC classification is divided into eight major classes of land, based on increasing management limitations from Class 1 through to Class 8. Class 1 land has very few limitations, and has the capability to sustain a wide range of potential land uses. Class 8 land has little or no inherent productive potential, and is normally used for catchment protection and/or recreational purposes. Classes 1 to 4 are arable. Classes 5 to 8 are non arable.

The capability classes are further subdivided depending on their major physical limitation uses. These are erodibility (e), wetness (w), soil (s) and climate (c). The number following this denotes the level of limitation relative to other units in the same class.

Within the Bay of Plenty region, a further refinement of the LUC system has been developed. This refinement involves the grouping of LUC units which occur together into suites. These suites are synonymous with the land management suites used in this document. The primary factor to delineate these LUC suites is soil parent material. The major suites within the Ohiwa Harbour Catchment are as below:

- Alluvial plains - Alluvium
- Hill country - Kaharoa ash, Taupo Pumice
- Steep lands - Thin ash deposits
- Dunes - Windblown sand

Through the use of LUC suites, the management constraints of different classes of land have been linked back to the soils and ultimately to the geology of the catchment.

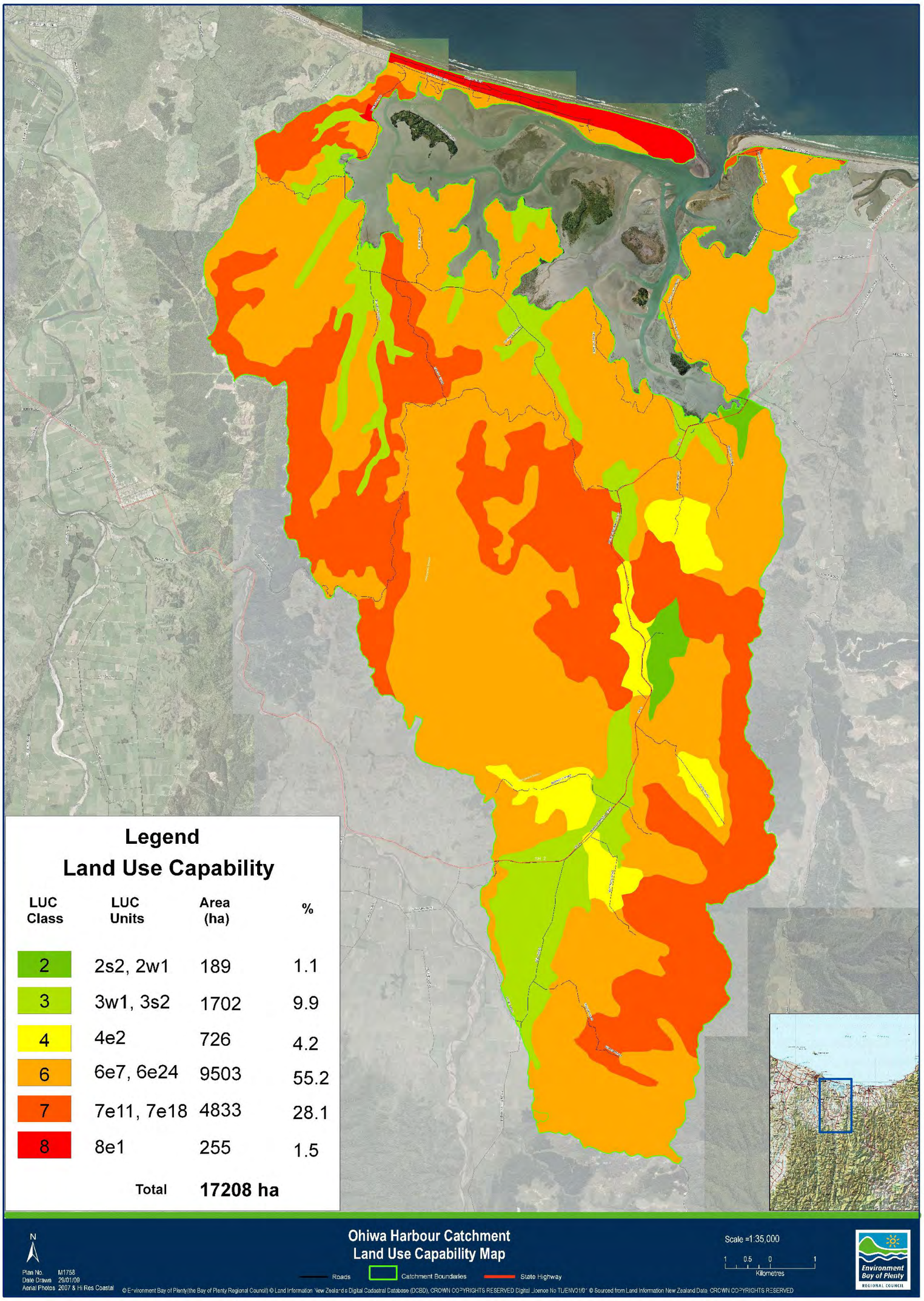
In general terms, the alluvial land is found on the fertile floodplains of the Nukuhou River catchment and some of the lower valley systems draining directly into the harbour. The Kaharoa ash land is found on all of the easy to moderately steep hill country. The windblown sand country forms the sand dunes of the Ōhope and Ohiwa Spits. The steep lands are found on the steeper headwater areas, where greywacke rock, and in some areas sandstone, form the base geology.

The following table gives a description of the LUC Class relating to the land management suites.

Table 1 Land use capability assessment

| Land Management Suites | LUC Class | LUC Unit | Area (ha) | Description | Strengths | Limitations | Recommended Land Use |
|---|---|---|---|---|---|---|---|
| Alluvial plains | Class 2 (1.1 %) | 2s2 and 2w1 | 189 | Flat to gently rolling land found on the fertile floodplains of the Nukuhou and Kutarere catchments, and is largely in dairying, with some maize | Natural fertility.<br>Great soils with a high production value, versatility and stock carrying capacity | 2s2 has a summer drought risk, slight wind erosion potential when cultivated<br>2w1 has a slight wetness limitation after drainage<br>Frosts in winter | Dairying, horticulture, maize and other cropping |
| | Class 3 (9.9 %) | 3w1 and 3s1 | 1702 | This land is found on the recent floodplains of the Nukuhou River and other valleys draining directly into the Ohiwa Harbour, and is largely used for dairying and some horticulture | Natural fertility<br>Great soils with a high production value, versatility and stock carrying capacity | 3w1 has a wetness limitation; however this is generally overcome with good drainage systems. Consider compaction in wet conditions.<br>3s1 has a summer drought risk<br>Both have sheet and rill erosion potential under cultivation<br>Frosts in winter | Dairying, horticulture, maize and other cropping<br>With consideration to management of the limitations |
| Rolling hills (to moderately steep country) | Class 4 (4.2 %) | 4e2 | 726 | Is found on the valley floors draining into the Nukuhou River<br>It is used for dairying and beef fattening | Good winter grazing<br>High production potential with consideration to cultivation limitations | 4e2 has the potential for moderate to severe rill and sheet erosion under cultivation | Use for dairy and deep rooting horticulture and cropping on the easier slopes with soil conservation practices<br>Sheep and beef on the steeper slopes.<br>Its production forestry potential is also very high |

| Land Management Suites | LUC Class | LUC Unit | Area (ha) | Description | Strengths | Limitations | Recommended Land Use |
|---|---|---|---|---|---|---|---|
| | Class 6 (55.2%) | 6e7 and 6e24 | 9503 | Includes large areas of good stable hill country where soil erosion can be minimised by good pasture establishment and management<br>This is the manageable hill country found throughout the catchment, and often occurs in association with Class VII land<br>Used for sheep and beef farming, as well as grazing young stock for dairying | Excellent potential for forestry<br>Good production value for sheep and beef when pasture and soil conservation measures applied | Land not suited for cultivation or cropping<br>Potential for moderate to sever sheet and slip erosion<br>Some areas of steep gully heads which are too steep for stock to sustainably graze | Production forestry<br>Sheep and beef farming with soil conservation management |
| Steep hill country | Class 7 (28.1%) | 7e11 and 7e18 | 4833 | This is the steeper hill country and is mostly in indigenous bush and production forestry | High potential for forestry for areas with good access<br>Good indigenous protection value | Land not suited for arable use or pastoral use and has severe limitations or hazards under perennial vegetation<br>Requires special soil conservation management | Indigenous bush conservation<br>Production forestry |
| Dunes | Class 80 (1.5%) | 8e1 | 255 | In the Ohiwa Harbour catchment, the Class 8e1 country is made up of the younger sand dunes on the Ōhope and Ohiwa Spits<br>These areas are still largely in their natural dune vegetation or encroached by urban development | Covered in indigenous dune vegetation with a high biodiversity value<br>Good recreation land use | This land has very severe to extreme limitations or hazards which make it unsuitable for arable, pastoral or production forestry use | Urban development, catchment protection purposes, and recreational use |


Legend
Land Use Capability
LUC Class
LUC Units
Area (ha)
%
2
2s2, 2w1
189
1.1
3
3w1, 3s2
1702
9.9
4
4e2
726
4.2
6
6e7, 6e24
9503
55.2
7
7e11, 7e18
4833
28.1
8
8e1
255
1.5
Total
17208 ha
N
Ohiwa Harbour Catchment
Land Use Capability Map
Scale =1:35,000
1 0.5 0 1
Kilometres
Plan No. M1758
Date Drawn 29/01/09
Aerial Photos 2007 & Hi Res Coastal
Roads
Catchment Boundaries
State Highway
Environment Bay of Plenty
REGIONAL COUNCIL
© Environment Bay of Plenty(the Bay of Plenty Regional Council) © Land Information New Zealand Digital Cadastral Database (DCBD), CROWN COPYRIGHTS RESERVED Digital Licence No TUENV01/01 © Sourced from Land Information New Zealand Data CROWN COPYRIGHTS RESERVED

## 1.5 Soils in Ohiwa Harbour catchment

The soils in the Ohiwa Harbour catchment are predominantly derived from airfall rhyolitic volcanic ash. However, there are also other parent materials and processes which have formed soils in different parts of the catchment. Soils on the floodplains and lower flats are formed from a mixture of colluvium and alluvial rhyolitic ash and greywacke. Soils on the dunes are formed from airfall tephra on windblown sand. The soils of the hills and steep headwater areas are Whakatane hill soils and associated steepland soils, formed from Tarawera ash, Kaharoa ash on Taupo pumice and Whakatane ash over sandstone or greywacke.

### 1.5.1 Steep land soils

Soils of the steep lands are related to the yellow brown pumice soils. The overlying ash cover is relatively thin, and the soils are Tawhia soils where they overlie greywacke and Ngāti Awa soils where they overlie sandstone. Tutaetoko steepland soils have a thin tephra overlying greywacke or sandstone. The ideal land use for these soils is reversion to indigenous forest but plantation forestry can be carried out with appropriate soil conservation guidelines.

### 1.5.2 Soils of the rolling to moderately steep hill country

These soils are classed as yellow brown pumice soils as they are formed from Tarawera ash, Kaharoa ash, Taupo pumice and Whakatane ash. The loamy topsoils have reasonable physical characteristics, being friable with a coarse soil texture. They are droughty in summer and have a low natural nutrient status and relatively weak soil structure. The Whakatane hill soils are well suited to a plantation forestry land use with appropriate sediment control measures.

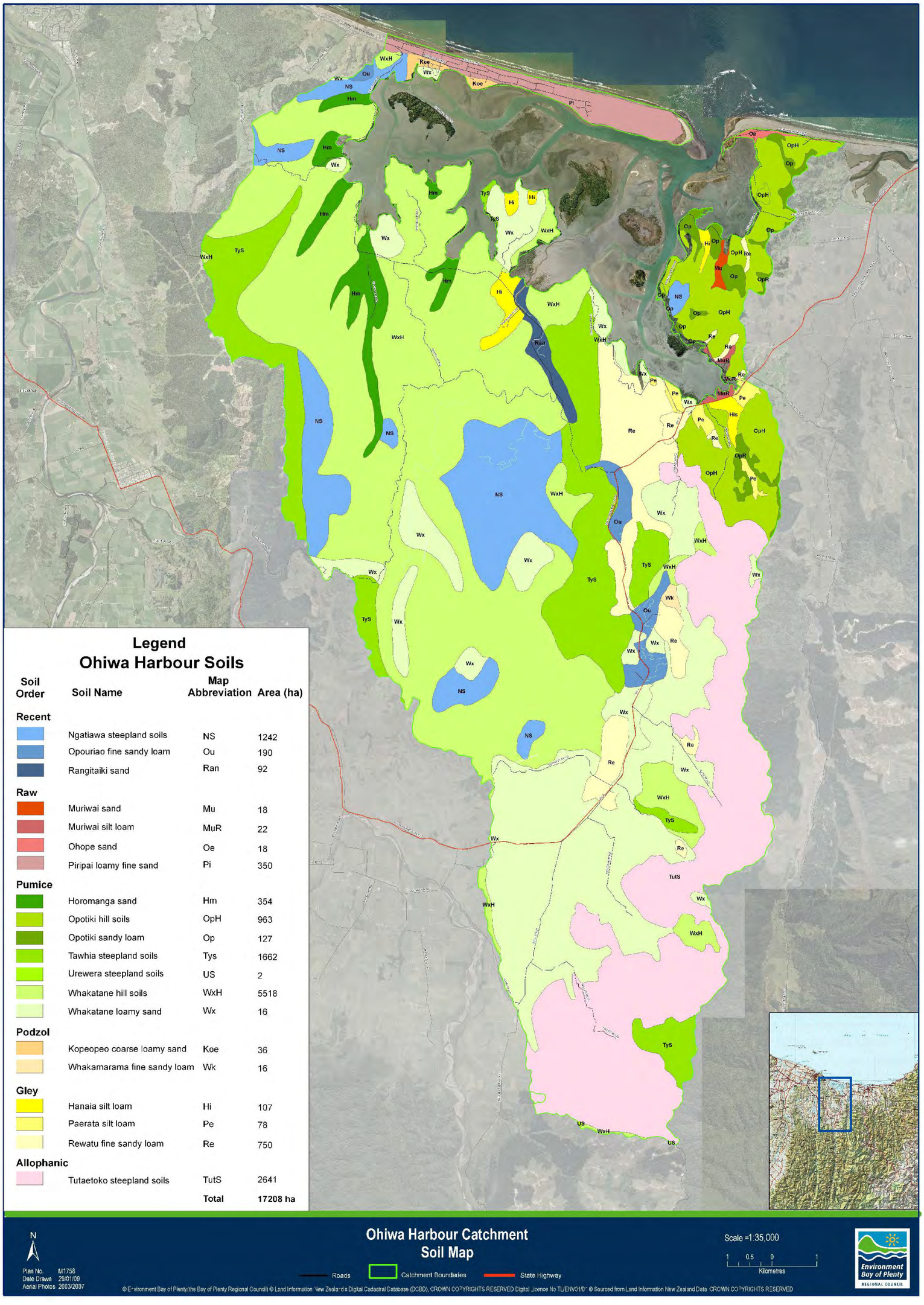
### 1.5.3 Soils of alluvial flood plains

These soils are formed from alluvium which is derived from rhyolitic ash and greywacke. The soils are the Rangitaiki soils and the Opouriao soils. The Rangitaiki soils are found on the more recent floodplains and therefore are often subject to flooding. They have course textures, excessive natural drainage and are used for runoff grazing etc. The Opouriao soils are excellent river flat soils, rarely subject to flooding and well drained. They have a potential for cropping, market gardening, dairy and beef grazing. The current land use on this soil type is mainly dairying.

### 1.5.4 Dune soils

The raw sand of the dunes is formed mainly from the littoral sands drifting along the coastline, and washed, then wind blown to form the dunes systems. The resultant raw soils are identified as Piripai soils, and are mainly formed from thin tephra cover (Tarawera ash and Kaharoa ash) on wind-blown littoral sands. The dunes are coarsely textured, excessively drained, and subject to wind erosion if vegetation is removed. The older dune areas with some soil development have Kopeopeo soils, which are still subject to wind erosion, but are not as well drained as the Piripai soils.

The following map shows the soils in the catchment, with soil order, soil name and area in hectares of each soil.


Legend
Ohiwa Harbour Soils
Soil Order | Soil Name | Map Abbreviation | Area (ha)
Recent
Ngatiawa steepland soils | NS | 1242
Opouriao fine sandy loam | Ou | 190
Rangitaiki sand | Ran | 92
Raw
Muriwai sand | Mu | 18
Muriwai silt loam | MuR | 22
Ohope sand | Oe | 18
Piripai loamy fine sand | Pi | 350
Pumice
Horomanga sand | Hm | 354
Opotiki hill soils | OpH | 963
Opotiki sandy loam | Op | 127
Tawhia steepland soils | Tys | 1662
Urewera steepland soils | US | 2
Whakatane hill soils | WxH | 5518
Whakatane loamy sand | Wx | 16
Podzol
Kopeopeo coarse loamy sand | Koe | 36
Whakamarama fine sandy loam | Wk | 16
Gley
Hanaia silt loam | Hi | 107
Paerata silt loam | Pe | 78
Rewatu fine sandy loam | Re | 750
Allophanic
Tutaetoko steepland soils | TutS | 2641
Total | 17208 ha
N
Plan No. M1758
Date Drawn 29/01/09
Aerial Photos 2003/2007
Ohiwa Harbour Catchment
Soil Map
Roads
Catchment Boundaries
State Highway
Scale =1:35,000
1 0.5 0 1
Kilometres
Environment Bay of Plenty
REGIONAL COUNCIL
© Environment Bay of Plenty(the Bay of Plenty Regional Council) © Land Information New Zealand Digital Cadastral Database (DCBD), CROWN COPYRIGHTS RESERVED Digital Licence No TUENV01/01 © Sourced from Land Information New Zealand Data. CROWN COPYRIGHTS RESERVED

The following table shows a brief summary of the soils in the catchment relating to the Land Management Suites and ultimately the associated LUC units and erosion types.

*Table 2 Soils and associated land uses*

| Land management Area | Soils | | | Current Land Use | Land Use Capability Units | Major Sediment Generation sources | Type of Erosion |
|---|---|---|---|---|---|---|---|
| | Description | Parent Material | Name of dominant Soils | | | | |
| Alluvial plains (11%) | Generally well drained loamy soils. These are the most fertile soils in the catchment; recommended fertilisers are P, K and N. Prone to stream bank erosion | Rhyolite ash and greywacke alluvium | Opouriao fine sandy loam, Rangitaiki sand, Hanaia silt loam, Horomanga sand and Piripai loamy fine sand and Paerata Peaty silt loam | Pasture for dairy stock and horticulture | 3w1, 3s1, 2w1 and 2s2 | Stream bank erosion, stock and access tracks, stock crossings winter and feed pads and cultivation | Sheet, rill and streambank |
| Rolling hills (to moderately steep hill country) (59.4%) | Well drained, friable soils, prone to moderate slip erosion on steeper slopes, recommended fertiliser P, K and Mg | Very thin Tarawera ash and Kaharoa ash on Taupo pumice and older weathered tephra | Whakatane hill soils, Whakatane loamy sand, Ōpōtiki hill and sandy loam soils, Muriwai sand and silt loam | Pasture for sheep and beef grazing, exotic and indigenous forest | 6e7, 6e24 and 4e2 | Erosion on pasture, forestry and farm tracks, stock crossings, stream banks, subdivision earthworks | Sheet, rill and slip |
| Steep hill country (28.1%) | Well drained, shallow soils, friable surface profile, easily eroded, prone to moderate to sever slip and sheet erosion | Very thin Tarawera ash and Kaharoa ash on older weathered tephra | Tawhia soils, Ngāti Awa steepland soils, Tutaetoko steepland soils and Urewera steepland soils. | Indigenous Forest, Exotic planted forest, scrub, pasture for sheep and goats | 7e11 and 7e18 | Erosion on pasture, forestry and farm tracks | Sheet, rill and slip |
| Dunes (<1.5%) | Coastal sands on dunes | Thin Tarawera ash and Kaharoa ash on windblown littoral sands | Piripai soils, Kopeopeo soils, Ōhope sand | Urban. Sand dunes of the Ōhope and Ohiwa spit | 8e1 | Wind blown sand into estuary | Wind |

## 1.6 Land cover and land use within Ohiwa Harbour catchment

The land use information for the Ohiwa Harbour catchment includes the land cover up to 2009 and the associated dominant land uses, and is therefore quite useful for catchment assessment. The combined land use/land cover data for the catchment is set out in the table below.

*Table 3 Land cover with associated land uses in the Ohiwa Harbour catchment*

| Combined land use/land cover data for Ohiwa Harbour Catchment | | | |
|---|---|---|---|
| **Land cover** | **Land Use** | **Area** | |
| | | **(ha)** | **(%)** |
| Pasture | Sheep and beef | 5,426 | 31.5 |
| | Dairy | 2,800 | 16.3 |
| | Deer | 700 | 4.1 |
| | Goats | 400 | 2.3 |
| | Other (lifestyle, horses etc.) | 107 | 0.6 |
| Indigenous forest | | 4311 | 25 |
| Exotic plantation | Pinus radiata, eucalyptus, acacia | 3105 | 18 |
| Urban | | 131 | 0.7 |
| Salt Marsh, dunes and mangroves | | 148 | 0.8 |
| Water | Ponds, open water in wetland/marsh etc. | 53 | 0.3 |
| Horticulture | Kiwifruit, avocado, truffle | 27 | 0.2 |
| **Total** | | **17208 ha** | **100%** |

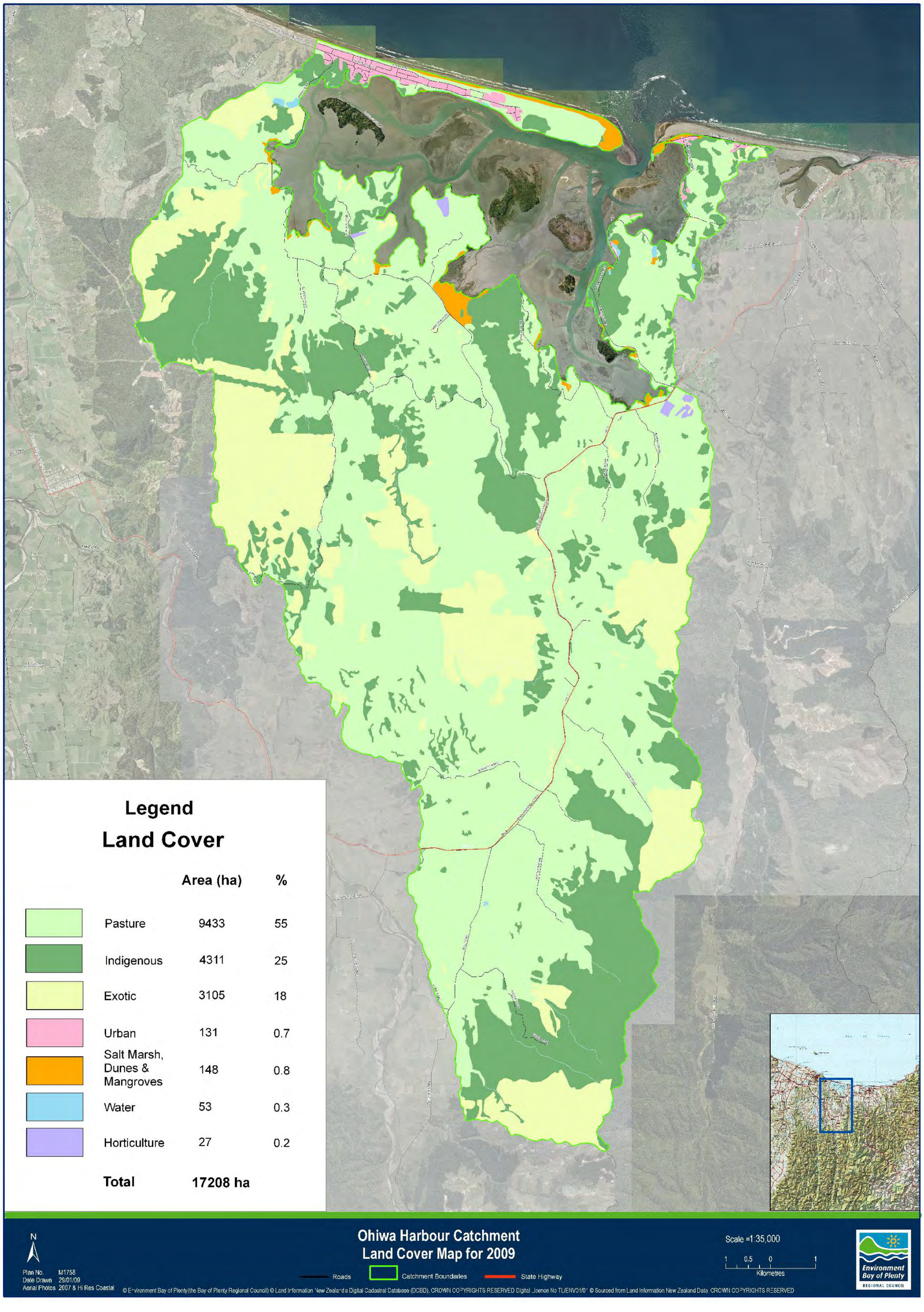
### 1.6.1 Pasture

The Nukuhou River valley has the major area of pastoral land uses; dairying is on the Class 2, 3 and 4 valley floors and sheep and beef on the steeper Class 6 and 7 lands. Goats are generally being grazed on the Class 7 slopes such as at Kererutahi and the steep hills bordering the Waiotahi River catchment.

The remaining areas in dairying pasture are some of the smaller Class 2 and 3 stream valleys (Wainui, Te Kakaha and Waiotane Streams) flowing directly into the harbour.

On the Class 6 and 7 lands the harbour margins and peninsular areas of Paparoa Road, Wainui and Burke Road are mostly grazed by sheep and beef.

The Hiwarau Block between Kutarere and Wainui is an area of Maori owned land which is still largely undeveloped. There are substantial areas of indigenous vegetation on the Hiwarau Block, which are unlikely to be developed because they are on very steep land.


Legend
Land Cover
Area (ha) %
Pasture 9433 55
Indigenous 4311 25
Exotic 3105 18
Urban 131 0.7
Salt Marsh, Dunes & Mangroves 148 0.8
Water 53 0.3
Horticulture 27 0.2
Total 17208 ha
N
Plan No. M1758
Date Drawn 29/01/09
Aerial Photos 2007 & Hi Res Coastal
Ohiwa Harbour Catchment
Land Cover Map for 2009
Roads
Catchment Boundaries
State Highway
Scale =1:35,000
1 0.5 0 1
Kilometres
Environment Bay of Plenty
REGIONAL COUNCIL
© Environment Bay of Plenty(the Bay of Plenty Regional Council) © Land Information New Zealand's Digital Cadastral Database (DCBD), CROWN COPYRIGHTS RESERVED Digital Licence No TU/ENV01/0 © Sourced from Land Information New Zealand Data CROWN COPYRIGHTS RESERVED

However around Hiwarau and Kutarere there are also areas of undeveloped Class 3 land suitable for potentially productive pasture blocks.

### 1.6.2 Indigenous vegetation

The area of indigenous vegetation in the total land catchment comprises 26%, of which approximately 5% is in mixed scrub which has a high indigenous component. Most of this is in native forest, although 0.6% of the native vegetation is native duneland scrub, mangroves and grasses, on the Ōhope Spit and marshland around the harbour margins. Generally, the areas of indigenous vegetation are found in reasonably large contiguous areas on the steeper parts of the catchment.

There are also smaller scattered areas of native vegetation throughout the catchment, often on private freehold land. These areas are often on steep stream margins, gullies etc. that have been traditionally too difficult to develop and/or not easily accessible to stock.

Some of the indigenous vegetation on private land has been fenced and protected from grazing under covenant with the QE II Trust, or with the regional council. Some land is also protected as protection areas under conditions of subdivision, with the Whakatane and Ōpōtiki District Councils. The value of this protection from a soil and water perspective is often overlooked and under valued.

### 1.6.3 Plantation forest

Ownership of exotic plantation forest in the catchment has recently changed from large corporate forest owners to individuals. The forest resource is managed by private forest companies or the new owners. For the pine plantations, harvesting will normally occur 25 to 30 years after planting. The eucalyptus is generally scheduled to be harvested 10 to 12 years after planting. Up to the end of 2007 there was a trend toward conversion of harvested exotic forest to pasture. This has slowed a little but large tracts of very steep land are being grassed and grazed; an example is the Kererutahi forest block.

Plantation forests are able to provide beneficial soil and water conservation effects over a long period, compared with other types of land use. However, harvesting and re-establishment operations are capable of producing elevated levels of soil erosion and down stream sedimentation, if they are not properly planned and implemented. The length of rotation, the areas harvested in any one year period, the types of harvesting system, the requirement for roading and tracking, and the re-establishment operations, will all contribute to the overall environmental effects of the plantation forest as a land use.

Much of the plantation forest is on steep Class 7 land, draining into the Ohiwa Harbour over a distance of less than 5 kilometres. This will require careful control over works involving roading and tracking, with earthmoving operations kept to a minimum. Also, most of the steeper country will need to be harvested using aerial hauler systems, rather than ground based harvesting systems. The major forest companies are tending to apply for long term consents (10 years) which means that the forward planning of harvest and re-establishment operations is able to be undertaken in reasonable detail. The major forest companies are also operating Environmental Management Systems (EMS's) which detail how environmental effects will be addressed.

### 1.6.4 Urban and lifestyle development

The increasing pressure for lifestyle blocks is resulting in more pastoral areas being subdivided, particularly around the harbour margins and Stanley/McCoy Road areas. There is less pressure on the more established pastoral areas in the Nukuhou River valley. As a result of the lifestyle subdivisions, there is an increasingly wider range of land uses including woodlots, small orchards, eco-tourism, farm-stays, etc. In general, this subdivision is concentrated on the Class 6 pastoral areas that have not been areas of high production. At the same time, many small areas of indigenous bush or harbour margin have been protected in conjunction with the subdivision process.

However, the pastoral areas with a harbour outlook are under increasing pressure for subdivision into lifestyle blocks. There have been a number of subdivisions into smaller lifestyle blocks over the last 10 to 15 years. It is likely that this trend will continue.

The pressure for urban subdivision, particularly on the Ōhope Spit, has been increasing over the last two decades. An application for a subdivision with canal access to the harbour was recently withdrawn following objections from a number of parties, including a joint objection from iwi. The concerns relating to urban subdivision include: erosion of dune areas, inundation of low-lying land from rising sea levels and storm surge, loss of natural character, effects on harbour water quality, and provision of adequate services.

## 1.7 Streams and rivers

The following table identifies stock exclusion status of the major streams and rivers in the Ohiwa Harbour catchment. Refer to the map attached which shows the lengths of stream and river which have stock exclusion and stock access.

*Table 4 Protection status of major rivers and streams in the catchment.*

| Waterway Name | Total length of stream (km) | Length of stream in which stock are excluded (km) | Length of stream in which stock have access (km) | Percentage of stream or river protected |
|---|---|---|---|---|
| Arawhatawhata Stream | 6.1 | 1.7 | 4.4 | 28 |
| Awaraputuna Stream | 2.4 | 1.4 | 1 | 58 |
| Horowera Stream | 6.9 | 1.8 | 5.1 | 26 |
| Kotare Stream | 4.7 | 0.8 | 3.9 | 17 |
| Kutarere Stream | 5 | 2.5 | 2.5 | 50 |
| Matahaka River | 7.6 | 3.6 | 4 | 47 |
| Nukuhou River | 25.3 | 23.2 | 2.1 | 92 |
| Ouaki Creek | 1 | 1 | 0 | 100 |
| Taramaiere Stream | 6 | 2.3 | 3.7 | 38 |
| Te Awawairoa Stream | 1.8 | 0 | 1.8 | 0 |
| Te Kakaha Stream | 2.6 | 1.5 | 1.1 | 58 |
| Te Rereoterangi Stream | 9.1 | 1.3 | 7.8 | 14 |

| Waterway Name | Total length of stream (km) | Length of stream in which stock are excluded (km) | Length of stream in which stock have access (km) | Percentage of stream or river protected |
|---|---|---|---|---|
| Waingarara Stream | 16.4 | 16.4 | 0 | 100 |
| Wainui Stream | 10 | 9.8 | 0.2 | 98 |
| Waionepu Stream | 5.4 | 4 | 1.4 | 74 |
| Waiotane Stream | 6 | 5.1 | 0.9 | 85 |
| Werakihi Stream | 5.8 | 4.3 | 1.5 | 74 |
| Unnamed Tributaries | 53.2 | 45.5 | 7.7 | 86 |
| **Total** | **175.5 km** | **126.2 km** | **49.3 km** | **72 %** |

The approximate total length of major streams and rivers in this catchment is 175.5 km. Of this 126.2 km is stock free, which includes both the headwaters which are generally forest covered (indigenous and exotic) and fenced riparian margins through farmed country. Of these major streams and rivers 49.3 km is still to be fenced to exclude stock.

Other sources of sediment and faecal material entering the streams and rivers not identified on the map is stock and access crossings through the waterways, stock tracks running alongside streams and stock standing pads (dairy sheds, winter pads, feed pads etc.) located near streams or rivers.

For the Nukuhou River and Matahaka River, Japanese walnut and large spreading species of willow are both an issue for these rivers due to debris damming and interference with fencing of these two waterways.

### 1.7.1 Ohiwa Harbour margin

Stock are excluded from 94% of the harbour margins. However there is still 2,800 m (5%) of harbour margin which needs to be fenced to exclude stock, predominantly around Kutarere. The status of stock exclusion in waterways of Ohiwa Harbour map attached shows the stock exclusion zones around the Ohiwa Harbour margin.

## 1.8 Erosion risk

Erosion Risk can be determined by the land use activities which coincide with Class 6 and 7 LUC classes - which have higher associated erosion risks.

The erosion risk map attached shows areas of high risk slip and sheet erosion and medium risk slip and sheet erosion within the Ohiwa Harbour catchment. This is based on the pasture covered and production forest covered LUC Classes 7 and 6. The pastoral areas are extremely vulnerable to slip and sheet erosion during high intensity rainfall events. The plantation forested areas are prone to erosion events during harvesting, and continue to be vulnerable for up to five years following.

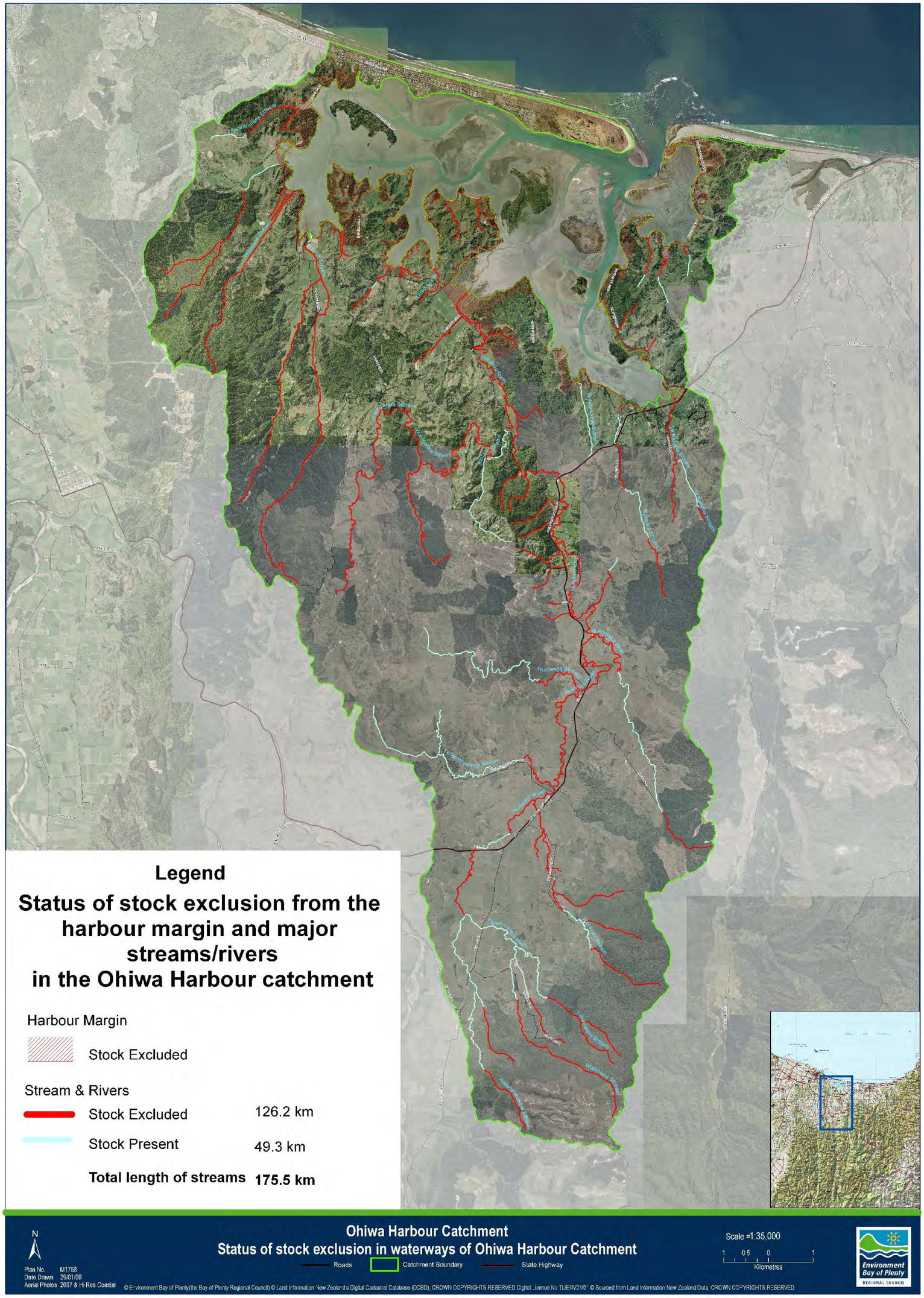

Legend
Status of stock exclusion from the harbour margin and major streams/rivers in the Ohiwa Harbour catchment
Harbour Margin
Stock Excluded
Stream & Rivers
Stock Excluded 126.2 km
Stock Present 49.3 km
Total length of streams 175.5 km
Ohiwa Harbour Catchment
Status of stock exclusion in waterways of Ohiwa Harbour Catchment
Roads
Catchment Boundary
State Highway
Scale =1:35,000
1 0.5 0 1
Kilometres
N
Plan No. M1758
Date Drawn 29/01/09
Aerial Photos 2007 & Hi Res Coastal
© Environment Bay of Plenty(the Bay of Plenty Regional Council) © Land Information New Zealand a Digital Cadastral Database (DCBD), CROWN COPYRIGHTS RESERVED Digital Licence No TUENV01/07 © Sourced from Land Information New Zealand Data CROWN COPYRIGHTS RESERVED
Environment Bay of Plenty
REGIONAL COUNCIL

*Table 5 Erosion risk and area in hectares for pasture and forestry land uses.*

| Land use | Erosion risk | LUC Class | Area (ha) | Erosion type | Recommended land use |
|---|---|---|---|---|---|
| Pasture | High | 7 | 1243 | Very high risk of slip, sheet and rill erosion under a pasture regime | Forestry, retirement, spaced conservation planting if maintained in pasture |
| | Medium | 6 | 5716 | Medium risk of slip, sheet and rill erosion under a pasture regime | Forestry, pasture if managed with lighter stock types, grazing to maintain suitable vegetation cover and spaced tree plantings |
| Forestry | High | 7 | 1604 | High risk of slip, sheet and rill erosion during and immediately after harvest operation | Forestry |
| | Medium | 6 | 1412 | Medium risk of slip, sheet and rill erosion during and immediately after harvest operation | Forestry |

## 1.9 Erosion types of land uses in the catchment

### 1.9.1 Pastoral land

Sedimentation often results from erosion which may be directly or indirectly associated with a pastoral land use. Surface erosion problems, slip, sheet and rill erosion, are common in ash soils in this catchment.

**Sheet erosion** occurs when thin layers of soil are washed down slope in a dispersed pattern, generally over a widespread area of a hill slope. Bare ground or intensively grazed pasture on steep slopes is susceptible to sheet erosion. Sheet erosion becomes more pronounced when rainfall intensity increases or where filtration of rainfall is reduced through soil compaction. In the Ohiwa Harbour, the Class 6 and 7 slopes are particularly susceptible to sheet erosion.

*Figure 6 – Sheet and rill erosion on cultivated pasture*

Also paddocks recently cultivated on Class 3 and 4 are prone to sheet erosion occurring if rain events occur while the bare soil is exposed.

Where sheet erosion is occurring on farmed pasture land, there is a gradual loss of fertile topsoil as it is washed down the slope into drains and streams. This is concerning as the production value for pasture farming of sheet eroded land is reduced and the resultant sediment is ending up in the waterways.

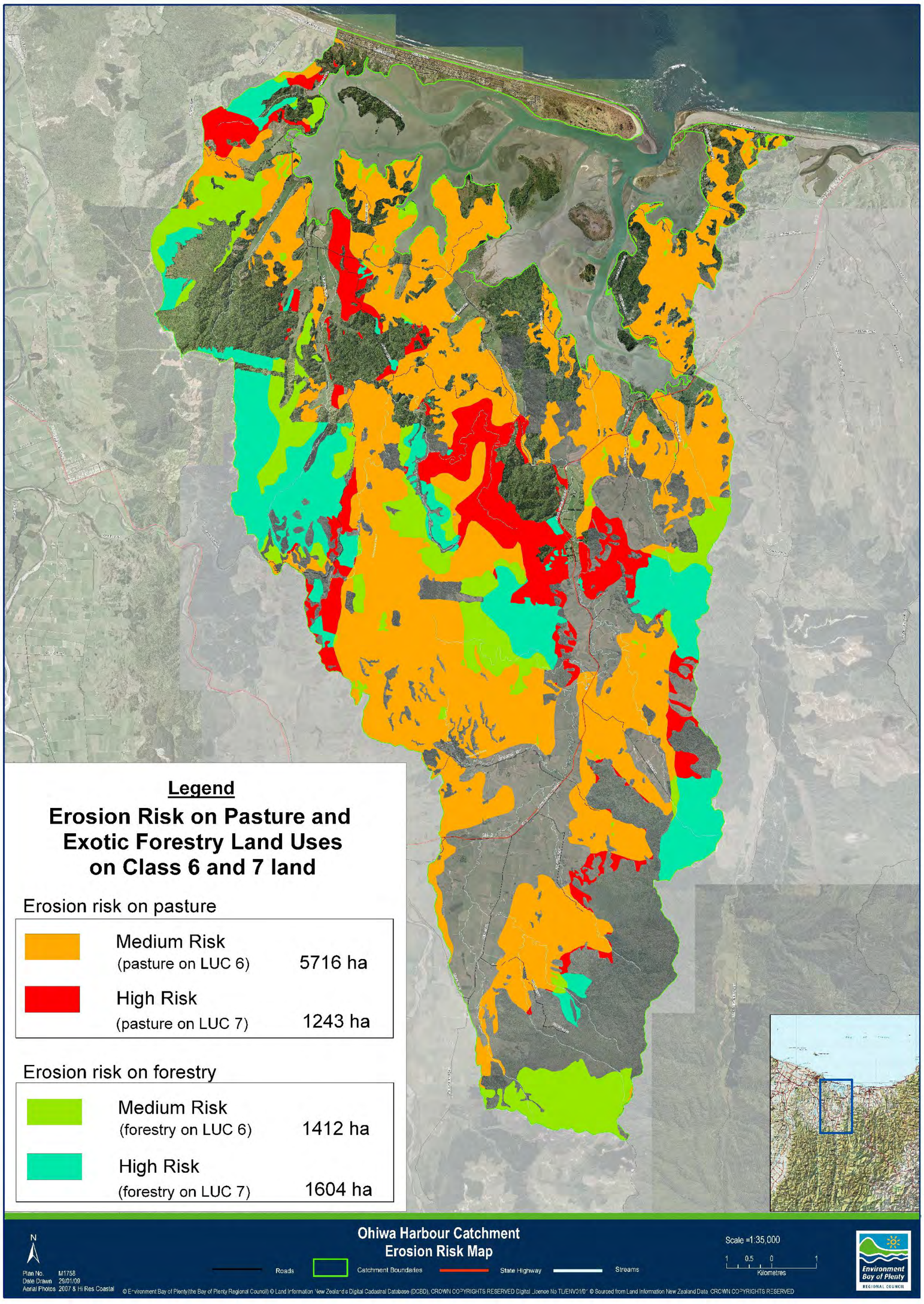

Legend
Erosion Risk on Pasture and Exotic Forestry Land Uses on Class 6 and 7 land
Erosion risk on pasture
Medium Risk (pasture on LUC 6) 5716 ha
High Risk (pasture on LUC 7) 1243 ha
Erosion risk on forestry
Medium Risk (forestry on LUC 6) 1412 ha
High Risk (forestry on LUC 7) 1604 ha
N
Plan No. M1758
Date Drawn 29/01/09
Aerial Photos 2007 & Hi Res Coastal
Ohiwa Harbour Catchment
Erosion Risk Map
Roads
Catchment Boundaries
State Highway
Streams
Scale =1:35,000
1 0.5 0 1
Kilometres
Environment Bay of Plenty
REGIONAL COUNCIL
© Environment Bay of Plenty(the Bay of Plenty Regional Council) © Land Information New Zealand's Digital Cadastral Database (DCBD), CROWN COPYRIGHTS RESERVED Digital Licence No TL/ENV01/01 © Sourced from Land Information New Zealand Data. CROWN COPYRIGHTS RESERVED

*Figure 6 – Debris flowing into the Ohiwa Harbour from slip erosion*

**Slip erosion** is the mass movement of soil generally occurring in heavy rainfall events, when the soils become saturated and when cohesion at subsurface layers fails the soil above slips. The occurrence on slip erosion is greatly increased on steep slopes and sheet eroded slopes. Steep gully heads in this catchment can often slip, as shown in the introduction photo.

*Figure 7 – Rill erosion on recently cultivated pasture.*

**Rill erosion** occurs when overland flow begins to concentrate in small channels and has a down cutting action. Sediment washed out of rills accumulates on pasture and finds its way into streams. Rill erosion often damages cultivated paddocks with exposed soils, earthwork sites and farm tracks. Rill and sheet erosion often occur together, starting off as sheet and then advancing to rill as the water down cuts channels into the open soil. The image left shows rill erosion on a recently cultivated paddock.

These erosion forms are easily exacerbated by stock pressure. Furthermore, bare ground does not readily revegetate when stock continue to graze the exposed area.

*Figure 8 – Stream bank erosion on the Nukuhou*

**Streambank erosion (left)** – there has been a loss of riparian margin vegetation in the catchment on farmed pastoral areas. This is a loss of habitat to in-stream biodiversity and the stabilising and filtering benefit vegetation has for streambanks. Generally increased streambank erosion occurs during flood events.

The result of increased hydraulic pressures on riparian margins lacking stabilising vegetation and debris dams altering stream flows towards exposed banks, scours away streambank soils depositing them in the waterways.

Stock access to streambanks removes stabilising vegetation and damages the banks as stock track along the banks, exposing bare soil. In particular heavy stock such as dairy, beef and deer are more of a problem for tracking/hoof damage; sheep cause very little tracking damage, if any.

The changes in land cover over the decades has altered the runoff patterns, which can affect stream flows, and result in streambank erosion as channels adjust to the changing hydraulic regimes. Loss of the native vegetation to pastoral development has long term effects on soil and water conservation values. These effects are aggravated as increasing stock numbers consolidate the ground surface and continue to affect runoff patterns.

Often, pastoral farming on wetter areas requires drainage, and/or flood protection. The construction of drains and stopbanks may increase rates of sedimentation, as more efficient drainage systems can increase the scour potential of the floodwater. Drain cleaning operations, particularly during low flow conditions, can result in suspended sediment being carried downstream.

### 1.9.2 Plantation forest land use

Over the last 20-25 years, plantation forestry had increased to the point where 19% of the total land catchment was in plantation forest. This figure has now slightly dropped to 17%. Generally the exotic forest areas are in the steeper Class 7 steep hill country. The majority of the area is planted in *Pinus radiata*, however, there are large stands of short rotation eucalyptus species. The forests are privately owned and managed by individuals or forestry consultants.

Plantation forests do have the potential to adversely affect water quality. Most of the adverse effects are associated with increased levels of sedimentation from earthworks. There are also adverse soil and water conservation effects associated with loss of native vegetation, and changes to water quantity. However, these effects are less pronounced than for pastoral farming, because a forestry land use is able to attenuate flood flows more than pastoral farming. Water quantity effects of plantation forestry relate to the short term effects of individual forestry operations, particularly harvesting, and also to the long term effects of the forest throughout the entire rotation. Shorter rotation species, such as eucalyptus, will have different effects from pines.

Forestry operations require earthworks for roads, tracks and landings. As much of the forestry is on the steeper hill country, there is a higher risk of sedimentation from the earthworks operations. Much of the plantation forest areas are harvested using aerial hauler systems, which tends to reduce the amount of roading required. In addition, most of the existing roading network is permanent, and only requires regular maintenance to control potential effects regarding soil and water conservation.

Fletcher Challenge Forest Ltd has undertaken research on the effects on water clarity and temperature in the Wainui Stream catchment. Results to date show marginal increases in water temperature below pine forest compared with native forest, but much less than pasture. Water clarity is less in pine forest compared to native forest, but not as low as in pastoral areas. Survey sites have also been established for stream habitat and in-stream macro invertebrate communities within native forest, pine forest and pasture. As the research continues over time, results should become more conclusive.

There are areas of native vegetation within the plantation forests. Some of these are quite substantial, and tend to be located in critical headwater areas and streamside areas.

### 1.9.3 Indigenous forest cover

Even though indigenous forest cover is seen as a sustainable land use for the Class 6 and 7 land in the catchment, it is still prone to erosion. Slip erosion does occur in indigenous forest though this is a natural process. However the impact is less as re-vegetation of the slip site is rapid and the slip debris are trapped by the forest floor vegetation.

However, feral animals (goat, deer, and pigs) and domestic stock access provides source of damage and therefore some sediment influx.

### 1.9.4 Urban development and lifestyle subdivision

While there has been considerable urban development of the Ōhope spit, sediment generation has been negligible due to the use of well designed earthworks and sediment control.

The demand for lifestyle subdivision is high, especially around the harbour margin areas, or where there is an outlook to the harbour. The sediment generation through earthworks activities can be high through poor practices and/or unsuitable erosion control mitigation methods.

### 1.9.5 Bacteria from effluent

Direct stock access to waterways when crossing or grazing the streambank margins is the first and obvious contribution of faecal material entering streams and rivers. However, indirect sources and runoff flow paths have a major contribution as follows:

- Runoff from paddocks, especially where there are ephemeral flow paths leading to the stream.
- Stock raceway-leads into streams or along side streams; raceways are impermeable flow-paths with high concentrations of effluent.
- Feeding pads and winter stand off pads near streams, these are concentration points with stock, any drainage from these sites will have high levels of effluent
- Effluent irrigators can lead to excess effluent building up in soils if left in paddocks for to long, this is easily leached to subsurface flows or overland runoff during rain events.
- Dairy sheds, woolsheds, stockyards near streams, are obviously high concentration areas for effluent

### 1.9.6 Nutrients

The nutrients nitrogen and phosphorus are of particular problem as they feed nuisance plants and algae growth in waterways. Phosphorus will often be bound to soil particles, and thus enter the stream and waters through sedimentation. The source of nitrogen entering waterways is mainly from fertilisers.

Application of fertiliser onto farmland can result in some losses to groundwater and streams. Applying fertiliser when soil moisture is too high can lead to greatest losses of excess nutrients to waterways. This in turn, increases the nutrient loading on natural waterways. Increased nutrients, particularly during the warmer seasons, can increase algal blooms within the streams and harbour waters, depleting oxygen within the water, and lowering the water quality. Fish especially are affected by the lack of oxygen in water.

### 1.9.7 Water quality monitoring

Bacteria and nutrients will reduce downstream water quality and are often combined with sediment. Within the Nukuhou River catchment Environment Bay of Plenty is currently monitoring water quality along five sites on this river, from the headwaters down to the river mouth. The sites have been sampled once a month and the samples were analysed for temperature, suspended solids, turbidity, pH, and bacteria (E. coli and faecal coliforms).

Results at times have been below the minimum bathing standard for the Nukuhou River, meaning that there is a potential health risk for swimmers in this river.

As the water quality monitoring continues a more robust analysis of the data can be established.

## 1.10 Catchment management recommendations

### 1.10.1 Indigenous forest protection

Much of the indigenous land that it is located on in the Ohiwa catchment is erosion prone LUC Class 6 and 7 land (4311 ha).

This has suitable long term vegetation/land cover but more should be protected if possible to the title by a covenant.

The protection of existing indigenous forest will assist erosion control by providing an excellent root mass to stabilise soils. The tree cover also intercepts rainfall and dissipates raindrop energy. It follows that every effort should be made to promote its protection.

A work focus will be on encouraging landowners to protect these areas using Environment Bay of Plenty's biodiversity programme to ensure pest animal control of goats, possums, mustelids and rats occurs.

### 1.10.2 Exotic forestry

The promotion of production forestry on marginal pasture land is essential to reduce sediment yields into the waterways which eventually drain into the Ohiwa Harbour. High risk areas are as identified by the erosion associated with LUC Class 7 pasture land use.

Some of the methods that can be used to promote continued exotic forestry are:

- The Afforestation Grant Scheme is an option for landowners with LUC Class 6 and 7 lands that they want to convert to forestry. Properties accepted into this scheme will have a percentage of the cost associated with the purchase, planting and releasing of the exotic or indigenous seedling. More information is on the Environment Bay of Plenty website under the land section (www.envbop.govt.nz)

- Providing detailed LUC and soil mapping information to individual landowners through farm planning.

- Forest versus pasture farming cost benefit analysis.

However consideration is needed of the high risks associated with sediment generation from forestry harvest, establishment (tracking and earthworks), and road and skid site construction. Education of forestry operators and contractors is essential. If tracks are well established, as in correctly placed and constructed with appropriate water controls then they should be easily maintained through many harvest cycles. Education and advice regarding the harvest and roading operation, needs to go hand in hand when promoting afforestation on farms.

The setting of conditions through the consent process for implementing the practices needed to mitigate erosion on individual harvest operations, site preparation for tracking and skid sties needs to continue. With the Forestry Operator Accreditation System in place, the promotion of forest operators to get accredited is essential. This will work alongside the Environmental Management Systems forest companies already have in place.

### 1.10.3 Waterway riparian protection

There is approximately 128.5 km of major waterways in this catchment, of which 47.3 km is still in need of riparian protection fencing to exclude stock. This reduces direct entry of sediment to the stream from stock activity.

Culverts and bridges are essential for streams with a high occurrence of stock crossings. Any stock raceways leading up to crossing points should have bunding (humps in the raceway) so that runoff flow is diverted to pasture areas first, or sediment/bacteria traps before entering the stream. This is important for both filtering sediment and effluent runoff entering the waterways from stock raceways.

### 1.10.4 Sediment from streambank erosion

Water and land plan regulations require that stock are to be fenced out of waterways and water bodies in the Ohiwa Harbour catchment. This will only be effective for runoff filtration if fences are well located and effective riparian buffer is established. However, to reduce sedimentation faecal material entering waterways a stock proof fence will benefit greatly. The Clean Streams Accord Regional Action Plan also requires dairy farmers to meet the Accords targets for fencing streams.

Riparian management through catchment protection and forested catchments have less peak runoff events, reducing water energy impacting on streambanks.

Behind protection fencing - planting of riparian vegetation; grasses, native trees and shrub willows can be used for streambank stabilisation. Root mass of vegetation holds soils in place.

Removal of ‘debris dams causing trees’ (in particular Japanese walnut and willow) in the Nukuhou and Matahaka Rivers is also important.

### 1.10.5 On-farm sediment identification

Soil slip, sheet and rill erosion are potential and occurring causes of sediment entering waterways in the catchment on pasture farms. Where the potential for soil slip can occur, sites should be retired, have spaced tree planting or planted in forestry trees. Erosion prone sites as identified on the erosion risk map need to be targeted for spaced tree planting, maintaining vegetation cover and use of suitable stock types.

Tracks, stock raceways, small quarries, feed pads, crossings, fords, yards bare areas are all examples of on farm areas which generate sediment. The light ash and nature of the soils in this catchment enable the sediment to be easily transported into waterways during heavy rain. Mitigation methods to enable the interception of sediment are essential and achievable:

- Soil conservation practices put in place such as spaced tree planting.
- Farm stock and access tracks should have suitable water control cut-offs to allow the water energy to dissipate evenly.
- Use of wetlands as sediment, nutrient and bacteria traps.
- Retire gullies and slopes which have already slip eroded.
- Land cultivation should be set back from the edge of rivers and streams is essential.
- Sediment traps are essential in runoff flow paths from quarries, feed pads, raceways leading to stream crossings, winter standoff yards. This can include diversion of runoff to pastoral areas which can filter the runoff. Where the runoff is heading should be in mind for construction of new tracks, feed pads etc.

### 1.10.6 Farm planning to reduce sediment yields

It is important that sustainable farming information is supplied to pastoral farmers, especially information such as the effects of sheet erosion on steep pastoral land resulting in losses in production.

Farm plans should be developed to encompass all aspects of farm management which have a sediment input to the system. This can allow the landowner, manager or workers to identify and manage issues on the property.

The maps provided with this document show detail at a 1:35,000 scale. At farm scale, maps can be produced to help with more detailed identification of land use areas on individually owned properties usually at scales of 1:10,000 or less.

Visual soil assessments (VSA) – provide VSA packs for farmers to carry out there own assessments of soils on there properties.

There is a need for ongoing sustainable land use advice through field visits, community workshops and access to information on the internet (e.g. maps and soil information for the region).

### 1.10.7 Subdivision and land development

Continue support of enforcement of sediment control on subdivision sites through the monitoring of consent process. As mentioned above, education around tracking on these sites is important.

Education is needed to be provided for contouring works, especially for smaller on farm works where consents are not needed.

### 1.10.8 **Recommendations for the next five years**

The following are the key recommendations for implementation over the next five years for reducing sediment, nutrients and bacteria effects on the Ohiwa Harbour:

- Promote the change in land use to forest type vegetation of all LUC Class 7 land in the Ohiwa Harbour catchment sites as per the erosion risk map.
- Continue fencing stock from the remaining 47.3 km of major waterways in this catchment.
- Continue streambank stabilising works (Japanese walnut removal, revegetation and stabilising works) for the major streams, particularly the Nukuhou River and Matahaka River.
- All stock crossings through streams must be altered to culverts or bridges.
- Promotion spaced soil conservation planting on LUC Class 6 pasture land.
- Promote the maintenance of suitable pasture cover, fertiliser regimes, and suitable stock types on farmed LUC Class 6 land.
- Continue to protect and retire indigenous forest, particularly focused on sites with high ecological values.
- Forestry operation education for large operations and on farm operations. Education needs to go hand in hand with any afforestation promotion.
- Forestry consents are applied correctly and monitored. Promote the use of Forestry Operators Accreditation System (FOAS).
- Implement and promote farm planning and sustainable land use education, where necessary.

# Part 2: Ohiwa Harbour Mangrove Management Plan

## 2.1 Introduction

### 2.1.1 Background

The increasing distribution of mangroves in the Ohiwa Harbour has given rise to concern from a number of individuals and groups who live near to, or have an interest in, the harbour. This concern was expressed by submitters during the development of the Ohiwa Harbour Strategy and was followed by further concern expressed by the Ōpōtiki District Council. It is well known that there are also others in the harbour community who share these concerns.

The Ohiwa Harbour is unusual that 80% of its bed is exposed at low tide. The substrate of a large part of this intertidal zone is mud and silt. Much of this area is potentially mangrove habitat and it is possible that mangroves may eventually spread to utilise this potential habitat. It is the perception of some in the community that this process is occurring at an increasing rate. It is also widely recognised that this spread is largely a result, directly or indirectly, or human activities in and around the harbour and that there is therefore a responsibility on the community to mitigate the effect of those activities.

The community concerns can be broadly categorised as follows:

That mangroves-

- increase the deposition of mud;
- affect recreational activities;
- affect shellfish beds and fish breeding;
- interfere with natural drainage into and through the harbour;
- change the ecological balance of the harbour; and
- interfere with access to the harbour.

The removal of mangroves is not a permitted activity under the operative Environment Bay of Plenty Coastal Environment Plan. Current requirements under this plan for any management of mangroves are that a discretionary activity consent must be obtained in accordance with rule 57:

*14.2.4(j)* *Removal, damage, modification or destruction of indigenous vegetation that is growing in the foreshore or seabed, is a discretionary activity.*

The regional policy has to follow national policy. Mangroves are specifically mentioned in the National Coastal Policy Statement as a national priority for the preservation of the natural character of the coastal environment:

*Policy 1.1.2(c)* *Protecting ecosystems which are unique to the coastal environment and vulnerable to modification, including estuaries, coastal wetlands, mangroves and dunes and their margins.*

There are also many in the local community who believe that mangroves have some ecological value, though little research has been conducted to confirm these values to date.

This management plan is a response to these community concerns and the difficulties facing those who would like to see some action taken. It provides some technical background to mangroves and their habitat, attempts to assess the extent of community concern, discusses control options and provides some guidance through resource consent options.

### 2.1.2 Ohiwa Harbour Strategy

The Ohiwa Harbour Strategy was launched by Environment Bay of Plenty who invited the public and interested organisations to participate in its development. The resulting Strategy was signed by Environment Bay of Plenty, Ōpōtiki District Council and Whakatane District Council. While the Strategy does not contain any rules, it does refer to plans which may have rules for how things occur in and around the harbour.

The issues around mangroves were summarised in the Strategy as one of the community concerns about the health of the estuary (chapter 7.1) and described thus:

Sedimentation contributing to the spread of mangroves, affecting access to recreation areas and threatening seafood resources.

The Strategy goes on to suggest the following actions:

*7.3.6 Management of Mangroves*

*Monitor mangrove distribution, research historical trends, the cause of mangrove spread in Ohiwa Harbour and the impact of mangrove growth on wildlife, cultural, hydrological and recreational values. Management plans will be supported.*

*The management of mangroves within the harbour needs to recognise where problems for wildlife, cultural, hydrological or recreational activities are occurring so that actions can be taken. Mapping and monitoring of the harbour and research from other harbours will allow the identification of sustainable mangrove management practices.*

*The implementation of mangrove control may be a role for community groups to undertake through the Estuary Care programme. Estuary care takes a wider view than just mangrove management as it includes pest control, wildlife monitoring, recreational access and sedimentation control.*

There were 19 submissions from the public to the draft Strategy in which the issue of mangroves were raised.

### 2.1.3 Consultation with the community

As part of the preparation of this plan as many as possible of those who submitted to the draft Ohiwa Strategy were contacted, as were members of the existing estuary care groups and representatives of Upokorehe, Ngāti Awa, the Department of Conservation and Forest and Bird. They were asked for their views on the effects of, and the need for the management of, mangroves. More specifically, they were asked to identify particular problem areas, the reasons for their views and their views as to how these problem areas may be dealt with. A summary of their comments is given in Appendix 1. The information gathered will also be used to inform any future resource consent process.

## 2.2 Mangroves – The background

### 2.2.1 The history of mangroves in the Ohiwa Harbour

The New Zealand mangrove *(Avicennia marina),* or Manawa, is native to New Zealand. We have only one species of mangrove and it is not considered threatened. It is believed to have arrived here relatively recently, some time before 14,000 years ago, probably from Australia where it is also native. In the far north, mangroves will grow to a height of 15m whereas in the Ohiwa Harbour they only grow to the size of small shrubs, Ohiwa being at the southern limit of their distribution. Cold winter conditions currently prevent their spread southwards and limit their height.

It is not known how long mangroves have been present in the Ohiwa Harbour. We do know however, from aerial photographs, that they were present in only small numbers in 1945, covering an area of about 20.6 canopy ha, principally in the vicinity of Motuotu Island with a few small pockets around the Nukuhou estuary. By 2003, mangroves covered an area of about 90.8 canopy ha. There is no reliable information for the period in between. Anecdotal evidence suggests that the spread of mangroves seems to have accelerated over the last two decades.

The scientific reserve of Pataua Island was established to protect a small population of mangroves present around its margins at the southern limit of mangroves.

## 2.3 Ecology of mangroves

Mangroves only inhabit the zone between mean sea level and high tide. They have a number of special adaptations that allow them to flourish in an environment too harsh for most plants. The mangrove's roots spread a considerable distance from the tree and produce large numbers of upright aerial roots resembling asparagus shoots. These are pneumatophores, or breathing roots, which allow the root system to obtain oxygen which is largely absent in the mud in which it grows. These roots also trap more mud around the parent tree, allowing the eventual seaward expansion of land which can then be colonised by other terrestrial plants. The fruit capsule is also unusual as it develops into an embryo plant with a well developed root before falling from the parent plant. The plantlet is able to float on the tide for a considerable time until it is deposited on the mud by the outgoing tide. At this point it is able to immediately anchor itself with its root before the incoming tide can wash it away.

Tropical mangrove forests contain numerous mangrove species and their decaying leaves support a rich biodiversity in otherwise nutrient poor tropical water. In New Zealand there is only the one species and less is known about the biodiversity mangroves support here, though the knowledge gaps are slowly being filled. Mangroves here do contribute to habitat diversity and they do have an ecological function. Fish species diversity in mangroves appears less than in some other estuarine habitats though there are several species that do use mangrove channels, such as mullet and smelt. The decomposing leaves of mangroves recycle nutrients which become available for small organisms which in turn become food for animals such as crabs, snails and worms. They also provide anchorage for mussels and oysters (NIWA, 2003). It is known that marsh birds such as banded rail and spotless crake use mangroves for foraging. Research is currently underway in the Ohiwa Harbour to determine the nature and extent of this. Preliminary results suggest that banded rail make extensive use of mangroves which seem to support significant populations of them. They will only venture short distances from the cover of mangroves or other saltmarsh vegetation.

The ecological function of mangroves is quite different from that of adjacent sandflats which have a higher proportion of shellfish but less worms. Sandflats also support seagrass beds which are well known to be ecologically rich environments. Anecdotal evidence suggests that wading birds frequent the sandflats more than the mangroves, presumably because of the greater food source there. The resulting absence of wading birds from the upper reaches of the Ohiwa estuary is of concern to some in the community. The sandflats are similarly more valued generally by humans as a source of kaimoana and for other recreational and aesthetic reasons.

It is not easy to compare the competing "worth" and value of these differing habitats. It appears that sandflat habitat has a richer biodiversity than mangrove habitat. There is evidence that the mangrove habitat is expanding at the expense of sandflat habitat.

### 2.3.1 The causes of mangrove spread

The spread of mangroves is largely a symptom of increased runoff from the estuary catchment. Estuaries naturally trap and fill with sediments and mangroves naturally spread in estuaries where climatic factors are favourable. Increased soil erosion in deforested catchments modified for human use, often coupled with inadequate sediment controls, has increased the sediment flow into estuaries. Sandflats become smothered with the resulting mud and mangroves spread rapidly, expanding from the headwaters and sides of the estuary. Mangroves, with their extensive root systems and pneumatophores help trap further silt. Eventually, the areas now being colonised by mangroves may turn into swamp or dry land. The infilling of estuaries such as Ohiwa by silt and the gradual change from an intertidal environment to freshwater swamp and eventually land is a completely natural process over geological time. The problem is an acceleration of what are otherwise natural processes (NIWA, 2003) and it is a feature of most estuaries in the northern part of the North Island.

An increased nutrient loading from fertiliser use, stock effluent and septic tank effluent in many of the waterways that feed estuaries may also be contributing to the increased vigour of mangroves. Slight increases in temperature due to climate change may also be allowing mangroves to thrive better an otherwise marginal environment.

There is evidence that sedimentation rates in some estuaries have increased by a factor of 10 since human occupation. Managing mangroves will not reduce sediment erosion in catchments and until this is controlled, estuarine ecosystems will continue to degrade (NIWA, 2003).

The removal of mangroves may allow some accumulated mud to disperse more freely but mud will still tend to accumulate in sheltered parts of the estuary. Their removal may in fact allow mud which they would otherwise consolidate to be distributed more widely around the estuary.

The removal of mangroves will not solve the problem of increased deposition of mud and any removal should be accompanied by reducing the sediment load entering the harbour by modifying land use practices in the catchment that cause the release of sediments. The Ohiwa Catchment Land Use Study has been carried out to address this.

It must also be remembered however that infilling of the harbour is also occurring as a result of sand deposition in the lower reaches of the harbour from the sea.

Due to the lack of accurate data until recently, it is difficult to quantify the increases in sediment deposition in the harbour and even more difficult to assess the part played in this process by mangroves. A picture of the trends should begin to emerge as systematic sediment mapping and measurement was begun in 2002 by Environment Bay of Plenty. Anecdotal evidence certainly suggests that many channels and mudflats are becoming shallower, although there is also evidence that sediment input from the catchment is now reasonably stable (Park, 2005).

Park (2005) also suggests that many of the harbour's natural mechanisms preventing sediment inputs have been lost. The freshwater wetlands that used to exist in most of the valleys leading to the harbour have been drained and used for agriculture. It is estimated that in 1840 there were 557 ha compared to only 64 ha of wetland in 1992. This loss continues.

Since the main reason for the increasing spread of mangroves is almost certainly the increase in sediment and nutrients emanating from the harbour catchment it is important to also read the Ohiwa Harbour Catchment Land Use Study in conjunction with this plan.

### 2.3.2 Other impacts on sedimentation in the harbour

It is also worth noting that there are other, less obvious, changes happening to the ecology of the estuary. Large areas of the estuary margin are being colonised by the introduced sea couch (*Elytrigia pycnantha*) which in some places is smothering the naturally occurring saltmarsh communities. In recent years the introduced saltwater paspalum (*Paspalum vaginatum*) has begun to colonise some areas of the higher intertidal zone leading to consolidation of sediments and the accretion of the estuary margin (Shaw and Allen 2003). Human induced changes in the distribution of fish, animals and birds may also be having impacts. Past grazing practices and current human traffic and activities in the intertidal zone may also be inducing incremental changes to this environment.

### 2.3.3 The impact of mangroves on recreational values

The harbour is highly valued by many residents and visitors for its recreational opportunities. The harbour is used actively by people fishing, gathering shellfish, swimming and boating. Consultation with members of the community has shown a concern that some of these activities are being impacted on by the spread of mangroves. Similarly, access to the harbour has been made difficult in many cases by the presence of mangroves.

The harbour is also used passively by people "enjoying the view" either from their homes as residents or from the harbour margins as walkers, drivers etc. There is some community feeling that extensive areas of mangroves interfere with people's appreciation of the harbour. Some people have said that their enjoyment is also diminished by the retreat of wading birds further out into the harbour as the mangroves advance. The unpleasant smell of the anaerobic mud amongst mangroves is another issue for some.

### 2.3.4 The impact of mangroves on iwi values

Iwi groups have expressed concerns that the escalating coverage of mangroves within the harbour has compromised the value of the harbour to them and affected their ability to utilise the estuarine environment for traditional practices. In particular a significant reduction in the range of fish, shellfish and bird species has been identified, some of which have been replaced by other less desirable exotic species. This has in part been attributed to the degraded habitat caused by the increased silt

build up around the harbour margins and the growth in mangroves. As a consequence, they have experienced some loss of traditions associated with the collection of kaimoana.

Further, traditional papakainga sites on the harbour margins have become less desirable due to degraded drainage and the smell that is a result of mud accumulation around the harbour margins. Anecdotal evidence suggests that many of these sites were, until recently, comparatively sandy and better drained.

It is also worth noting however that in many places the stems of mature mangroves have been colonized by pacific oysters which have become a valuable source of kaimoana to many local residents.

### 2.3.5 The impact of mangroves on hydrological values

It is not yet clear to what extent mangroves and/or sediment build up have impacted upon the hydrology of the harbour. There is some public concern that mangroves have grown so close to channels that they are beginning to interfere with water flow through them, causing water to back up and exacerbate flooding during periods of heavy rain. There is also concern that many channels are becoming increasingly difficult to navigate as they become shallower.

On the other hand, there are places on the harbour margins where mangroves may be helping to buffer the shoreline from wave action, thus reducing shoreline erosion in those situations. However this effect may be limited as mangroves are unable to establish in places where there is too much disturbance from waves.

## 2.4 Managing mangrove spread – the process

### 2.4.1 Resource consents - the need for a resource consent

It has been identified that mangrove removal from Ohiwa Harbour will require Resource Consent from Environment Bay of Plenty.

A Coastal Permit is required under section 12(1) of the Resource Management Act 1991 together with Resource Consent from Environment Bay of Plenty under Rule 14.2.4 of the Bay of Plenty Regional Coastal Environment Plan before any interventionist management of mangroves can occur. Resource consents/coastal permits are issued by Environment Bay of Plenty and the application process necessitates notifying affected parties such as the Department of Conservation.

Consents may be required to carry out activities such as:

- Disturbing the foreshore and seabed of the harbour
- Deposit mangrove material on the foreshore and seabed
- Remove indigenous vegetation from the foreshore and seabed
- Discharge contaminants to the air from the burning of mangroves

Exactly which permits are required will depend on the extent of mangrove removal that is being proposed. For example, if the proposal was to remove seedlings and outlying plants only, to contain mangroves to their current distribution, then the only permit required may be to remove indigenous vegetation. If the proposal was to remove significant stands of mature mangroves then several of the above permits may be required.

### 2.4.2 The application for a resource consent

Anybody is allowed to make application for a resource consent. However, Environment Bay of Plenty is unlikely to grant consents for mangrove management to individuals and it has been Environment Bay of Plenty practice to date to provide assistance to a recognised group as follows:

- a Care Group already registered with Environment Bay of Plenty;
- a group of interested individuals who can then become a registered Care Group. The process in becoming such a group is a reasonably simple process;
- an already recognised group, such as a hapū or incorporated society etc, who may then easily become a Care Group.

For ease of management and to avoid duplication of effort, it is also desirable that a single consent be gained by a single group for work to be carried out throughout the harbour. To meet the expectations of groups and individuals around the harbour, some consultation and co-operation will be necessary by the group who apply for the consent.

Once such a group is formed, Environment Bay of Plenty Land Management staff will work closely with the group to prepare the resource consent application. Application costs and fees for the consent application will be covered by Environment Bay of Plenty. Once the consent is granted Environment Bay of Plenty Land Management staff will provide technical support and work with the group to plan operations and to ensure that the conditions of the consent are met.

There are several existing Care Groups operating in or around the harbour, neither of which is willing to hold the consent for this proposal. It is understood that this is not because of any opposition to the proposal in principle, rather these groups have a focus on protecting avifauna and their habitats or other values and do not wish for this role to be expanded.

It will therefore be necessary for an existing community group to make the application, or for a new group to be formed to do so.

While the evolution of a number of community groups around the harbour, each with their particular environmental interests, is inevitable, it is suggested that all such groups collaborate where appropriate and possible in order to ensure the overall wellbeing of the harbour ecology into the future.

### 2.4.3 Resource consent conditions

Any consent granted will have some conditions attached. These may cover, but may not be limited to, such matters as the following:

- The area of mangroves to be removed in any one year which will need to be less than 4ha in total
- The need to carry out work at times of the year when breeding birds are not disturbed
- The need to protect saltmarsh
- The manner in which debris is dealt with
- The need to protect the shoreline from erosion

- The need to managed access points to avoid excessive damage to the harbour margins
- The type of equipment that can be used
- The “authorisation” of the people involved in the work
- The clear identification of the areas where removal is to take place
- Monitoring requirements which may involve such matters as bird surveys and sediment measurements.

### 2.4.4 Consultation

The granting of a consent will require extensive consultation to take place prior to the application being made. The consultation carried out already (appendix 1) will form the basis of this requirement.

### 2.4.5 The Ohiwa Community

The Ohiwa Community has been consulted on this proposal.

Further consultation will be necessary as planning work proceeds.

### 2.4.6 The Department of Conservation

The department will have to give formal approval. It is concerned with ensuring that the ecosystem services provided by existing mature mangroves are maintained. It has indicated a neutral position with respect to developing mangrove populations and the removal of seedlings and outlying plants.

However substantial populations of mangroves are to be found in DOC reserves such as Pataua Island Scientific reserve and the Motuotu nature Reserve. An application for the removal of indigenous plants in these situations would need to be granted under the Reserves Act 1977. Indeed Pataua Island was specifically reserved to protect what was then a small population of mangroves at their southernmost limit.

It is therefore suggested that, for the time being, the resource consent application process should not be complicated by requiring additional authorisation for work on reserves managed by DOC.

### 2.4.7 The territorial authorities

For most of the harbour, mangroves are located on the harbour bed under the management of the Department of Conservation and Environment Bay of Plenty. In a few instances mangroves are growing on reserve land owned by a Territorial Authority, either the Ōpōtiki or Whakatane District Council. In these cases the written approval of the TA will be required. Both TA’s are parties to the OHSIG and have stated their support for the proposal to proceed.

### 2.4.8 Iwi

Ngāti Awa Iwi, Upokorehe hapū through Whakatōhea Iwi and Tūhoe Iwi collaboratively hold mana whenua and mana moana over the harbour and have a kaitiaki role . These Iwi will also need to provide formal approval. Both Upokorehe and Ngāti Awa have already been approached and have indicated their desire to see mangroves managed. Upokorehe, and through them, Whakatōhea, have indicated a strong desire to be actively involved in the management process and

this initiative has already been widely discussed at hapū hui and resource management committee level.

### 2.4.9 The position of Environment Bay of Plenty

Environment Bay of Plenty has had considerable experience over the last five years of working with community groups managing mangroves in the Tauranga harbour. The precedents set there will largely need to be followed by those undertaking similar work in the Ohiwa harbour. As far as the consent is concerned, Environment Bay of Plenty have, to date, accepted that well prepared applications meet the purpose of the Resource Management Act and consents have been granted.

Environment Bay of Plenty Land Management staff will be able to provide considerable assistance with:

- the application for the consent,
- managing removal work carried out,
- reporting on it,
- monitoring the consent conditions.

Environment Bay of Plenty Land Resources section will pay the consent application costs and annual compliance costs associated with it.

It should be noted that the abovementioned assistance from Environment Bay of Plenty can only be provided to a group which becomes a care group registered with Environment Bay of Plenty.

## 2.5 Mangrove management implementation

### 2.5.1 Forming a Care Group

Environment Bay of Plenty's Care Group programme was set up to facilitate community groups carrying out the care, protection, enhancement of and advocacy for the natural environment in or close to their communities. Two groups around the Ohiwa harbour, the Nukuhou Saltmarsh Care Group and the Ohiwa Reserves Care Group carry out a range of activities aimed at protecting various aspects of parts of the harbour, particularly focused on the protection of birds and their habitat. Other groups are also involved with pest control. Such groups are also able to aim to manage mangroves it they wish.

Care groups are registered with Environment Bay of Plenty and there are simple guidelines for their constitution and operation. Depending on the nature and scope of the proposed initiatives they can be eligible for technical support, training and financial assistance with other resources such as materials and services. An already constituted community group could also become a care group.

While neither of the existing care groups have indicated any interest in becoming directly involved in mangrove management, individual members may wish to contribute. Establishment of another care group focused on mangrove removal could be a possibility. But Environment Bay of Plenty would prefer to see such a group also taking an interest in other aspects of the harbour environment, as mangroves are a part of the wider harbour ecosystem. Mangroves should not be seen in isolation from either it or indeed the Ohiwa catchment which provides the sediment and nutrients on which the mangroves thrive.

It is therefore desirable that any care groups around the harbour maintain close working relationships with each other. There may be skills and expertise which can be shared between the various groups with the common goal of enhancing the harbour environment overall.

It is important to bear in mind that the process of removing mangroves involves considerable time and effort, so any group formed for this purpose needs to have a large enough group of fit people to carry out the work.

### 2.5.2 Which mangroves to remove?

People and groups who have been consulted during the development of this plan have a wide range of ideas about which areas of mangroves should be managed and for what reasons. Drawing lines on maps and prioritising areas for management is not within the scope of this document. Neither is it any one agency's role to decide this. Such decisions will have to be made by any group(s) constituted with the task of mangrove management as their objective. Environment Bay of Plenty staff will be able to help facilitate the development of any such group and assist in the planning of management operations by way of the provision of maps and technical advice etc. Such planning should begin identify areas of mangroves that have significant values and should not be removed and identify areas that the community may wish to manage in some way. A rationale for any such management will need to be clearly identified. This information will need to form part of any consent application.

### 2.5.3 Methods for removing mangroves

Compared with other locations further north in New Zealand the mangrove plants in the Ohiwa Harbour are relatively small in height (most are below 1200mm) and sparse in their distribution. Outside of the densest populations at Nukuhou marshland margins; Pataua and Motuotu Islands, distribution is scattered, discrete and restricted to the harbour margins.

It is anticipated that the majority of mangrove removal will be undertaken by the use of hand held equipment.

Removal of mangroves by hand pulling has proven to be a successful means of control where infestations are of only moderate density and where the plants up to a maximum height of approximately 500 mm high.

For larger plants, up to 1200mm high, lopping off at ground level using a pair of garden loppers or handsaw has proved effective.

This method can be effectively achieved by moderately fit community volunteers; it does not require high degree of skill and costs very little.

The impact on the environment would be minimal amounting to:

- 'Footprints in the mud'.
- Occasional and intermittent noise from the use of a scrub bar.
- The vegetative debris – the cut off or extracted mangrove plants. In many cases it is possible that this material be left where it lies to decompose. The small volume of material is not anticipated to have any more negative effect than the vegetative debris that already occurs naturally and would decompose quite quickly. However the removal or burning of the material may be required

as one of the conditions of the resource consent. Burning of the material would require an additional consent to discharge contaminants to the air.

- Tracking from accessing the work areas. Access to the harbour will need to be managed so that tracking is kept to a minimum and new tracks are not formed in areas where indigenous habitat might be damaged. This is also a matter which is likely to be subject to conditions in the resource consent.

### 2.5.4 Costs

The following approximate annual costs are based on the assumption that a group from the community will be set up to manage mangroves in the harbour and that that group will provide voluntary labour to carry out the work. An estuary care group would be provided with some funding for operational work in line with that currently provided to estuary care groups in the Tauranga harbour and as budgetary considerations allow.

Estimates as to the density and size of mangroves at some locations has been initiated (refer Appendix 2). However, no consideration has been yet given to quantifying how much mangrove removal can be accomplished within a set time frame – this would be influenced by the density, and size of the mangroves and the removal method used.

| Item | Resources Provided By Community Group | Resources Provided By Environment Bay Of Plenty For Estuary Care Group Operations |
|---|---|---|
| **Consent application** | Volunteer time | Staff time<br>Application costs |
| **Labour to carry out mangrove removal** | Volunteer time | |
| **Hand tools (saws, lopper etc)** | | $400 |
| **Safety equipment (gloves etc)** | | $100 |
| **Scrub bar hire (4 working bees/year x 2 scrub bars) + fuel** | | $900 |
| **Morning tea etc for working bees** | | $400 |
| **Monitoring of working bees** | | Staff time |
| **Public notification/advertising of working bees** | | $800 |
| **Compliance with resource consent conditions** | | Staff time or contractors |
| **Resource consent monitoring requirements** | | Staff time or contractors |
| **Work planning, notification, management and annual reporting** | Volunteer time | Staff time |
| **Incidental and admin costs** | | $100 |
| **Total costs** | | $2700 |

## 2.6 Summary of recommended approach to the management of mangroves

**Step 1**

Concerned members of the community need to form a group (or there may be a pre-existing group) which can become an Estuary Care group registered with Environment Bay of Plenty.

**Step 2**

The group will need to agree on the level and location of management/removal it wishes to see in consultation with the local community and affected parties and develop a plan to support this.

**Step 3**

The group will need to apply for a resource consent from Environment Bay of Plenty to remove mangroves using hand held tools. It is recommended that a single consent be applied for, covering the whole harbour.

**Step 4**

Once the resource consent has been issued the group will need to carefully plan and manage the removal work in a way that complies with the conditions of the resource consent.

Environment Bay of Plenty staff will be able to offer considerable assistance with each of these steps.

**The need for further education and awareness**

Given the widespread lack of understanding of the dynamics of the harbour and the links between mangrove spread and sedimentation from the wider catchment , it is also recommended that some effort be made to raise the level of understanding in the community. This work should begin as soon as possible and could be incorporated into the wider context of understanding and caring for the harbour.

# Appendices

# Appendix 1 – Consultation with community and users: A summary

Upokorehe resource management committee 26 November and 3 December 2008.

The following points were made in regard to mangroves:

- Most importantly the threat to shellfish beds.
- The spread of seedlings rather than mature plants.
- People are already pulling them out and will do anyway, law or no law.
- They may be native but are not native to Ohiwa Harbour.
- Loss of crabs and thereby flounder.
- Mangroves choking channels and increasing flooding.
- Change in bird populations e.g. loss of stilts.

The focus of this group is on mangroves, though there is increasing awareness that sedimentation is exacerbating their spread. The group is also concerned about the more general health and wellbeing of the harbour. As well as removing seedlings, some desire was expressed to remove larger stands of mature plants in some places, particularly around channels and areas with cultural significance.

**Hapū Meeting Saturday, 6 December 2008**

The hapū members' present expressed encouragement for current direction and support of the work with the resource management committee. Suggested Lance Reha be the primary contact with authority from the committee. Lance is to provide details of the mangrove management that the hapū would like to achieve.

**Ohiwa Residents and Ratepayers Association**

A short presentation was given and feedback requested. People generally felt that mangroves are a problem to some degree and that something should be done about them. Few were prepared to be specific and to say where or how. A few expressed the view that any control of mangroves should take into account the positive ecological values of mangroves.

**Submitters to the Draft Ohiwa Strategy**

There were 19 submitters to the draft Ohiwa Strategy who referred in some way to mangroves. Most of these were contacted by phone.

Many explained that they had seen a rapid increase in mangroves in the last 20 years or so and were fearful that their children may not be able to enjoy the harbour in the same way they have done. Those who explained their wish for some level of mangrove control gave the following reasons:

- Mangroves are affecting recreational use;
- Mangroves affect wading birds;
- Mangroves reduce breeding and feeding areas for flounder, snapper and other fish;
- Mangroves clog drains and channels thus increasing sedimentation;
- Mangroves prevent access;

- Mangroves are smelly, unsightly and mosquito infested; and
- Mangroves should be removed from culturally significant areas.

A few were aware that the cause of the problem is largely the increased deposition of silt from the catchment and they expressed a desire to see more work, such as riparian planting, done to mitigate these effects.

As for the management of the mangroves themselves, the consensus of opinion was that total removal is not necessarily desirable and certainly not practical but that their further spread should be controlled by the removal of seedlings and outlying plants. Many felt it would be desirable to clear plants from around channels and access points. Suggestions for how this could be achieved included the use of volunteers, schools, Department of Corrections and work schemes. Many expressed a willingness to participate in any work programme. It was generally felt that Environment Bay of Plenty should cover any costs associated with mangrove removal as it is considered to be for the wider public benefit.

A number of respondents felt that they should be allowed to freely remove mangroves from in front of their properties to allow them access to the harbour.

Several submitters gave some detailed and reasoned arguments for specific sites where mangroves should be controlled.

There were also two submitters (including Department of Conservation) who pointed out that mangrove habitat supports endangered marshbirds and other aquatic life.

**Care Group Members**

Members of the Ohiwa Reserves and Nukuhou Saltmarsh care groups were invited to comment on proposals to manage mangroves.

The respondents suggested that:

- Sedimentation, natural and man made is the cause of mangrove spread,
- More work needs to be done to minimise sediment runoff in the catchment with regional and local councils providing incentives and assistance,
- Stopping the siltation and spread of mangroves are likely to be unrealistic goals.

**Other points raised were that:**

- Ecosystems naturally change and evolve and this is occurring in the harbour,
- Mangroves reduce the aesthetic and recreational values of the harbour and may decrease property values,
- Mangroves are reducing the habitat for wading birds,
- Mangroves are causing a reduction in habitat for shellfish,
- Initial mangrove control should be aimed at containment,
- Overall responsibility should lie with Environment Bay of Plenty
- Costs should be covered by Environment Bay of Plenty
- Landowners should be allowed to control mangroves adjacent to their land.

**Ngāti Awa**

Beverley Hughes expressed a desire to see some control of seedling and isolated mangroves, particularly in culturally significant areas, which are seen as affecting wildlife and traditional food gathering practices in the harbour. She also expressed a willingness to work with Upokorehe to that end. Iwi representatives will also define the areas they wish to see mangroves removed from.

**Department of Conservation**

Fiona Hennessy and Chris Staite suggested that Department of Conservation would have few issues with the removal of seedling mangroves. The removal of seedlings is of little significance as it's the environmental services provided by mature stands which are important. Removal would need to avoid areas managed by the Department of Conservation, as well as erodible coast and saltmarsh margins. There would also have to be very good reasons to remove mangroves from CHPZ's (eg the Nukuhou estuary). The department is happy to wok alongside other groups and organisations to facilitate strategic mangrove management in the harbour.

**Forest and Bird**

Linda Conning suggested that Forest and Bird would not necessarily be opposed to the removal of small plants and the clearing of access as long as there were good reasons. It is important to also focus on the sedimentation issues in the catchment. Proposals would need to be based on good science. Bird feeding areas, seagrass and shellfish beds should be identified and monitored as part of any removal programme.

# Appendix 2 – Assessment of existing mangroves

The proposal to control the spread of mangroves in the Ohiwa Harbour requires some initial assessment of the current extent of the mangrove infestation. The effectiveness of any control measures is influenced by how big the problem is; that is how many and how big are the plants in the areas to be targeted. A close examination of any mangrove infestation suggests that the numbers and size of plants may be greater than suggested by a cursory glance.

A survey of selected sites has been begun as follows:

| Location | Length Of Harbour Margin | Estimated Total Number Of Mangroves | Percentage Less Than 500mm |
|---|---|---|---|
| **328 Ohiwa Harbour Rd** | 120m | 180 | 50% |
| **95 Ohiwa Loop Rd** | 580m | 175,000 | 80% |

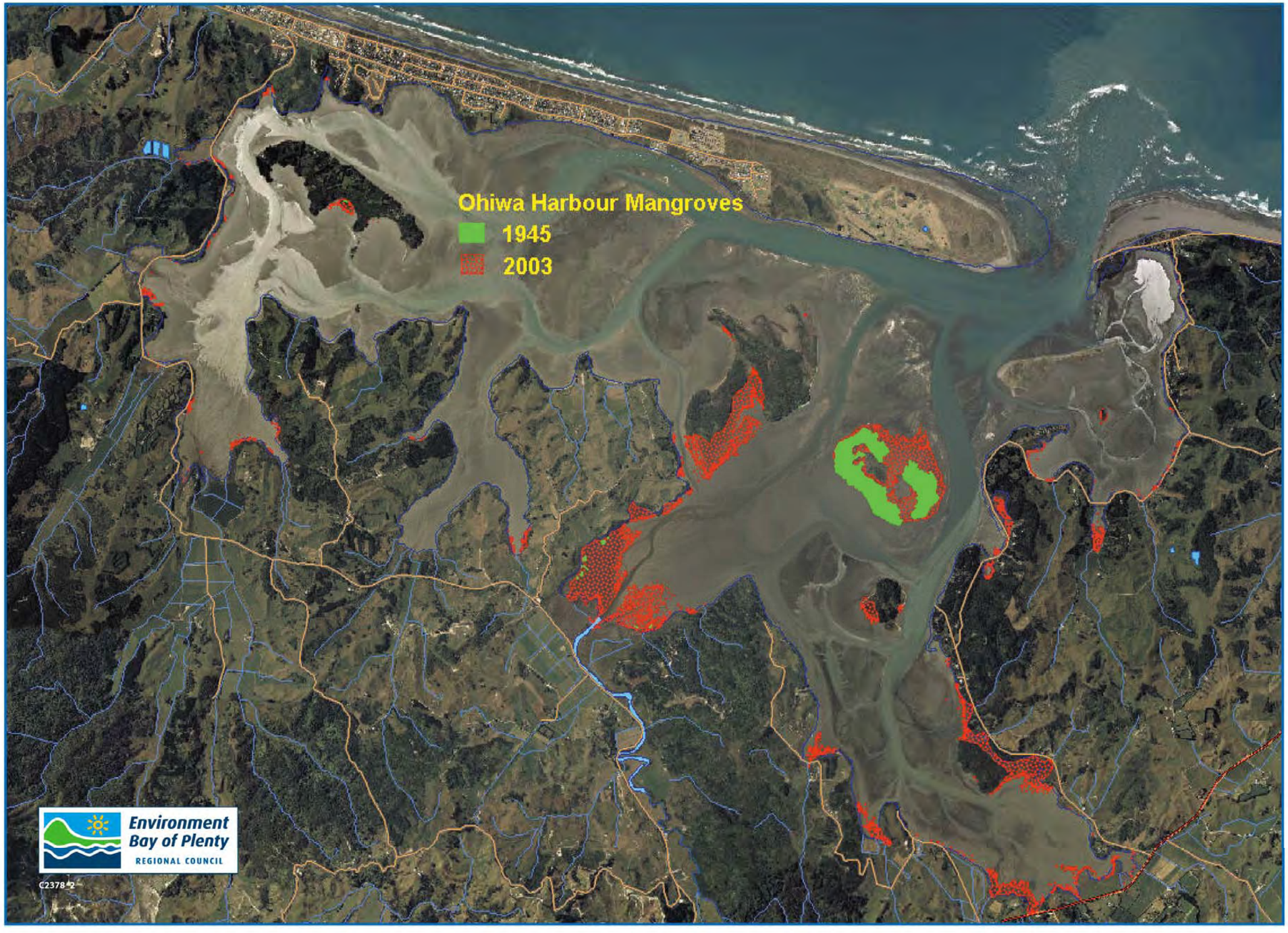
It is recommended that a survey along these lines is conducted before any concrete proposals for removal are developed to accurately assess the extent of the mangroves and the work entailed in removing them.

# Appendix 3 – Map showing approximate extent of mangroves in 1945 and 2003

Insert map

**Map showing approximate extent of mangroves in 1945 and 2003**

**Appendix 3**



# Appendix 4 – Map showing detailed extent of mangroves in 2007

Insert map

## Map showing detailed extent of mangroves in 2007

**Appendix 4**