Environment Waikato Internal Series 2007/15

Whangamata Mangrove Management Options Report

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Environment Waikato
REGIONAL COUNCIL

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1 Introduction

1.1 Developing an integrated harbour plan

Since 2005, Environment Waikato has been working with the community and a wide range of academic, professional and government organisations to develop a strategy to sustainably manage Whangamata Harbour and its catchment. Information was also gathered from past and present initiatives such as the Whangamata Community Plan, Peninsula Project and Hauraki Iwi Environmental Plan, among others.

The plan's development was initially prompted by discussions on the spread and management of mangroves in Whangamata Harbour. This is a contentious issue and there are many differing opinions as to how (or if) they should be managed. In response to this a community meeting was held in November 2005. Those attending the meeting agreed that mangrove issues and the overall health of the harbour must be looked at in a holistic, integrated way. They requested that Environment Waikato prepare an integrated management plan for Whangamata Harbour.

Three key documents have been developed through this process.

- **The Draft Whangamata Harbour Plan 2007**[1]
  This plan sets out the **strategic context** for managing Whangamata Harbour and its catchment. The harbour plan notes that:
  - reducing the amount of sediment from the catchment entering the harbour is a priority issue in Whangamata
  - the problem of sedimentation infilling the harbour has developed over decades from soil erosion caused by land clearance for urban and agricultural use (including farming and forestry) and from stream bank erosion
  - increased sedimentation has contributed to the expansion of mangroves in the harbour because mangroves grow in mud.
- **The Draft Whangamata Catchment Management Plan 2007**[2]
  As a supporting document to the harbour plan, the catchment plan sets out the priority works we propose to carry out to address the sedimentation and flooding issues identified in the harbour plan, the timeframe over which the works will be done and estimated costs.
- **The Whangamata Mangrove Management Options Report**
  This report has been provided for discussion with the community on how (or if) mangroves in Whangamata should be managed. See section 1.2 for more information.

Before we can finalise the harbour and catchment plans, confirm the timeframe over which the works identified in the catchment plan will be carried out or decide how mangroves will be managed, we need the Whangamata community to give us feedback on these three documents.

Copies of the full documents, an overview document summarising the harbour and catchment plans and this options report, and a feedback form are available from:

- libraries in Thames, Whangamata, Tairua and Hamilton
- Environment Waikato's offices in Hamilton and Whitianga
- Thames-Coromandel District Council's offices in Thames, Whangamata and Tairua.

[1] Environment Waikato. 2007: *Draft Whangamata Harbour Plan*. Environment Waikato Internal Series 2007/14, Environment Waikato, Hamilton. Available online at www.ew.govt.nz/projects/iwhangamata/index.htm.
[2] Environment Waikato. 2007: *Draft Whangamata Catchment Management Plan*. Environment Waikato Internal Series 2007/13, Environment Waikato, Hamilton. Available online at www.ew.govt.nz/projects/iwhangamata/index.htm.

Alternatively, they can be downloaded from www.ew.govt.nz/projects/whangamata/index.htm or ordered by phoning Environment Waikato's freephone 0800 800 401.

1.2 Mangrove management options report

This report is a supporting document to the draft harbour and catchment plans mentioned above. It summarises information about New Zealand's mangroves (why managing them is complex and what's happening in relation to Whangamata's mangroves), details six scenarios for managing mangroves and outlines the consultation process related to their management. It also provides details on where to find other relevant information on New Zealand's mangroves, including information on what other councils are doing.

The proposed mangrove management scenarios, detailed in **section 6** of this report, range from 'no removal' (status quo) to various levels of removal in relation to past mangrove distribution. The maps provided with this report show the distribution of mangroves surveyed in the harbour in 1944, 1965, 1978, 1993 and 2002.

Feedback from the Whangamata community on the mangrove management scenarios, and the harbour and catchment plans, will help Environment Waikato's council decide on how (or if) Whangamata's mangroves should be managed. Currently, **mangrove seedlings only** can be removed under the conditions of the current resource consent granted to Whangamata Harbour Care Inc. in December 2006 (see section 3.1.1 for consent conditions).

2 About mangroves

Mangroves take root in heavy mud and tolerate being submerged in salt water that would quickly kill other plants. Despite their unforgiving environment, mangrove communities are productive and complex ecosystems. Our only mangrove species (*Avicennia marina* subsp. *Australasica*) has been native to New Zealand for thousands of years,[3] growing along sheltered coastlines and estuaries in the northern part of the North Island and flourishing in warmer areas.

Mangrove communities provide shelter and food for several species of fish and a safe haven for shellfish, insects and rare birds. Mangroves provide a place for plants and animals to live among and grow on. These plants and animals in turn provide a food source to other animals in the estuary. In some areas mangroves can protect and stabilise land and form a buffer zone to absorb floodwaters (for example, protecting shore areas from wave action, erosion and flooding). However in other areas (such as streams and other waterways) they can block drainage and contribute to flooding – this is the case in some parts of Whangamata Harbour.

For a summary of information on Whangamata's mangroves, see section 3 of this report.

2.1 Managing mangroves

Informed decision-making on how (or if) Whangamata's mangroves should be managed needs to take into account all the available information alongside the values people place on mangroves. However, it is a very complex issue.

Before deciding which option is best overall, there are a number of key points that should be considered.

[3] Pocknall, D.T., Gregory, M.R., and Grieg, D.A. 1989: Palynology of core 80/20 and its implications for understanding Holocene sea level changes in the Firth of Thames, New Zealand. *Journal of the Royal Society of New Zealand* 19: 171-179.

- The Waikato Regional Coastal Plan recognises Whangamata Harbour as an area of significant conservation value. It also recognises that estuarine areas around the harbour support a wide variety of plant and animal life, including some rare/threatened and/or migratory species.

- Deciding how to manage mangroves will require a trade-off between what the community wants and what's best for the environment.

- If we don't do anything, except continue to remove seedlings, the mangroves will not spread but they will continue to grow. As they grow, they may impact on other habitats, access to and around the harbour may become increasingly difficult and more views could be blocked. On the other hand, clearing large areas of mangroves may create other problems. For example, disturbed sediment may release previously trapped pollutants or shift to create another problem elsewhere. However, there are important gaps in our knowledge of mangroves and their ecological role. This means:
  - mangrove management should be considered on a case by case basis
  - the outcomes of removing mangroves are uncertain and each case (including a trial period) should be monitored during and after removal to minimise or avoid any harmful effects
  - mangrove management should be reviewed as further monitoring fills these gaps.

- Depending on their location, there are differences in the characteristics and ecological roles of mangroves, for example:
  - where and how quickly they can grow and spread
  - the role they play in local food chains
  - the types and numbers of animals and plants they support
  - how they respond to changing conditions in the estuaries and harbours they live in.

  These differences can also apply to mangrove communities within the same harbour or catchment.

- Mangroves can have positive or negative effects. For example, as mentioned in section 2 above, in some situations they can protect areas against flooding by providing a buffer; in others, they can increase the flood risk by restricting the flow of flood water if they are growing around the outlet of a drain, stream or river.

- People have different values about mangroves. For example, some people think they are an eyesore and restrict the use of the harbour; others think they are a natural part of the changing harbour ecosystem and should be left untouched.

In addition to these key points, the following sections of this report will be helpful in assessing the 'management scenarios' in section 6.

- Section 2.2 – more information on mangroves and their management (including those in Whangamata).
- Section 3.1 – an overview of what's happening in relation to Whangamata's mangroves.
- Section 4 – more information on people's values related to mangroves.
- Section 5 – how the mangrove management scenarios were developed.

2.2 More mangrove information

2.2.1 Mangrove information – Environment Waikato

Environment Waikato has tried to provide as much information as possible about mangroves and the pros and cons of their management through this options report, the full Whangamata Harbour Plan, and information and links in the harbour plan project pages on our website at www.ew.govt.nz/projects/whangamata/index.htm.

Mangrove factsheet

Environment Waikato's mangrove factsheet provides more information about mangroves in New Zealand and the Waikato region. It can be downloaded in PDF format from our website at:

www.ew.govt.nz/enviroinfo/coasts/coastalecosystems/estuaries/index.htm#Heading2

A copy of this factsheet can be ordered by phoning Environment Waikato's freephone 0800 800 401.

2.2.2 NIWA – '*For and Against Mangrove Control*'

The National Institute for Water and Atmospheric Research (NIWA) has produced a publication, '*For and Against Mangrove Control'*. This publication clarifies the facts about mangroves, the consequences of actions taken in relation to them and the likelihood of achieving goals through these actions.

- A copy of this publication is available in Appendix II of this report.
- Copies can also be found on NIWA's website at http://www.niwascience.co.nz/rc/freshwater/mangrove.pdf/view_pdf.

2.2.3 Mangrove information – other councils

Auckland Regional Council (ARC) and Environment Bay of Plenty (EBoP) have conducted separate reviews of mangrove issues. EBoP's review focuses on mangroves management in their region, while ARC's review focuses on a technical review of the current state of knowledge of mangrove ecology, recent expansion, and its effects.

These reviews are listed below and are available to download free in PDF format from each council's website. Alternatively, you can contact the councils concerned if you would like a printed copy. Other relevant links on these councils' websites are also included below.

- Environment Bay of Plenty (www.envbop.govt.nz/) (EBop).
  - Environment Bay of Plenty's mangroves review (2007)[4] includes the review report itself - Catalyst Management Services' report, '*Estuary Care Review*' – and the Chief Executive's report on how its recommendations will be addressed. The review is available online at http://www.envbop.govt.nz/Coast/Tauranga Harbour/Mangroves.asp.
  - See also EBop's Coastal publications for other related information at http://www.envbop.govt.nz/Publications/Reports.asp.

[4] Environment Bay of Plenty, 2007*: Estuary Care Review*. Report to Council, report no. 010607, May, Catalyst Management Services. http://www.envbop.govt.nz/coast/media/pdf/Mangroves-Report-to-Council-010607.pdf.

- Auckland Regional Council (www.arc.govt.nz/) (ARC).

    - Full report PDF of ARC's mangroves review (2007)[5] (Technical publication 325: 156 pages) – '*The New Zealand Mangrove: Review of the Current State of* Knowledge'. This review is available online at http://www.arc.govt.nz/arc/index.cfm?B1BFD2DD-BCD4-1A24-901C-9AD2050A42F2#mangrove.
    - Summary booklet of the above mangroves review, listing its key findings in an easily understandable booklet called 'New Zealand's Mangroves.'[6] This booklet is available online on ARC's webpage 'Mangroves and the Coastal Plan'[7] at http://www.arc.govt.nz/arc/index.cfm?BB3A7F29-BCD4-1A24-9734-A117F8A54F0E.

3 Mangroves in Whangamata

3.1 What is happening

Mangrove expansion in Whangamata Harbour relates to two key points.

- Most of Whangamata's mangrove expansion has happened during decades of land clearance for urban development, forestry and farming.
- Erosion and soil run-off into the area's waterways, and then into the harbour, has provided a 'garden' for the mangroves to expand.

Mangrove expansion is therefore linked to one of the major issues identified in the harbour plan – the effect of sedimentation on the long-term health of the harbour and its catchment.[8]

Mangroves have been rapidly expanding in the Whangamata catchment since 1944, for the reasons outlined above. However, since the late 1990s this growth has slowed. Over the last eight years, mangroves have increased in *height* but not in *area.* In fact the area of mangroves has *decreased* by about four hectares.

As mentioned in section 2.1, managing mangroves is complex. As a first step, the harbour plan recommends addressing sedimentation by reducing the amount of soil eroding into Whangamata's streams. This will help limit the places where mangroves can grow. It will also reduce the rate of infilling of the harbour. The Draft Whangamata Catchment Management Plan 2007 has more information on the works that could achieve this.

The consented removal of mangrove seedlings will help prevent mangroves spreading further.

In the long-term however, Environment Waikato, the Whangamata community and other agencies need to work together to make decisions on how (or if) mangroves should be managed in the harbour. This is essential if we are to minimise or avoid any harmful environmental, social, cultural or economic effects in these areas or in other parts of Whangamata and its catchment.

[5] Morrisey, D., Beard, C., Morrison, M., Craggs, R. and Lowe, M., 2007: *The New Zealand Mangrove: Review of the Current State of Knowledge.* Auckland Regional Council Technical Publication Number 325, Auckland, New Zealand. http://www.arc.govt.nz/arc/index.cfm?B1BFD2DD-BCD4-1A24-901C-9AD2050A42F2#mangrove.

[6] Auckland Regional Council, 2007: *Mangroves in New Zealand*. Summary booklet. Auckland Regional Council, Auckland, New Zealand. http://www.arc.govt.nz/arc/index.cfm?BB3A7F29-BCD4-1A24-9734-A117F8A54F0E.

[7] This page also provides a brief overview of ARC's proposed plan change to the Auckland Regional Plan: Coastal (ARP:C), chapter 16, relating to mangroves.

[8] Global warming may also become more important in the future, with fewer frosts increasing mangrove seedling survival.

3.1.1 Mangrove seedling removal

Unauthorised removal

In October 2005 and January 2007, unauthorised clearance of mature mangroves and seedlings occurred in the Moanaanuanu Estuary. Unauthorised mature plant removal and seedling removal has also been carried out in other parts of the harbour. Because of the wider issues associated with mangrove clearance (outlined above), it is important that these activities do not continue.[9]

Controlled mangrove seedling removal through the resource consent process is an important first step in 'holding the line' and stopping the spread of mangroves until appropriate decisions about how (and if) mature mangroves should be managed can be reached. The consent process also provides a valuable forum for considering all of the issues associated with mangrove management outlined earlier in this report.

Whangamata Harbour Care Inc. consent

In November 2005 Whangamata Harbour Care Inc. lodged a consent application with Environment Waikato seeking to be able to remove mangrove seedlings. The consent was granted in December 2006 by the Environment Court for a 12-year period, with certain conditions to protect bird life, cultural sites and the environment.

- Mangrove seedlings can be removed between January and July.
- Mangrove seedling removal from August to December is not permitted, due to the risk of disturbing bird nesting sites.
- The area of seedling removal covers a significant part of the harbour, but excludes removing seedlings within mature mangrove areas, or in specified cultural or conservation sites.
- Only mangrove seedlings with a single stem can be removed, seedlings must be removed from the seaward side of mangrove stands and the removal must be by hand.

3.1.2 Other relevant activities in Whangamata

Section 8 of this report has more information about what Environment Waikato and other organisations have been doing including:

- related activities in the Whangamata catchment
- the '*Moanaanuanu Estuary Rehabilitation Concept*' (a report now with the Thames-Coromandel District Council)
- Environment Waikato's coastal management in the Waikato region.

3.2 Proposed funding, costs and benefits

The funding and cost proposals in the catchment plan and this mangrove management options report recognise that the regional community would, to some extent, also experience associated benefits from mangrove management.

One funding proposal under consideration specifically for mangrove management is that a targeted rate could be established for the Whangamata catchment, made up of an 80 per cent Whangamata targeted catchment rate and a 20 per cent peninsula or district rate.[10] See section 6.2.1 and section 6.2.3 for more detailed information on proposed costings and rating implications for each of the six scenarios.

[9] It could be argued that the unauthorised removal of seedlings may have assisted in halting the spread of mangroves in these areas. However, these actions were not carried out under specific consent conditions and monitoring designed to minimise any harmful effects was not done. Therefore it is uncertain how these actions have impacted on plant and animal life in these areas of the estuary.

[10] The rating implications for the Whangamata catchment are provided on the basis of recovering 80 per cent of costs of mangrove removal for different scenarios over a 10 year period via a targeted rate over 4,581 rateable properties. The rate factors are GST inclusive.

Funding for the wider range of works detailed in the catchment plan is provided for under the existing Peninsula Project Funding Policy.[11] The primary aim of the catchment plan's works is to reduce the amount of soil eroding into Whangamata's streams, ultimately reducing the amount of sediment in these waterways and the harbour. There will be other benefits too, like more native plants, improved habitats for fish and insects and better water quality. See the full catchment plan for more information.[12]

4 People's values about mangroves

The types of values people hold about mangroves and how strongly they feel about these values varies greatly within the community. People's values about mangroves span environmental, cultural, social, economic concerns.

- From an environmental perspective, some people see mangroves as contributing to the environment's health. These people see mangroves as an indigenous species which is merely responding to changing environmental conditions. Others see mangroves as ecologically damaging weeds which are an eyesore, block views and restrict the use of the harbour.
- From a cultural perspective, iwi in the Whangamata catchment have consistently stated and have an interest in the sustainable management of coastal systems and as 'kaitiaki' (guardians) have an integral role in determining future management of coastal areas.[13]

There are more pragmatic reasons which also influence people's values about mangroves and their concern about the long-term heath of the harbour. For example:

- harmful environmental impacts from our activities can affect people's safety, by increasing flooding and erosion
- reducing the 'natural character' of an area can make it a less enjoyable place to live in or visit, which can have economic effects on a community as people leave and visitor numbers drop.

In many cases, these values are not relevant to mangrove communities as a whole. How relevant they are often depends on the effect mangroves are having in a specific area.

The following list is a sample of the different opinions and values people hold about mangroves.

[11] The total costs associated with the catchment management plan's proposed programme of works do not include ongoing annual maintenance costs whereas those associated with the scenarios in the mangrove management options report do. At this stage, proposed costs for the catchment management programme total $670,000 (this figure does not include ongoing annual maintenance costs). It is expected that this programme could be implemented over the next 10 years, however to deliver this programme in a shorter time frame additional funding would be needed.

[12] Consultation with the community on funding, rating and costs of future works, services and activities related to carrying out the harbour plan's wider recommendations will also take place at each relevant stage as appropriate.

[13] Hauraki Māori Trust Board, 2004: *Whaia te Mahere Taiao a Hauraki*. Hauraki Iwi Environmental Plan.

Value/opinion examples
Mangroves are native plants which provide a place for animals and plants to live in (for example, they can help support shellfish communities, extend and provide habitat for a number of rare bird species and create a link between environments – from the sea to mangroves to wetlands).
Mangroves can provide a buffer in the way of floodwaters – particularly important should sea levels rise in the future.
In some places, mangroves can protect waterways by trapping sediment so it doesn't get into the harbour.
In some places, mangroves can protect water quality because they can trap pollutants in their sediment.
Mangroves support the overall 'natural character' of an area as well as its ecology – making it attractive for people to live in and visit.
Mangroves don't look very nice and they can get in the way of views.
Mangroves can block access to waterways.
Mangroves can stop floodwaters from draining away.
Mangroves will take over the harbour.
Mangroves trap sediment which covers sand and creates muddy environments.
Mangroves trap sediment and this speeds up the infilling and shallowing of the places where they are growing.

5 Developing the scenarios

In early 2007, Environment Waikato commissioned an investigation into various options for mangrove management.[14] [15] This investigation included examining mangroves present in the harbour in 2002, 1993, 1978, 1965 and 1944 (scenarios 1, 3, 4, 5 and 6) and assessing mangrove management options that could take the mangrove coverage back to each of these historic baselines. These five scenarios were considered against a range of criteria, including the:

- estimated time and cost involved in removal work (if any)
- likelihood of getting a resource consent
- estimated cost of the resource consent process
- effectiveness of any mangrove removal (both factual and people's opinions)
- certainty of outcomes (large amounts of removal and maintenance will lower the certainty of outcomes in the long-term, due to the greater number of variables to be managed)
- issues related to the movement of sediment following mangrove removal
- benefits related to acting now rather than leaving decisions and actions to future generations.

The 'eight hectare' area

A previous survey of mangrove areas was carried out by Environment Waikato at the community's request earlier in 2007. This survey identified sites totalling approximately eight hectares as proposed areas for mature mangrove removal based on whether they were:

[14] Beca Carter Hollings & Ferner Ltd. 2007: *Assessment of Different Mangrove Removal Options*. 4250648/PFD: T1:67040-JFL176L08.DOC. Beca Carter Hollings & Ferner Ltd, Tauranga.
[15] Beca Carter Hollings & Ferner Ltd. 2007: *Mangrove Growth in Whangamata Harbour*. Aerial maps (PDF format). Beca Carter Hollings & Ferner Ltd, Tauranga.

a. contributing to sediment accumulation
b. spreading into seagrass habitat
c. reducing tidal access to wetlands
d. spreading into saltmarsh habitat.

A small number of these areas have had consented clearing carried out and are being carefully monitored to assess any effects from this work. The remaining areas are now under consideration as scenario 2 in this options report.

Moanaanuanu Estuary

The Moanaanuanu Estuary is an area south of the causeway where significant unauthorised clearing of mature mangroves has been carried out. An additional management initiative for this area, the *Moanaanuanu Estuary Rehabilitation Concept*, has been commissioned by Environment Waikato and is now under consideration by Thames-Coromandel District Council. See section 8.1 for more information.

Environment Waikato has used this and other related information to create six options or 'scenarios' for public consideration. These scenarios are detailed in section 6 of this report. Each scenario includes:

- estimated costs and rating implications relevant to each of the six 'scenarios'
- a brief summary of the pros and cons of each scenario
- historic information and maps showing mangrove growth in the Whangamata Harbour area in 2002 ('current day') and back to 1944 (scenarios 1, 3, 4, 5 and 6)
- a map showing the targeted sites for the originally proposed 'eight hectares' of mature mangrove removal areas (scenario 2).[16]

6 Mangrove management options

Environment Waikato has identified two key actions to manage mangroves – controlling their spread (by removing seedlings) and the removal of selected mature mangroves blocking waterways. These actions are managed by Environment Waikato through the resource consent process and our navigation safety and river and catchment management activities.

Removing mangroves to achieve other outcomes, like improving views and access to and around the harbour, needs further consultation before consent applications are considered. That's why we would like to know which scenario(s) Whangamata residents and ratepayers prefer. However, feedback on the six scenarios can also include comments related to navigation safety and river and catchment management issues (such as flooding, erosion and mangroves blocking access), as this information will be useful in Environment Waikato's planning to address these issues.

6.1 Feedback

Environment Waikato has prepared a questionnaire which Whangamata residents and ratepayers can complete to give us feedback on:

- their preferred option for managing mangroves
- the issues identified in the draft harbour plan
- the priority works proposed in the draft catchment plan and the timeframe over which the work will be done.

[16] Note: consented removal of mangroves has taken place in a small number of these areas; the remaining areas are now part of Environment Waikato's further consultation through this mangrove management options report.

The questionnaire, along with this options report and the draft harbour and catchment plans, can be downloaded from our Whangamata Harbour Plan webpages at www.ew.govt.nz/projects/whangamata/index.htm. Printed copies can be ordered by phoning Environment Waikato's freephone 0800 800 401.

6.2 Scenarios/proposed management options

6.2.1 Cost estimates

The initial removal and ongoing maintenance costs, and subsequent household rates, are an estimate only.[17] [18] They could vary significantly depending on the type of consent required (for example, whether it's a notified consent or requires a hearing) and whether this process goes through the Environment Court. Any appeal to the Environment Court objecting to mangrove management is outside Environment Waikato's control. It is also possible the court may decline any proposal to manage mangroves. The cost of the court process may add an additional $7.50 to $15.00 per property to the rates information shown for each scenario (or $1.40 to $2.80 per $100,000 of capital value).

Trial areas

All of these scenarios assume a one hectare trial area would be cleared first as part of any consented mangrove removal work, except for the 'current day' scenario (2002 baseline) which does not require the removal of mature mangroves. Each trial area would be monitored to assess the effects of mangrove removal before any further removal work goes ahead for that site. The cost of clearing a trial area is estimated to be $47,000 including consent costs (applicable to each of the scenarios).

Wentworth River area

It should also be noted that the harbour plan points out that a number of commercial and residential properties near the Wentworth River and surrounding areas will still be vulnerable to flooding in the future whether mangroves are removed from this area or not. For more information, see the Wentworth River Flood Hazard Assessment Report 2007.[19]

Mangrove removal for flood management

As mentioned at the beginning of this section, the removal of mangroves blocking waterways relates to access and flood risk issues and as such is already covered by the Draft Whangamata Catchment Management Plan 2007 and Environment Waikato's river and catchment management services work.

6.2.2 Maps – overview

The maps provided include:

- a Whangamata town map (detail)
- a Whangamata catchment map
- five maps showing historic mangrove coverage (scenarios 1, 3, 4, 5 and 6)
- a map showing targeted removal of eight hectares of mangroves (scenario 2).

[17] Prior to development of this options report, an initial cost of $103,000 was identified for mangrove management (this estimate did not include ongoing maintenance costs). This was based on managing the targeted 'eight hectares' of removal sites as identified in an initial study during development of the harbour plan (that is, a one hectare initial trial removal followed by removal in the remaining site areas). This estimation has been updated to include ongoing maintenance costs and now relates to 'Scenario 2' – eight hectares targeted sites.

[18] Any removal and maintenance work would be carried out by professional commercial agencies contracted by Environment Waikato. Where appropriate, Environment Waikato may from time to time request volunteers to assist these agencies under supervision.

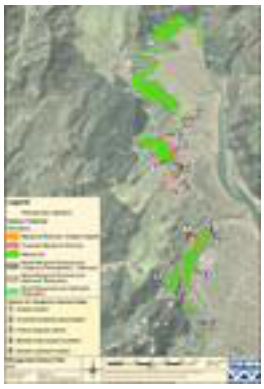
[19] Environment Waikato. 2007: *Wentworth River Flood Hazard Assessment 2007.* Environment Waikato Technical Report 2007/16, Environment Waikato, Hamilton.

The map for scenario 2 shows:

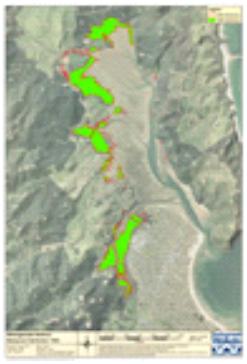
- the sites initially identified for targeted mangrove removal under the ‘eight hectare’ proposal
- why these areas were identified as mangrove removal sites
- areas within these sites where mangrove removal has already been carried out.



MAP (2002 - Current day)
Scenario 1: No removal



MAP (8 ha sites)
Scenario 2: Remove 8 ha



MAP (1993)
Scenario 3: Remove 12 ha



MAP (1978)
Scenario 4: Remove 24 ha



MAP (1965)
Scenario 5: Remove 57 ha



MAP (1944)
Scenario 6: Remove 73 ha

Larger versions of each of these maps can be found in Appendix I.

6.2.3 Scenarios

Scenarios 1, 3, 4, 5 and 6 below show the total area of mangroves which would need to be removed to take mangroves in Whangamata Harbour back that shown in each of the five 'historic baseline' years. For example, in Scenario 4, 24 hectares of mangroves would need to be removed to bring mangrove coverage in the harbour back to 1978 levels. Scenario 2 is not based on historic mangrove distribution in the harbour; instead, it relates to the eight hectares of mangroves targeted for consented removal as identified in Environment Waikato's 2007 study.

- A standard one hectare trial clearance cost of $47,000 including related consent costs is applicable to each of the scenarios except for Scenario 1, 'no removal'. Costs shown below are additional any trial clearance cost in each case.
- Figures shown below include GST. See sections 3.2 and 6.3.1 of this report for more information on the proposed funding and estimated costs of mangrove management.
- The assessments below suggest that removing 24 hectares or less of mangroves in the Whangamata Harbour area (scenarios 1, 2, 3, and 4) is likely to achieve some of the required outcomes, while keeping harmful effects to a minimum using careful processes and monitoring.
- However, the mangrove removal in areas larger than 24 hectares carries higher uncertainty and risk of harmful effects (scenarios 5 and 6).
- Before deciding which option is best overall, see section 2 of this report for key points that should be considered and section 4 for information about people's values related to mangroves.

Scenario number	**Historic baseline year**	**Estimated initial removal cost**	**Ongoing maintenance (cost per year and duration)**	**Pros and cons**
Scenario 1 No removal	Mangrove cover in **2002** ('current day')	Nil, which means no additional rates cost.	Nil, which means no additional rates cost.	• The physical and ecological functions of the mangroves and harbour will be maintained at current levels. • No impact on plant and animal habitats. • Provides a buffer for bank erosion. • Existing seedling removal means the mangroves will not spread but they will continue to grow. As they grow, they may impact on other habitats, access to and around the harbour may become increasingly difficult and more views could be blocked. • Sedimentation will continue and the risk of flooding in the estuary will slowly increase. • Ongoing seedling removal is required.

Scenario 2 Remove 8 hectares	Environment Waikato 2007 **targeted** sites	$103,000 That's an additional rates cost of $3.00 per property (or $0.60 per $100,000 of capital value) per year for 10 years.	$6,000 per year for six years following removal. That's an additional rates cost of $1.50 per property (or $0.30 per $100,000 of capital value) per year.	• Will open up areas that have recently been blocked, partially addressing concerns over mangroves restricting harbour access and impacting on views. • Will provide a clear channel for water to flow to the harbour. • The physical and ecological functions of the mangroves and harbour will largely be maintained. • A small volume of sediment will be disturbed but the effects of it shifting and moving elsewhere in the harbour are likely to be minor. • Not likely to impact on plant and animal habitats. • Will only partially address concerns over mangroves restricting harbour access and impacting on views. • Sedimentation will continue and the risk of flooding in the estuary will slowly increase. • Requires ongoing maintenance.
Scenario 3 Remove 12 hectares	Mangrove cover in **1993**	$165,000 That's an additional rates cost of $5.00 per property (or $0.90 per $100,000 of capital value) per year for 10 years.	$10,000 per year for eight years following removal. That's an additional rates cost of $2.50 per property (or $0.50 per $100,000 of capital value) per year.	• Will open up areas that have recently been blocked, partially addressing concerns over mangroves restricting harbour access and impacting on views. • Will provide a clear channel for water to flow to the harbour. • The physical and ecological functions of the mangroves and harbour will mostly be maintained. • Will only partially address concerns over mangroves restricting harbour access and impacting on views. • A slightly higher volume of sediment will be disturbed and is likely to shift elsewhere and harm other places in the harbour, although the scope and scale of problems that might occur is difficult to predict. • Sedimentation will continue and the risk of flooding in the estuary will slowly increase. • Reduced buffer for bank erosion. • Requires ongoing maintenance.

Scenario 4 Remove 24 hectares	Mangrove cover in **1978**	$263,000 That's an additional rates cost of $7.90 per property (or $1.50 per $100,000 of capital value) per year for 10 years.	$19,000 per year for 11 years following removal. That's an additional rates cost of $4.70 per property (or $0.90 per $100,000 of capital value) per year.	• The pros and cons for this scenario are similar to those outlined under Scenario 3, but the effects are likely to be more significant and the costs are higher.
Scenario 5 Remove 57 hectares	Mangrove cover in **1965**	$401,000 That's an additional rates cost of $12.00 per property (or $2.30 per $100,000 of capital value) per year for 10 years.	$46,000 per year for 15 years following removal. That's an additional rates cost of $11.30 per property (or $2.10 per $100,000 of capital value) per year.	• A big improvement in harbour access and views. • Will reduce sedimentation and flood risks in the estuary and river mouths. • The mangroves' physical and ecological functions will be compromised. • Highly likely that a large volume of disturbed sediment will shift elsewhere and harm other places in the harbour, although it's difficult to predict the scope and scale of problems that might occur. • Significant increase in the risk of bank erosion in the harbour. • Requires ongoing maintenance.
Scenario 6 Remove 73 hectares	Mangrove cover in **1944**	$497,000 That's an additional rates cost of $14.90 per property (or $2.80 per $100,000 of capital value) per year for 10 years.	$57,000 per year for 15 years following removal. That's an additional rates cost of $14.00 per property (or $2.60 per $100,000 of capital value) per year.	• The pros and cons for this scenario are similar to those outlined under Scenario 5, but the environmental effects are likely to be more significant and the costs are much higher.

7 What happens next

Environment Waikato is seeking feedback up to **Wednesday, 7 November 2007** on the:

- issues identified in the Draft Whangamata Harbour Plan that are a risk to the harbour
- the priority works proposed in the Draft Whangamata Catchment Management Plan to address the sedimentation and flooding issues identified in the harbour plan, and the timeframe over which the work will be done
- options for managing mangroves.

Information day

An information day will be held on **Saturday, 20 October 2007** at the Thames-Coromandel District Council office on Port Road in Whangamata. People can drop-in anytime between 10am-2pm.

Decision-making

The final decision on outcomes related to the harbour plan, catchment plan and mangrove management options report will be made by Environment Waikato's council after following the processes outlined below.

- As well as holding an information day and receiving feedback through the questionnaire, Environment Waikato will hold community meetings and face to face discussions with relevant organisations.
- The feedback received will be used to assist us in finalising the harbour plan and catchment plan and in decision-making related to managing mangroves in Whangamata Harbour.
- Before any actions can be taken on managing mature mangroves in Whangamata Harbour, Environment Waikato will need to:
  - have the appropriate experts assess the public feedback on the scenario(s)
  - determine whether Environment Waikato's decisions on mangrove management in Whangamata Harbour require further consultation through a formal process (if so, this would be through public notification and a submissions and hearings process)
  - take feasible scenario(s) through the resource consent process
  - follow the processes of the Environment Court where required.

In the meantime, **mangrove seedlings only** can be removed under the conditions of the current resource consent granted to Whangamata Harbour Care Inc. in December 2006 (see section 3.1.1).

Environment Waikato is committed to working with the community and key organisations on these issues, so we can take people's differing views into account as realistically as possible through a democratic process. Environment Waikato will keep the community and other relevant stakeholders informed on progress throughout the consultation process.

8 More information

8.1 Moanaanuanu Estuary Rehabilitation Concept

The '*Moanaanuanu Estuary Rehabilitation Concept*' (2007)[20] contains suggestions and recommendations for a variety of restoration and enhancement work in the Moanaanuanu Estuary and its surrounds. These are aimed at increasing the recreational and educational opportunities provided and protecting the area's ecology and creating buffering margins to minimise flooding. Some suggestions include creating or enhancing walkways, boardwalks, bridges and tree lighting; and carrying out weed management and replanting native plants. Those parts of the estuary area which are subject to consent in relation to the proposed Whangamata Marina are excluded from the report's assessment as they have been thoroughly investigated as part of recent planning approvals for that area and will be managed under the consent conditions for the marina.

The '*Moanaanuanu Estuary Rehabilitation Concept*' report is now with the Thames-Coromandel District Council for consideration. In addition, public consultation on addressing mangrove management issues in the Moanaanuanu Estuary and its surrounding areas is part of 'Scenario 2' in Environment Waikato's mangrove management options report.

8.2 Other Environment Waikato activities in the Whangamata catchment

General management activities

- Environment Waikato's environmental monitoring (for example, rainfall stations, coastal ecosystems, stream sediment monitoring) includes activities in the Whangamata catchment.
- Environment Waikato (along with Thames-Coromandel District Council and other agencies) is involved in the development of the 'Coromandel Peninsula Blueprint Project' – a strategy being developed to manage growth and development for the Coromandel Peninsula, including harbour planning.
- Environment Waikato works with other agencies through the Peninsula Project to provide river and catchment services to the Coromandel Peninsula. This project provides some works and services in the Whangamata catchment through the Whangamata catchment plan.
- Environment Waikato provides a harbourmaster and navigation safety services in the Whangamata Harbour as part of its responsibilities for managing navigation safety functions in all navigable waters within the Waikato Regional Council boundaries except Lake Taupo.
- Environment Waikato's beachcare programme includes supporting rivercare, streamcare and harbourcare groups working in the Whangamata catchment.

Specific management activities

Since 2001, Environment Waikato has carried out a number of specific activities aimed at assessing and monitoring mangroves in Whangamata Harbour in preparation for their future management.

[20] Beca Carter Hollings & Ferner Ltd. 2007: *Moanaanuanu Estuary Rehabilitation Concept*. 4250648/PFD: T1:65537-SAJ74R01.DOC. Beca Carter Hollings & Ferner Ltd, Tauranga.

- An experimental mangrove removal trial was held in 2001 in Patiki Bay (another 50 plants were removed in 2004).
- Environment Waikato's contributed to a 2002 investigation into the role of nutrients in the spread of mangroves in Whangamata Harbour.
- Mangrove seedlings in a significant area of the harbour can now be removed under specific resource consent conditions. See the Whangamata Harbour Care Inc. consent mentioned in section 3.1.1 above.
- Environment Waikato carried out some limited clearing of mangroves in early 2007 to improve drainage into the harbour from the Te Weiti Stream and reduce flooding.
- Vegetation habitat in the harbour was remapped in 2004 and again in 2006 by Environment Waikato. See our regularly updated Extent of Coastal Habitats indicator for results at: www.ew.govt.nz/enviroinfo/indicators/coasts/biodiversity/co2/keypoints.htm.
- Sediment traps have been dug in the stream bottoms near where they enter the harbour.
- Riparian planting to reduce stream bank erosion is being supported in parts of the Wentworth River.
- A rat control programme is underway around the Moanaanuanu Estuary.
- A restoration project was ready to begin for the Department of Conservation wetland opposite Papamaire Island. Iwi are keen to get this underway and have requested time to prepare appropriately before the project proceeds.

Coastal information

- Environment Waikato has a wide range of information available on coastal issues, monitoring and planning. Environment Waikato's Coastal Publications are available to order online at: www.ew.govt.nz/publications/index.htm

  If you prefer, you can order them by phoning Environment Waikato's freephone 0800 800 401. Much of this material is available free while other, larger documents or reports can be purchased for a small charge.

- Environment Waikato's website has information on Our Coasts and Coastal Hazards at: www.ew.govt.nz/enviroinfo/coasts/index.htm

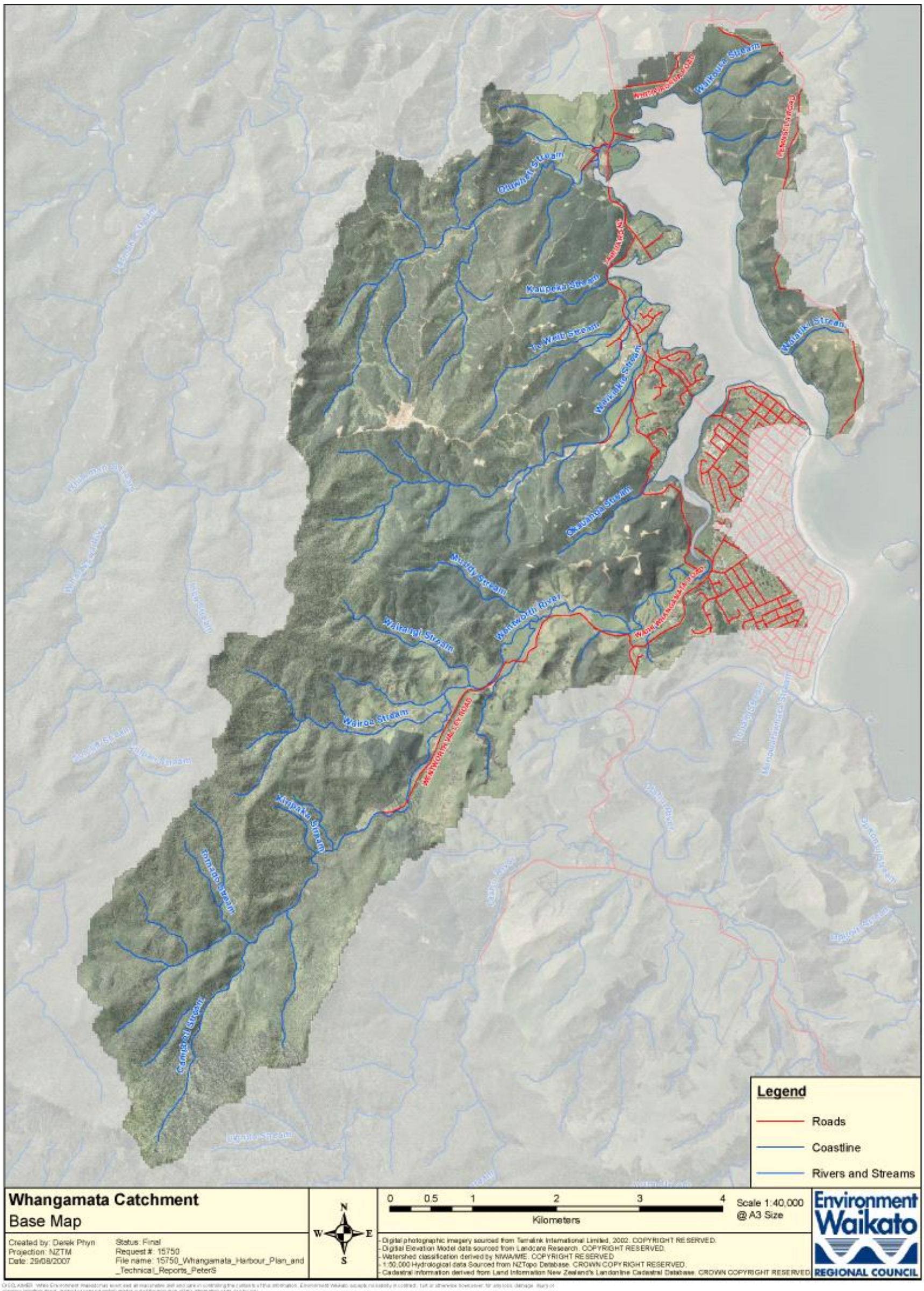
- More information on climate change and coastal weather hazards is available from:

  - New Zealand's National Institute for Atmospheric and Water Research (NIWA) at: http://www.niwascience.co.nz/rc/prog/
  - The New Zealand Government Climate Change Project (2001 report) at: http://www.mfe.govt.nz/publications/climate/effect-coastal-sep01/

9 Appendices

9.1 Appendix I – Maps

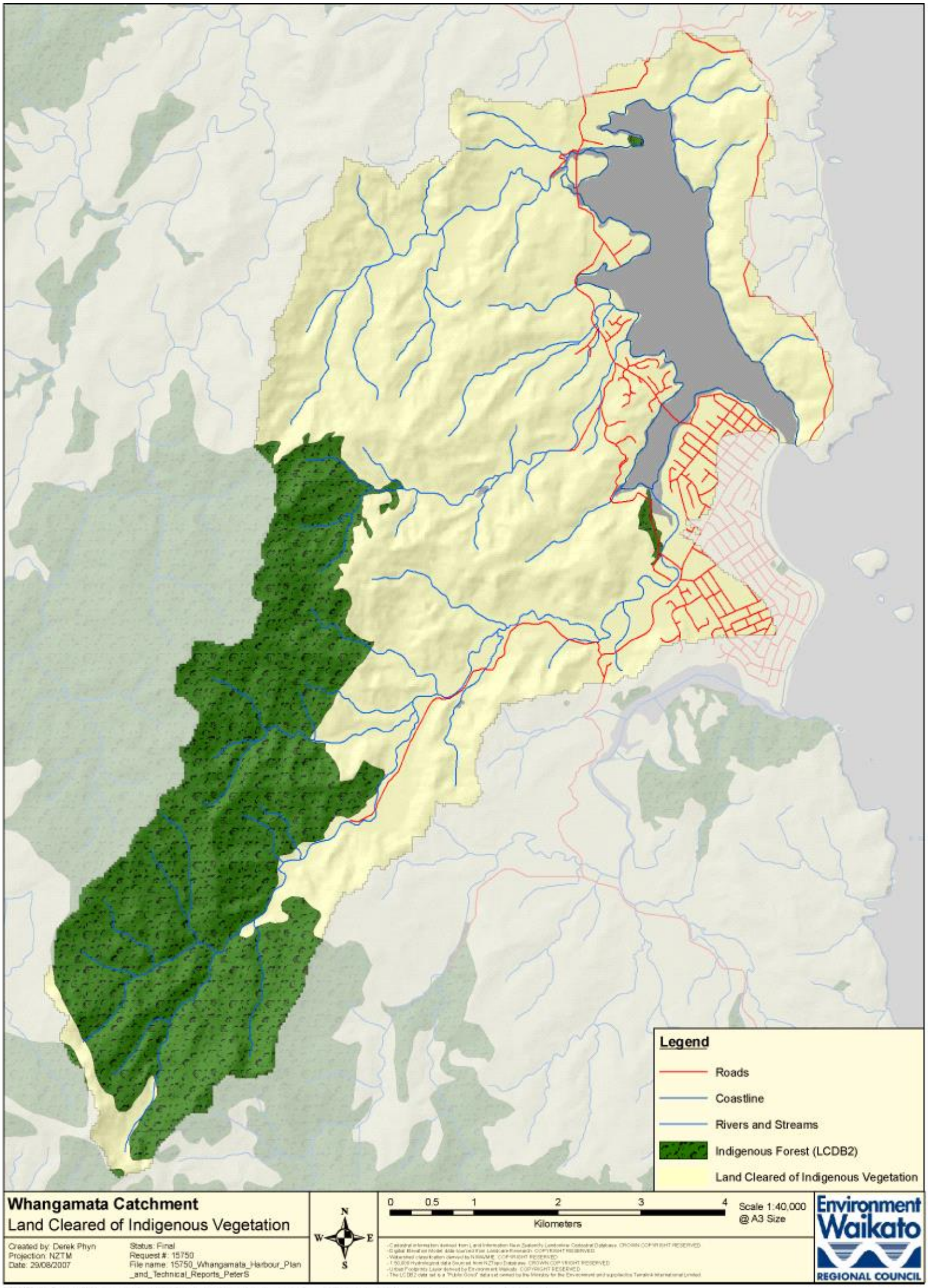
Whangamata catchment map



Whangamata locations map

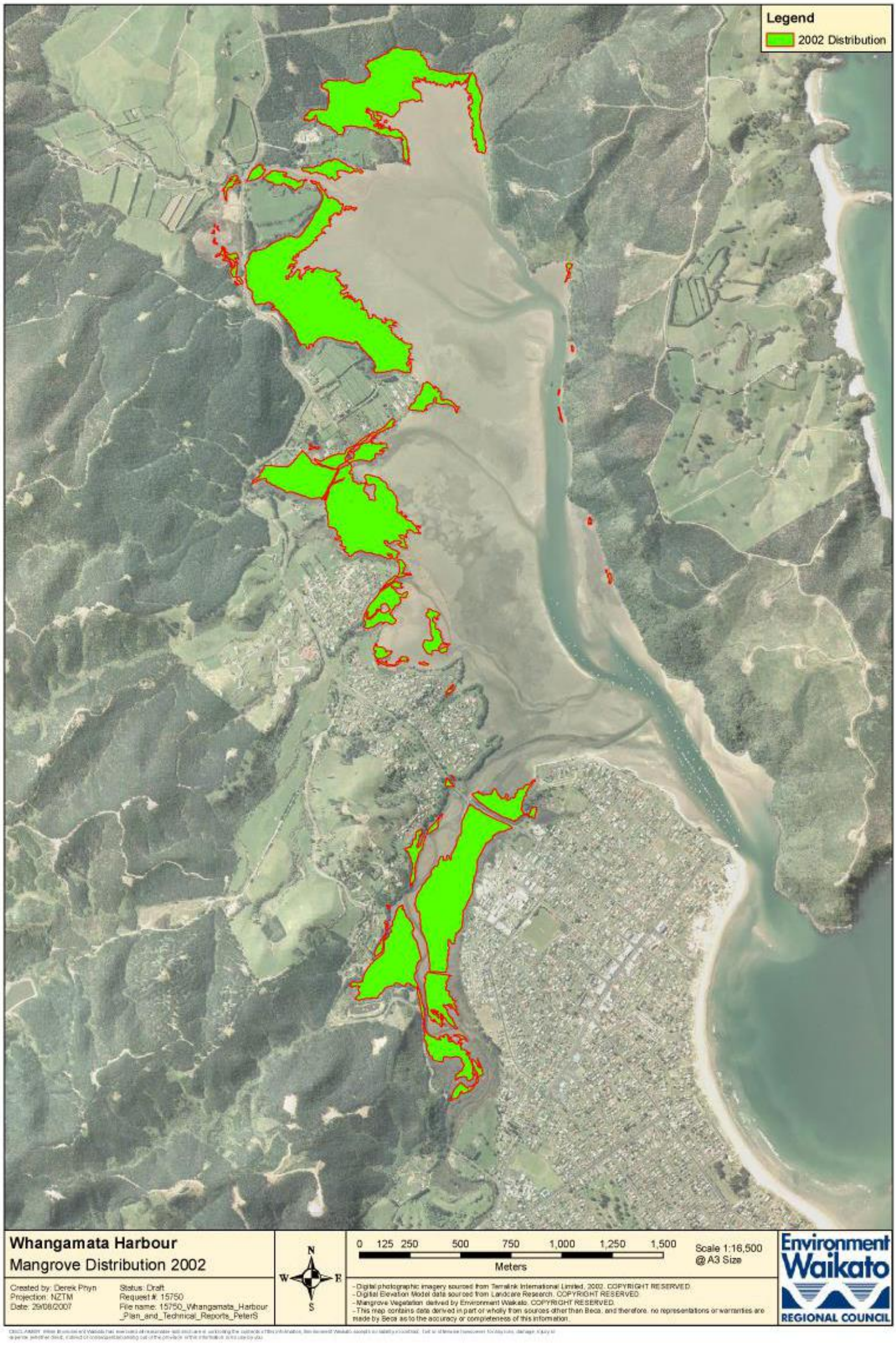


Whangamata catchment – Land clearance



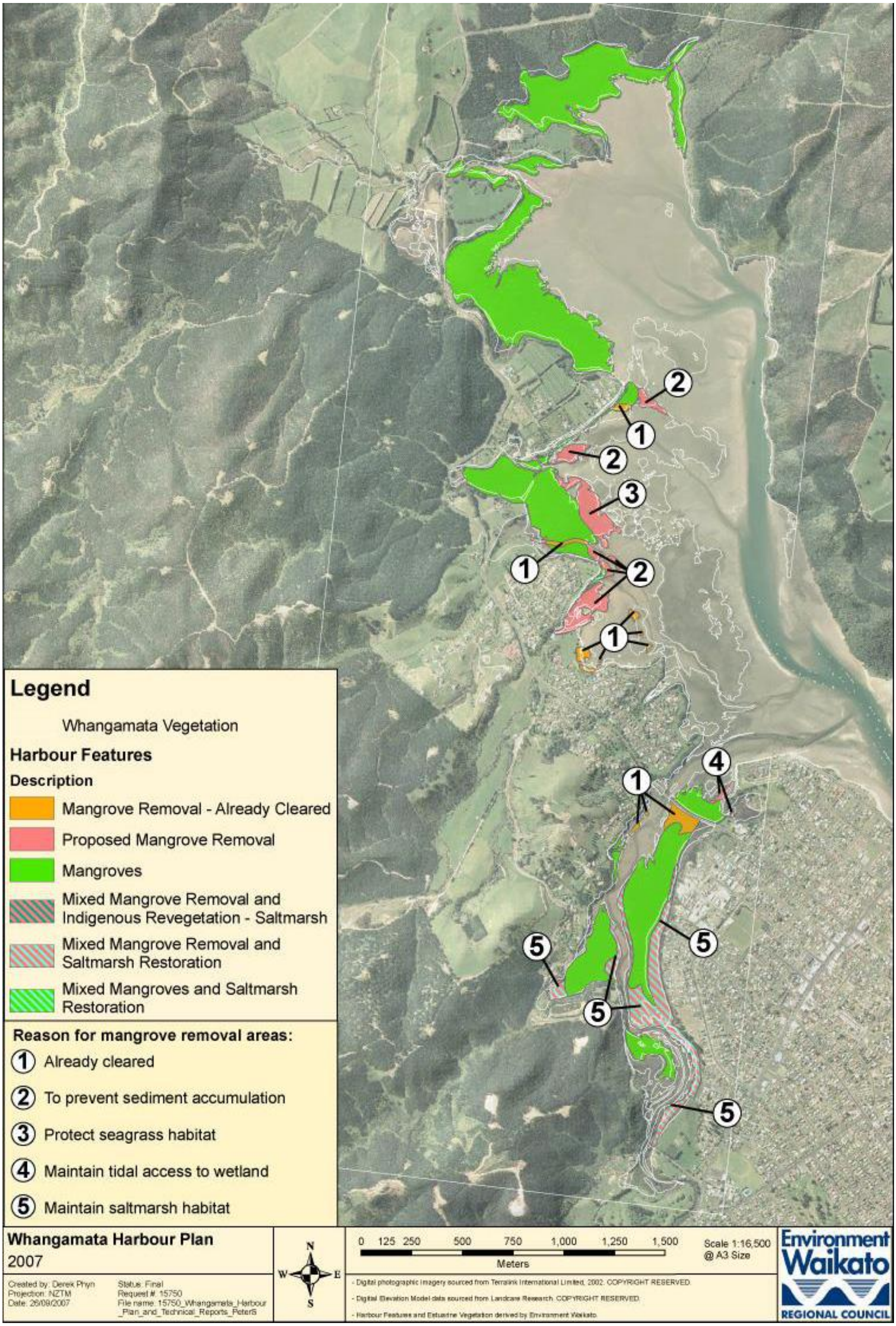
Scenario 1 – No removal

The map below shows mangrove cover in 2002 (current day). These are the mangrove areas that would be retained under Scenario 1 (no removal).



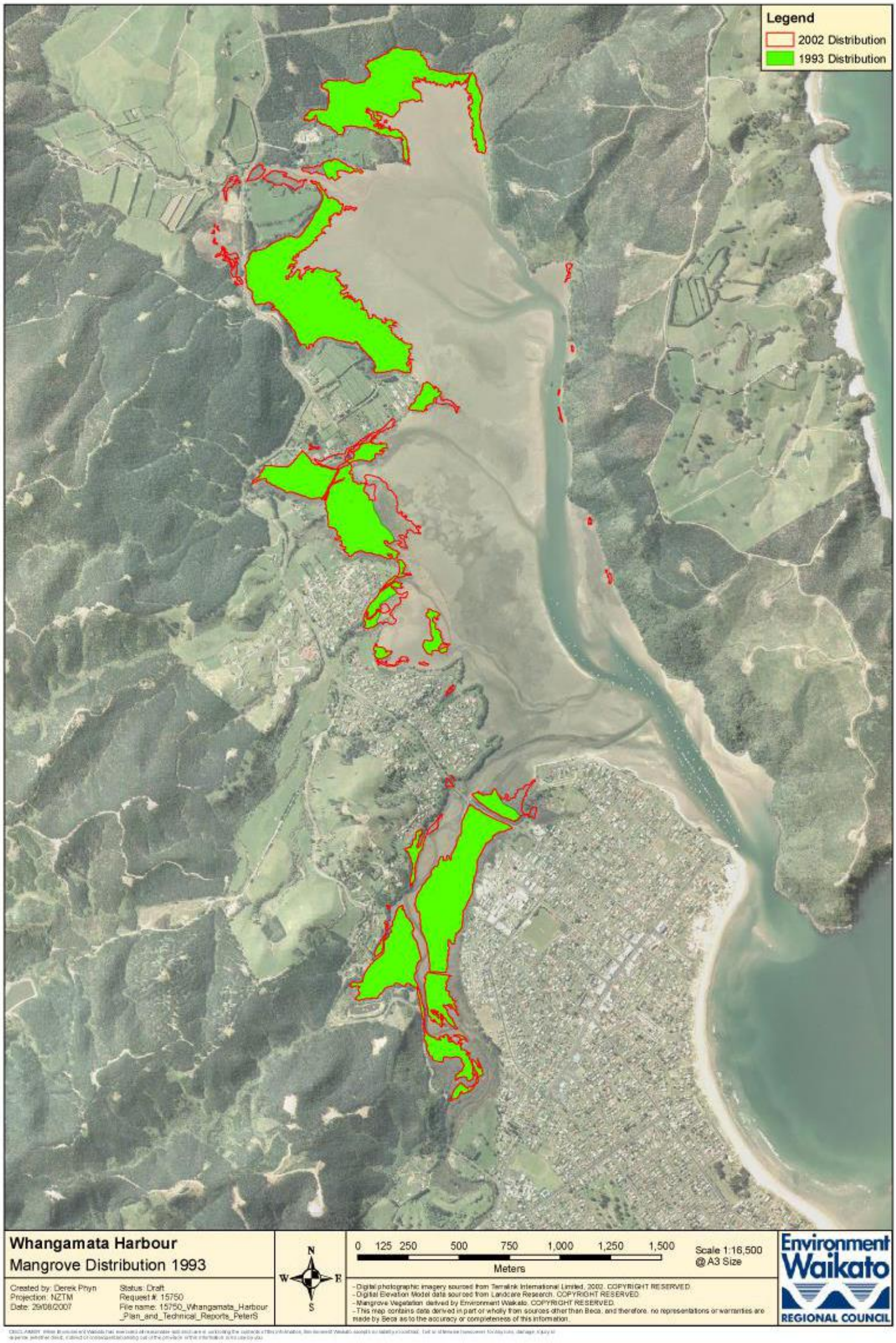
Scenario 2: 'Eight hectares' - targeted mangrove management areas:

This map shows the 'eight hectares' of initially selected mangrove removal sites identified by Environment Waikato in 2007.



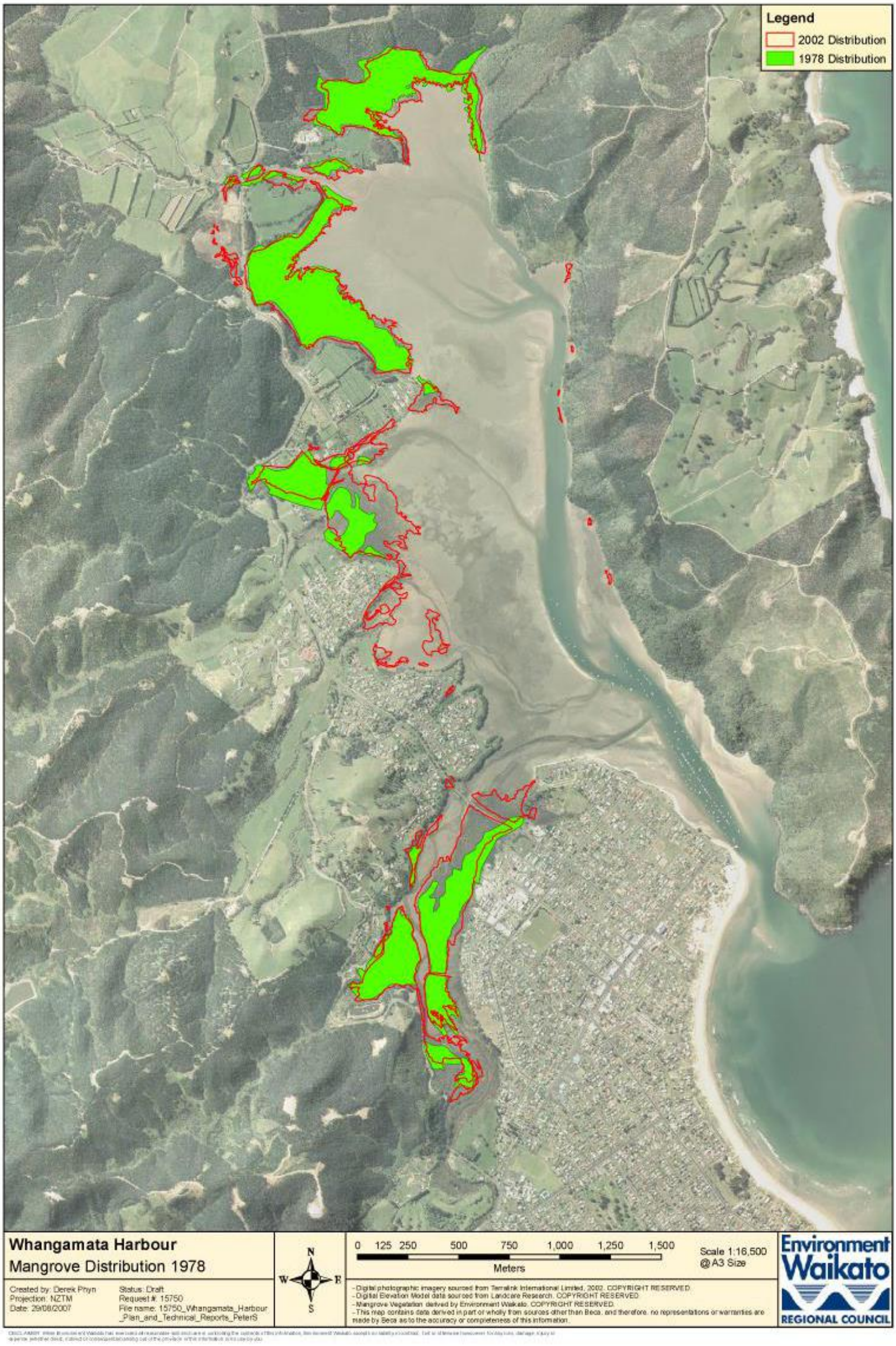
Scenario 3 – Remove 12 hectares

The map below shows mangrove cover in 1993. These are the mangrove areas that would be retained under scenario 3 (remove 12 hectares).



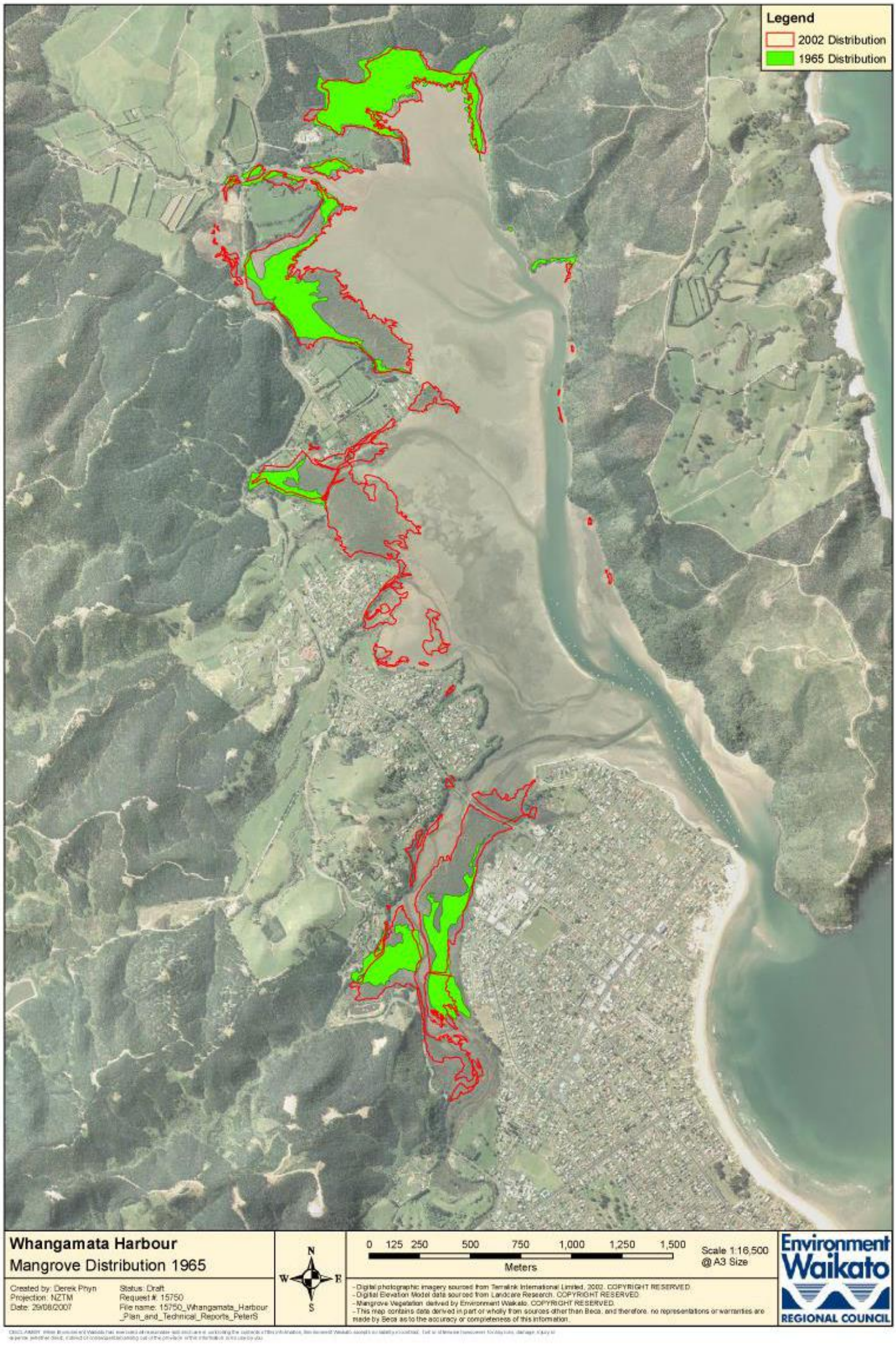
Scenario 4 – Remove 24 hectares

The map below shows mangrove cover in 1978. These are the mangrove areas that would be retained under scenario 4 (remove 24 hectares).



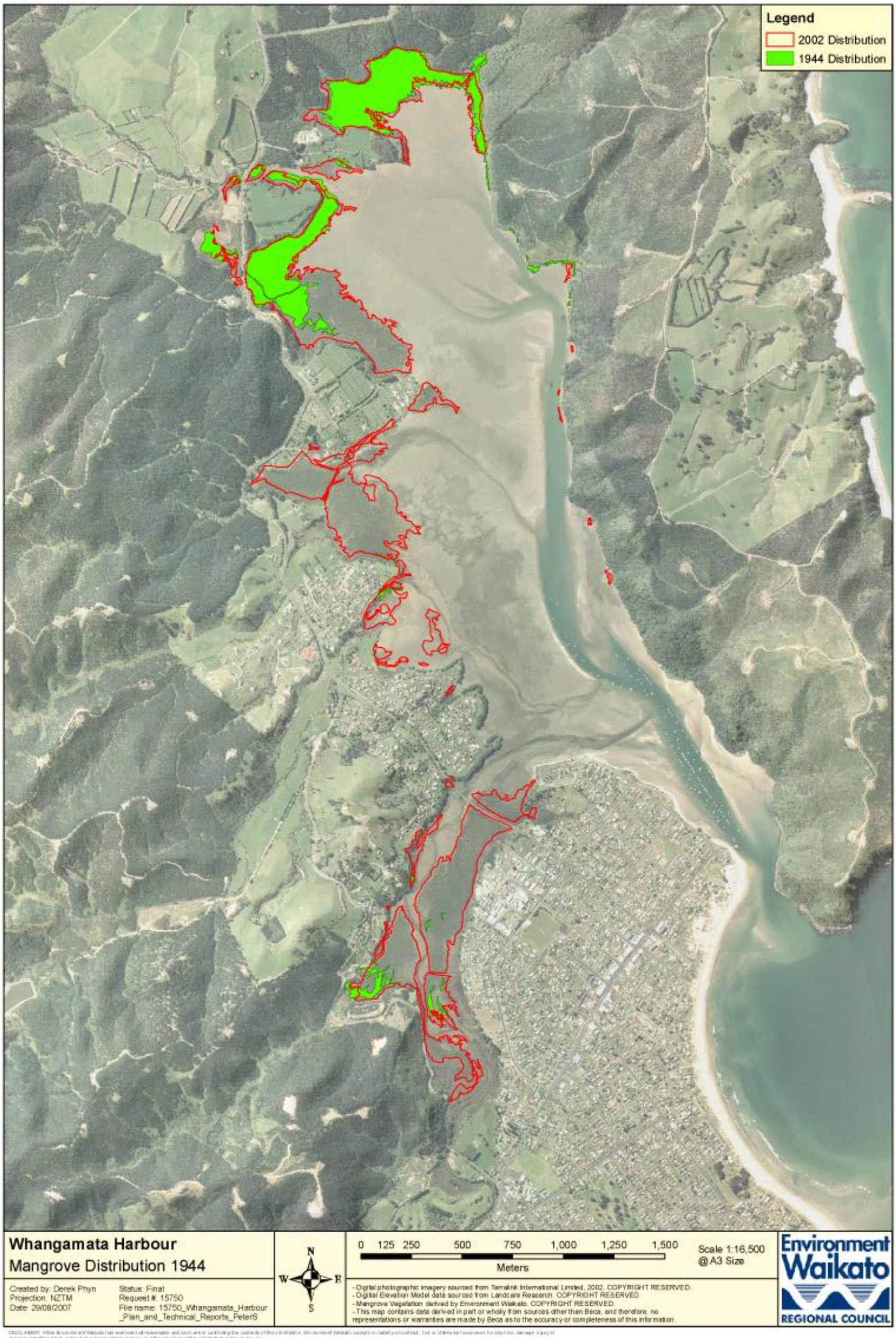
Scenario 5 – Remove 57 hectares

The map below shows mangrove cover in 1965. These are the mangrove areas that would be retained under scenario 5 (remove 57 hectares).



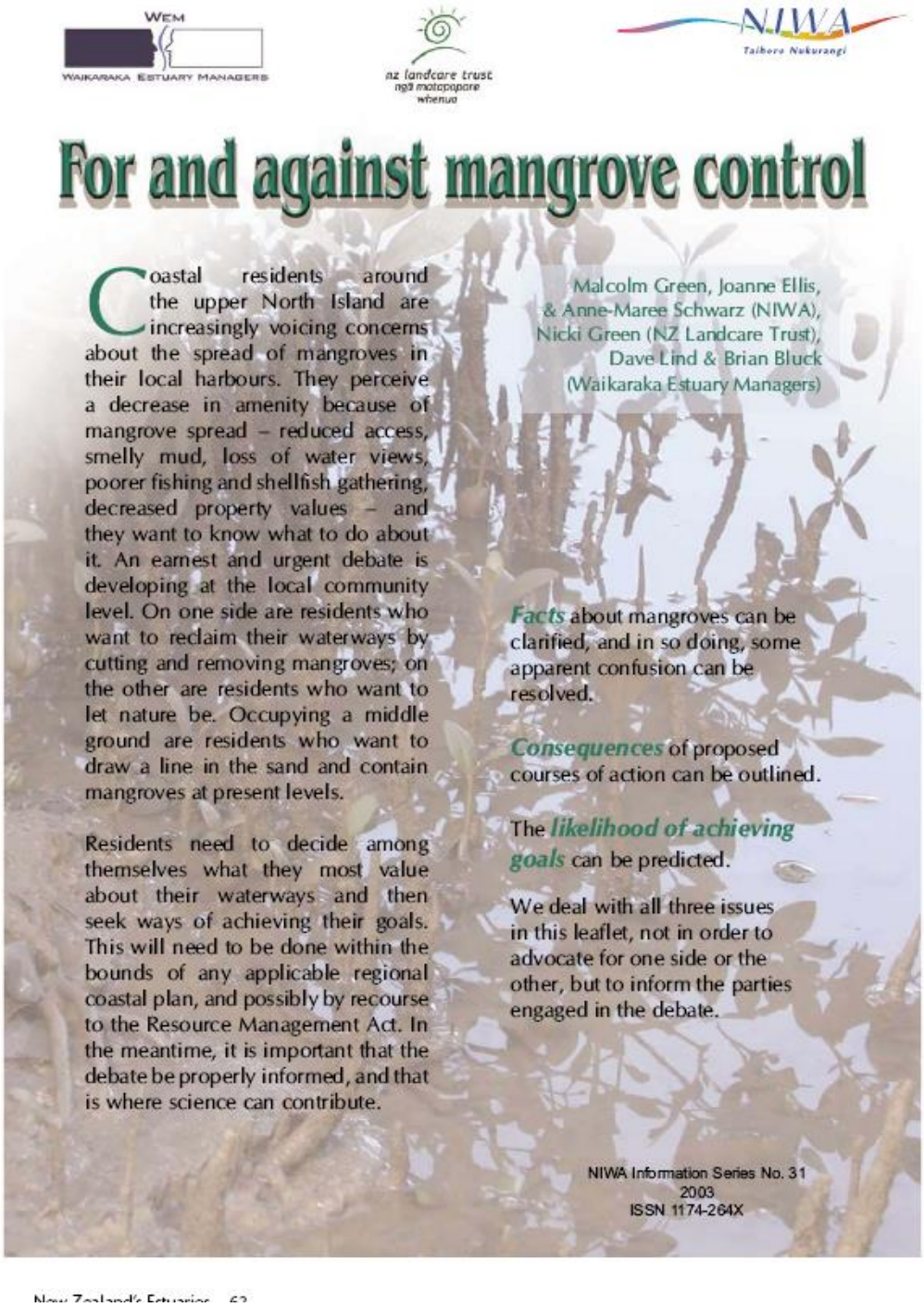
Scenario 6 – Remove 73 hectares

The map below shows mangrove cover in 1944. These are the mangrove areas that would be retained under scenario 6 (remove 73 hectares).



9.2 Appendix II – NIWA: 'For and Against Mangrove Control'

The following information has been provided by the National Institute for Water and Atmospheric Research (NIWA). Copies can also be found on NIWA's website at http://www.niwascience.co.nz/rc/freshwater/mangrove.pdf/view_pdf.



WEM
WAIKARAKA ESTUARY MANAGERS

nz landcare trust
nga motopopore whenua

NIWA
Taihoro Nukurangi

For and against mangrove control

Coastal residents around the upper North Island are increasingly voicing concerns about the spread of mangroves in their local harbours. They perceive a decrease in amenity because of mangrove spread – reduced access, smelly mud, loss of water views, poorer fishing and shellfish gathering, decreased property values – and they want to know what to do about it. An earnest and urgent debate is developing at the local community level. On one side are residents who want to reclaim their waterways by cutting and removing mangroves; on the other are residents who want to let nature be. Occupying a middle ground are residents who want to draw a line in the sand and contain mangroves at present levels.

Residents need to decide among themselves what they most value about their waterways and then seek ways of achieving their goals. This will need to be done within the bounds of any applicable regional coastal plan, and possibly by recourse to the Resource Management Act. In the meantime, it is important that the debate be properly informed, and that is where science can contribute.

Malcolm Green, Joanne Ellis, & Anne-Maree Schwarz (NIWA), Nicki Green (NZ Landcare Trust), Dave Lind & Brian Bluck (Waikaraka Estuary Managers)

Facts about mangroves can be clarified, and in so doing, some apparent confusion can be resolved.

Consequences of proposed courses of action can be outlined.

The ***likelihood of achieving goals*** can be predicted.

We deal with all three issues in this leaflet, not in order to advocate for one side or the other, but to inform the parties engaged in the debate.

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What is the problem?



Waikaraka Estuary (Tauranga) 1976 ...



... and 1999.

The real problem is increased sediment runoff from the catchment (in the past and present); mangrove spreading is a symptom of that problem. Estuaries do naturally trap and fill with sediments, and mangroves do naturally spread in estuaries where climatic and other factors are favourable. However, what we are seeing today are the results of silt clogging waterways. This is caused by increased soil erosion on developing and deforested catchments, often coupled with inadequate sediment controls that could otherwise halt or limit the sediment onslaught. Under this deluge of silt, sandflat habitats become smothered and mangroves spread rapidly, expanding from the headwaters and sides of the estuary out into areas that were previously floored with clean sand. And here's the perverse part: mangrove spread and silt deposition are intimately bound together – mangroves help trap silt and silt provides the environment that helps mangroves to thrive. The problem here then is an *acceleration* of what are otherwise natural processes.

The true extent of the problem is not easy to determine, but there is evidence that sedimentation rates in some estuaries have increased by at least a factor of 10 since human occupation. What is clear is that getting rid of mangroves will not halt sediment erosion in disturbed catchments, and until this is controlled and abated, estuarine and coastal ecosystems will continue to degrade.

Frequently asked questions

Are mangroves a native species?

The New Zealand mangrove, Avicennia marina, or manawa, is native to New Zealand. We have only this one species of mangrove, and it is not regarded as threatened. It is believed to have arrived on our shores about 14 000 years ago. In northern New Zealand, mangroves grow as tall trees, but they become smaller and more shrub-like the farther south they grow. Avicennia marina is one of the most widespread mangrove species in the world. Its southernmost limits are in New Zealand, and in Victoria, southeastern Australia. In New Zealand, mangroves do not occur naturally south of about Ohiwa Harbour on the east coast and Kawhia on the west.

If we get rid of the mangroves, will the mud then disappear?

The situation will differ for every estuary. Mangroves do stabilise mud deposits by binding them with their roots and by helping to still waves and currents. By removing mangroves, mudbanks might be destabilised and the liberated mud might be dispersed. However, mud will still tend to accumulate in the quiet waters of the upper, sheltered margins of estuaries, whether there are mangroves there or not. It is fair to say that some mud will indeed disappear, to turn up in other parts of the estuary or to be carried out by tidal flows through the mouth of the estuary to the open coast.

Do fish use mangroves in New Zealand?

Overseas, mangroves are considered to be important nurseries for coastal and inshore fisheries, because they provide food (e.g., small worms) and shelter for numerous species of crustaceans and fish, especially juveniles. In some tropical mangrove forests (mangals), which can have up to 30 different species of mangrove, 90% of the fish present are obliged to spend part of their life cycle in the mangal. In New Zealand, there is less information available on how fish use mangroves, but research in progress is filling in some of the blanks. While it appears that fish species diversity is less than in some other estuarine habitats (e.g., seagrass beds), there are several species that do use mangrove channels, such as yellow-eyed mullet, grey mullet, smelt, and anchovies. The effect of estuarine water and habitat quality on fish usage of mangroves in New Zealand is not well understood yet – we have much more to learn about how fish "regard" mangroves in sediment-impacted estuaries before we can draw conclusions.

Are mangroves useful resources for people?

Mangroves are highly prized resources in other parts of the world, being used for timber, firewood, food, and coastal protection. This is not so in New Zealand.

Are New Zealand mangroves different from mangroves in warmer climates?

New Zealand mangrove forests are composed of a single species and individuals tend to be smaller than elsewhere. There is a strong trend in tree size from the north (where they are relatively big) to the south (where they are relatively small). These special features of our local scene mean that not all overseas research necessarily applies to New Zealand, and to assume that it does could be misleading.



Are mangrove spread and sediment runoff from the catchment related?

As in the rest of the world, there are many environmental factors that determine where and how fast mangroves grow in New Zealand. These include salinity, temperature, sea level, suitable substrate, and the supply and availability of nutrients. Although the relative importance of these factors varies from location to location, there is one common element: where there is an accelerated rate of mangrove spread in an estuary there will also have been an increased sediment runoff from the catchment that drains into that estuary.

Are mangroves weeds?

A weed is a plant in a place where it is not wanted, which is a value judgement made by humans. In the estimation of some people, mangroves are indeed weeds.

Are mangroves worthless?

Do not confuse being called a weed with being worthless. Mangroves serve physical and ecological functions, which may vary from place to place.

On the ***physical*** side, mangroves stabilise sediments that might otherwise cloud waters, settle in other parts of the estuary, or be flushed out to sea. Roots, trunks, and pneumatophores along with fallen leaves and twigs provide surfaces capable of trapping sediments. They also impede water movement, which further promotes sediment deposition. In these ways, mangroves help to maintain water clarity. Mangrove decline or eradication may, therefore, cause increased turbidity, and leave shellfish beds, seagrasses, and fish habitats elsewhere in the estuary more prone to smothering and siltation. On the other hand, by accumulating sediments and slowing water movement, mangroves help to reduce estuary flushing by tides. This might hasten the natural fate of the estuary, which is to fill with sediments and become a freshwater swamp or wetland.

On the ***ecological*** side, mangroves contribute to the species and habitat diversity of New Zealand estuarine ecosystems. Microscopic bacteria decompose leaves dropped by mangroves, thereby recycling nutrients in the estuary and making them available for other photosynthetic organisms (e.g., algae). These in turn are significant sources of food to animals that live in the sediment, such as crabs, snails, cockles, and worms. Mangrove trees also provide anchorage surfaces for filter-feeding organisms such as black mussels, small barnacles, rock oysters, and Pacific oysters. Carnivorous scavengers and predators, such as mudflat whelks and snapping shrimp, form another strand in the food web.



Whangapoua

What is the ecological issue here?

Mangroves do have intrinsic worth, but it is not easy to compare that with competing values. It is true that the number of species found in mangrove stands and associated sediments is lower than on adjacent intertidal sandflats, but the community composition (the types of animal that make up the community) is quite different. Sandflat communities have a higher proportion of shellfish than muddy areas, but relatively more worms live in mud. The only safe conclusion is that the ecological function of mangroves is different from the ecological function of sandflats. When mangroves spread, they do so at the expense of other habitats, and the value – ecological and human – of those habitats that are consumed is lost. The habitats that yield to the spread are the lower intertidal and subtidal zones, which people prize for kaimoana, recreational opportunities, and aesthetic reasons. On the other hand, mangroves are a natural, valuable part of the estuarine ecosystem, and spreading is a natural part of the way an estuary "ages". The problem here is that it is all happening too (unnaturally) quickly. Left alone and with unrestrained soil erosion in the catchment, mangroves will continue to spread. Eventually, the tide may turn against the mangroves, and the part of the estuary that they once inhabited may turn into swamp or land.

What would happen ... ?

Option 1. If we turn the clock back

Goals

- Remove all (or almost all) mangroves
- Restore sandy beds and clear water with corresponding animal life and improved human amenity (views, access, aesthetics, recreation, commerce)

Pros	Cons
Maximum improvement in human amenity	Probably not fully or easily achievable
Retain and restore sandy habitats (and their attendant ecological values) that are currently being consumed by mangroves. May lead to overall increase in estuary biodiversity	Physical functions of mangroves lost (mud presently bound up in mangroves may be released and dispersed, possibly to affect other habitats and the water column)
Possibly allow sediment that is presently building up in estuary to be flushed out to sea	Ecological functions of mangroves lost
Create opportunities to restore areas of saltmarsh	Trampling of adjacent habitats during initial and maintenance works if not properly organised and managed
Depending on level of participation, a sense of ownership and understanding of the ecosystem is fostered within the community	Maximum (and very likely unacceptable) cost

Are goals achievable?

Goals cannot even be approached without effective sediment controls (e.g., earthworks, riverside management, urban stormwater) in place in the catchment. Even with effective sediment controls, existing silt may tend to re-accumulate in sheltered, upper reaches of the harbour. The bed is, therefore, unlikely to turn sandy after mangrove removal. However, that may not be true in areas with natural physical processes that prevent mud buildup (e.g., exposed to predominant winds that generate waves that scour the seabed clean). Unless every single plant is removed, mangroves will try to recolonise, which will be aided by natural return of sediments to sheltered, upper reaches. Finally, water clarity may decline throughout the estuary as mud that was stabilised by mangroves is again reactivated and widely dispersed by waves and currents.

Time/effort/dollars

- Resource consent will be required
- Initial effort will be expensive (volunteer labour will reduce costs)
- Perpetual maintenance will be required

Option 2. If we draw a line in the sand

Goals

- Maintain status quo by preventing mangrove propagules from establishing

Pros	Cons
Possibly achievable, especially if effective controls on sediment erosion in the catchment can be put in place	Trampling of adjacent habitats during works if not properly organised and managed
Breathing room while catchment issues are addressed	Without erosion controls in the catchment, capacity of existing mangroves to "absorb" sediments may be exceeded in time, causing increased turbidity and increased smothering risk throughout rest of estuary
Physical functions of mangroves maintained	Human amenity only partially addressed
Loss of estuarine flushing capacity slowed	
Ecological functions of mangroves maintained	
Human amenity maintained in some areas	

Are goals achievable?

Possibly, with a commitment to ongoing maintenance.

Time/effort/dollars

- Resource consent ***might*** be required
- No large initial effort and expense required
- Regular maintenance will be required (may reduce over time)



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Option 3. If we let nature be

Goals

- Allow estuary to age naturally

Pros	Cons
Achievable, but ...	... ageing may not be "natural", due to the disturbance of the catchment. Intervention may be appropriate to maintain ecological functioning and biodiversity of the estuary as a whole
Physical functions of mangroves maintained	Loss of other estuarine habitats and their attendant ecological and physical functions (shellfish beds, seagrass beds, flounder fishing areas, wading and diving, bird habitats)
Continued trapping of terrestrial sediments or contaminants	Loss of human amenity (access, kaimoana, aesthetics, recreation, commerce)
Reduced erosion of shorelines and stream banks	
Creation of coastal land for development	
Ecological functions of mangroves maintained	
Minimum cost	

Are goals achievable?

It is obviously easy to "let nature be", but "natural ageing" may not be the result in what are already sediment-impacted estuaries. Intervention may be appropriate and effective.

Time/effort/dollars

- None

The fourth way

There is another option: managed control (or "total estuary management"). For example, nature might be left alone to run its course in the estuary, but strong controls could be placed on sediment erosion on the land to retard the estuary ageing. Where mangroves are important for coastal protection, they can be left alone, but where overriding values relate to access or open-water views, an eradication or control scheme might be started. The fourth way may often be the smartest way, and it is becoming increasingly viable as we learn more about mangroves and the way estuaries work, and as we collect our experiences to date on attempts to control mangrove spread.

What is missing?

Usually, local knowledge. If every estuary or every part of an estuary were the same, then we could write the textbook on mangroves and that would be the end of the story. But that is not the case. Instead, we need to "tweak" our understanding and our expectations for each local setting. For instance, Option 1 may be viable in an embayment that is exposed to the region's dominant wind. This is because waves kicked up by the wind may readily scour the mudbanks that would remain behind after clearing of mangroves. An important early step in preparing any management plan is to develop an understanding of the local setting.

Where to from here?

Most importantly, mangroves cannot be adequately managed on an individual or uncoordinated basis; individuals need to band together to achieve a result.

The coastal marine area is Crown land, administered by the Department of Conservation and regulated by regional councils under regional coastal plans. Some district councils also regulate through by-laws down to mean low-water spring tide. Many estuaries have esplanade reserves or strips on the land bounding them, which are the responsibility of district councils. Numerous people might have interests in any given estuary, including those who live next to it, have a view to it, or use it for recreation. Maori have long used estuaries for food gathering and cultural resources. A successful estuary management plan will be based on the constructive involvement of all interested parties, rather than simply the opinions of one or two people. Long-term support will be required of the whole community. Acting individually or in isolated groups can lead to polarisation within the community, conflict, and even legal challenges.

What can you do if you are concerned about the state of your estuary? Here are some suggestions, based on the experiences of existing community groups.

1. Talk informally to neighbours and local marae representatives to find out their interests and concerns.
2. Find out what information the regional and district councils hold about the estuary, including regional and district plans and rules. Councils can often provide useful maps and aerial photos.
3. Call a public meeting to hear what others have to say, and build a shared vision for the future. What do you value about your estuary? The wildlife, boating opportunities, kaimoana, walking access, open-water views? How do you want your estuary to be, say, 10 years from now?
4. Focus on wider issues beyond mangroves; think about cause and effect, including changes required in the catchment to reduce silt loads. Identify potential ways of achieving your vision, and pick your first steps.
5. A community group can be formed to develop and implement a plan, and to maintain communication with agencies and the wider community. Group members should always seek to base decisions on sound information, discussion, and understanding of legal requirements.
6. An independent facilitator can be valuable in meetings to keep discussions on track and to ensure all parties are heard, particularly if views are diverse. A facilitator may also be able to help you find advice and resources, and to build relationships with agencies and other parties. In Tauranga Harbour, the NZ Landcare Trust is providing such support to Waikaraka Estuary Managers and other landcare groups. Similar support may be available in your area.

Concluding remarks

Sediment-clogged estuaries and coasts are symptoms of a problem that began on the land hundreds of years ago when New Zealand's forests were burned and cleared. True solutions, therefore, must include the catchment. Regional councils have at their disposal numerous statutes that can be brought to bear on the problem, and there are many devices and practices that can be used to control soil erosion. Statutes need to be enforced, and strengthened if inadequate. Erosion controls need to be used on land, and used properly. Discharges into estuaries must be controlled and managed. To truly effectively protect, restore, and enhance your local waterway requires you to become involved in the management of the catchment as well.

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