The New Coast: How can an environmentally sustainable model of coastal development be developed?

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A research by design project submitted in partial fulfillment of the requirement for the degree of Master of Landscape Architecture, Unitec Insititue of Technology, 2015.

Abstract

How can we sustainably develop the coastline as a part of urban area for the future? How can we develop the coastline with environmental tourism? This project is about developing the coastal zone for tourism in environmentally sustainable ways, and also about protecting the lifestyles of local residents. Auckland is a world-famous city, 70% of the city's area consists of coastal waters. Geographical features show that Auckland is a coastal city, with many coastal resources; nevertheless most of Auckland's coastline is still in an undeveloped state, and some beaches show natural erosion or man-made pollution. Most coastal cities around the world develop their coastline as a regional priority, because of economic and environmental factors. As a coastal city, Auckland has great potential for development in this area, whether from the perspective of urban development or ecological protection or basic services for residents. On the other hand, with the rapid development of urbanization in Auckland, land has become the main reason for limiting the future development of Auckland. For New Zealand as an island country, its coastline is the most abundant resource, which may also add to Auckland's future development and provide a valuable reference.

As the largest city in New Zealand, Auckland has been a transit point for tourism, coastal development may be a great help. In maintaining this potential economic resources as a driving force for urban development, this project is based on these questions and deals with them through the development of environmentally sustainable ideas for landscape architecture design practice. This topic also includes; aesthetics, recreation, leisure, early investigation of sociological and ecological features, the involvement of coastal stakeholders and the local population in the planning process, exact site selection and environmental design.

Designing an environmentally friendly coastal zone will further enhance the ability of stakeholders to better develop and protect coastal zones and form a new consensus is the aim of the research. The design methodology is based on an environmentally sustainable development concept that includes both social and environmentally sustainable development. Through the process of finding a test site in the coastal region and creating a new environmental analysis model, a new design model has been created.

The main objective of the project is to create a new methodology to be used as a reference in the environmental assessment of coastal areas, The results will drive both coastal settlement design methods and regional economic development, thus helping in the planning for the future development of the larger coastal zone.

Key words: Coastal Zone, Environmentally sustainable tourism, Regional development interaction, Sustainable development.

Declaration of work

I confirm that:

• This Thesis represents my own work.

• The contribution of supervisors and others to this work was consistent with the Unitec Code of Supervision.

• Research for this work has been conducted in accordance with the Unitec Research Ethics Committee Policy and Procedures, and has fulfilled the requirements set for this project by the Unitec Research Ethics Committee (Application number 2013-1075).

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Date: 6 October 2015

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1.0 Introduction

1.0 Introduction

From the world view, there are a lot of big cities close to the ocean, such as New York, Tokyo, Shanghai, Hong Kong, Singapore and Sydney. These cities rely on their own geographical advantages in their development processes, either to become an international or national trade centres or financial centres. However, some other coastal cities choose a different strategy for development, such as Miami, Los Angeles, Barcelona, Venice, Gold Coast or Honolulu, which have all become famous tourist destinations, attracting global travel enthusiasts.

The coastal city of Auckland, New Zealand's largest city and the centre of finance, transport and education, is currently in the process of expanding. There are many development issues and challenges, especially in terms of transportation, infrastructure and urban development.

This research project will give an example of coastal zone development strategies causing changes in local economies, with an aim of drawing on experience in landscape architecture practice to create an environmentally sustainable coastal zone.

Based on international cases of development of coastal areas, tourism is an important driver, but the effect that this kind of urban development has on original natural ecological coastal zones has often, lead to a series of man-made disasters, which affect the lives of local residents, transport and accommodation, as well as causing environmental damage. One response has been to develop Ecotourism. The International Ecotourism Society (TIES) in 2015 defined environmentally sustainable tourism to mean responsible travel to natural areas that conserve the environment and improve the wellbeing of local people.

This project will create a virtuous cycle system that will build sustainable development through coastal projects promoting the development of the city, in order to better maintain Auckland's character. This will include a specific project design, and a search for the same situation elsewhere in the world.

1.1 Research question

How can we advance an environmentally sustainable coastal development?

How can environmentally sustainable tourism be used to preserve coastal zones?

1.2 Rationale

Hansom (1988) notes: "The coastal zone includes the land-sea-air interface zone around continents and islands and is defined as extending from the inland limit of tidal or sea-spray influence to the outer extent of the continental shelf." (p.10)

Coastal zone development has always been important in the world. However, due to human activity and other reasons, coastal zone ecosystems have been under great threat. To solve these potential challenges, coastal zones need sustainable ways to be developed in the future. "New Zealand has a long and diverse coast, and it stretches some 19,883km. About 700 years ago, Maori first arrived in this land and the coast zone provided most food and living places." (Peart, 2005, p.5). Therefore, coastal zones are not a simple concept for this country; they are important constituent elements of this place. As the fastest-growing region in this country, Auckland has many potential coastal resources.

Development of coastal areas in the world has always had a lot of attention, both in the past and the present, and people through a variety of methods have developed the coast's edge. Because of the relationship between human beings and water, or because of we have a long history of developing coastal zones for activities such as transportation, food gathering, or trade exchanges the coast has been an important zone. (Whitney, 1994).

There are many developed coastal city examples around the world (Han, 1999). It is worth looking at these examples to study both the advantages and disadvantages of coastal zone development experiences. Dubai is one such example. A lot of people think that this city has a luxury lifestyle and people bring a huge amount of wealth. However, from the point of view of the surrounding natural environment, the desert environment has becomes fragile. The Dubai government is developing the city as a coastal tourism destination. The development of Dubai includes artificial islands as a new driving force for urban development, for example, Palm Island and World Islands (Smit, 2005). Through the construction of artificial islands, the local government is increasing tourism to attract people around the world who love the sea, who want holiday homes, and is achieving unprecedented success.

The Gold Coast, in Queensland, Australia, has a natural advantage in its 40km-long natural sand beach, and the infrastructure to attract investors from around the world, with high-rise buildings for people who want to enjoy the sea This coastal region tourism project has attracted a lot of tourists (Coiacetto, 2009).

San Ya is an emerging tourist city on Hainan Island, China's second largest island. The government set a policy for San Ya as a coastal city based around tourism. It has many excellent natural resources, and major developments in real estate investments as well as education and tourism-based projects (Han, 1999).

From the above cases, we can see that these coastal cities have been developed in different ways to achieve different goals. To enhance the economic value of coastal zones through artificial islands (Dubai), using natural geographical conditions in coastal areas for the construction of a variety of recreation options (Gold Coast), and using national policies to support` the development of coastal areas (San Ya). However, from the perspective of sustainable development, these developments are flawed. For Auckland, the bodies involved in decision-making should learn from these examples of coastal development and be aware of challenges and problems in the development of coastal areas.

As an island nation, New Zealand has a number of excellent coastal areas, and has successfully developed a number of coastal resorts, ports and coastal towns. According to the report of Aecom Global Cities Institute (2012), Auckland is the largest coastal city in the entire country and the development of existing coastal areas is successful.

However, the people responsible for the future development of Auckland should be aware of its unique geographical environment and the desirability of developing sustainable urban development model.

Auckland has a unique geographical environment, resulting in a large number of excellent bays and beaches, which have been developed either for residential areas, or as regional parks, ports and industrial areas. Although there is potential opportunity for the development of Auckland coastal areas, there are some new considerations, such as preserving the existing ecology and ensuring sustainably development. While the development of coastal areas can make a success out of the abovementioned aspects, there are many issues that also need to be studied and discussed, of which the sustainable development of coastal areas is critical. Around the world, there are many research institutions that have specifically studied and discussed this issue.

My research aim is to create innovative solutions to help in the sustainability development of Auckland's coastal area. The research outcome will provide an environmentally sustainable coastal zone development model that will assume a sustainable or ecological value by testing different design approaches and solving problems that may arise.

2.0 Literature Research

2.0 Literature Research

This chapter will provide a review of sustainable development research and the key factors relevant to the coastal development; I will then discuss coastal ecology and environmentally sustainable tourism. The ambition of the research project is to lead to a broad discussion on environmentally sustainable development issues in coastal zones.

The main areas of literature and case studies include three aspects:

- Sustainable development
- Coastal ecology
- Environmentally sustainable tourism

The ways of searching these aspects will include:

- Searching the books and journals related to research in the field
- Query and browse through online resources
- Searching a specific case as a reference and summary

2.1 Sustainable development

The sustainable development model put forward in 1980 has been widely promoted around the world. While the main direction of this research project is environmentally sustainable coastal development, the concept of sustainable development will be used as a major guiding idea for the entire project.

Specifically, the review of sustainable development will be carried out in three main areas, starting with a sustainable development definition and cases. This will be followed by a discussion of two key factors in sustainable development, which are environmental sustainability and social sustainability, plus discussions and study of their application in coastal areas.

2.1.1 Definition and cases

'Sustainable development means meeting the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987, p. 43)."

Based on respecting the natural environment, sustainable development has always been important for coastal zone development. Sustainable development does not mean slow development; it is more concerned with protecting the environment during the development process. In fact, sustainable development has been used differently in many cities and places in the world.

For example, Adelaide, Australia, has used the sustainable development concept for the redevelopment of the center of the city, and to address environmental issues (Peart, 2005; Miguel, R, 1999). The guiding principles of this project are to reflect ecology and promote social equity. There are several cases of how sustainable development can be applied to urban planning.

Williamsburg, Virginia, USA: The new town of this city has followed sustainable development ideas, keeping the balance between human

societies and the natural environment.

Seattle, Washington, USA: The whole city was planned for all aspects of sustainable development concepts, including environmental assessment and social assessment.

Arnhem Land, Northern Territory, Australia: This new tourist resort has been designed as a sustainable destination, without the trappings of traditional tourism. The resort offers a new wilderness experience for tourists and reduces the impact on the natural environment.

To summarise, using the concept of sustainable development, these examples have developed different approaches, these methods include the following:

- Balance: As the core of sustainable development, 'balance' plays an important role in testing the development result, for example, how to balance human activities and natural ecosystems, population, transportation, energy resource usage and so on. This project aims to find an environmentally sustainable method for coastal zone development, which will achieve environmental protection and develop a mutual balance to guide the principle of coastal zone development.
- Quality: The quality of a development is the character of sustainable development. This also applies to the standard of construction in the development process. The quality of a sustainable development also has other features, such as efficient use of resources and more effective implementation plans.
- Long term: Any sustainable development projects are not short term; they are always accompanied by a long period of planning and implementation in order to achieve the final desired result. Long-term sustainable development is not just for environmental protection and recovery, but it returns an economic benefit as well. As sustainable development continues, environmental health and economic benefits will also improve, thereby promoting the development of the local community.
- Renewability: Renewability is a result of sustainable development and is an ideal tool for coastal zone development. In addition, renewability includes recycling, reducing pollution and reducing development costs.

2.1.2 Environmental sustainability

Environmental sustainability has been defined in different ways. Munasingha, M & Shearer, W. (1995, p. 6) have defined it as "environment sustainability means maintaining or importing the integrity of the life supporting systems of the earth". This focuses on bio-geophysical aspects, and through bio-geochemical integrity emphasizing environmental sustainability, protecting natural environmental resources such as air, land, water and plants. Another writer shows environmental sustainability as the ability to manage the qualities that are promoted in the physical environment (Sutton, 2004). This definition considers that humans can improve the sustainability of natural systems. Both explanations are relevant to sustainable coastal development, which uses planning and the creation of reasonable environmental conditions to protect coastal areas in a diverse natural ecological system.

According to the Environmental Strategy for the First Decade of the 21st Century (The Organization for Economic Co-operation and Development, 2001) there are four specific criteria for environmental sustainability:

- Regeneration (Renewable resources shall be used efficiently and their use shall not be permitted to exceed their long-term rates of natural regeneration)
- Substitutability (non-renewable resources shall be used efficiently and their use limited to levels which can be offset by substitution with renewable resources or other forms of capital)
- Assimilation (releases of hazardous or polluting substances into the environment shall not exceed their assimilative capacity)

- Avoiding irreversibility

These criteria are used in the development of a research methodology to shape the environmental sustainability criteria and guide the coastal zone investigation.

2.1.3 Social sustainability

Social sustainability is an important part of sustainable development,. Black defined social sustainability as “the extent to which social values, social identities, social relationships and social institutions can continue into the future.” (Black, 2004, p.33-44). Gilbert (1996) believed that social sustainability is the cohesion of society and its ability to work towards common goals.. Individual needs, such as those of health and well-being, nutrition, shelter, education and cultural expression should be met.

The two definitions show different views of social sustainability, which include different evaluation criteria and the associated practical applications. For instance, the criteria of socially sustainable development values, the connection of social development and socially sustainable development to meet individual needs. These criteria can be applied to coastal regions. As another criterion for understanding and developing the regional coastal environment, social sustainability will also be used in the research study.

2.1.4 Summary

A sustainable urban development plan will provide a solution to the process of economic development, but will also protect the city’s original ecosystem. As a developing city, Auckland will encounter a variety of challenges as it develops rapidly and environmental change occurs. (Aecom Global Cities Institute, 2012)

Sustainable development has been advocated by various countries in the past decade, for both the country and the city. Sustainable development and urban planning theory also raises questions about sustainable development in terms of urban development concepts (Kates, Parris, & Leiserowitz, 2005).

Understanding the sustainable development approach will guide this research project to an analysis of the coastal zone environment and future development trends. A new sustainable coastal development model can also be developed from the study of sustainable development theory.

2.2 Coastal ecology

This section identifies the ecological characteristics of coastal zone, and discusses the practical ecological impact from coastal zone development, so as to further discuss how to establish a sustainable coastal development model.

2.2.1 Coastal environment

“The coast is the area where the land and the sea meet.” (Peart, 2005, p.3). Coastlines create a unique ecology system, which can be influenced by both sea and land. Raewyn Peart (2005) discusses that the term “coastal environment” normally includes three types of areas:

- The active coastal zone - where waves meet the shore (coastline)
- The land backdrop to the sea - that usually extends at least to the top of the first inland hill. It may also include more extensive

land areas where salt water, dunes and salt-laden winds influence the ecology of the land

- Near shore coastal waters - that are affected by land processes such as sediments and pollutants washing from the land into the sea

In this project, coastal zone means the 'land backdrop to the sea', it has a wide range of coastal areas, and therefore it also includes various ecological systems. For instance, in this research, the coastal zone includes inland hills, rivers, dunes and salt marshes, therefore it also includes different kinds of vegetation and animals. However, because of human activities, coastal environments have experienced a lot of challenges.

2.2.2 Coastal Development

"Coastal areas are the most dynamic portions of the global ecosystem and also the most subjected to population concentration." (Willis, I. 2007, p. 76)

As a result of its special natural environment, coastal areas attract many people to visit and live. There are many famous coastal cities in the world, however these cities rate differently for the ways the coastal area protect the native ecology Coastal development is one of the important factors affecting coastal environmental changes. Three coastal cities show different examples of coastal development.

- Gold Coast

Prideaux (2004, p. 40) believe that "Tourism is largely responsible for the development of the Gold Coast." As a world-famous tourism destination, Gold Coast now attracts thousands of domestic and international visitors. In 1981, it was a small coastal town in Queensland, but it has now grown to be Australia's sixth largest city with a population in excess of 500,000, with more than two million tourists visiting annually, and bringing in more than $1 billion in revenue (Gold Coast City Council, 2014). These achievements are the result of tourism development in the coastal area.

Gold Coast- Surfers Paradise Skyline (Burns, 2012)

The other result of the development of tourism on the Gold Coast is that the coastline is now covered with many resorts and high-rise residential areas, all forming a high-density urban space. Prideaux (2004) argues that the original Gold Coast environment was sited on a narrow coastal plain, and surrounded with a series of mountain ranges with a diverse range of flora and fauna. By developing resorts, the natural environment on the Gold Coast has changed. A large number of beaches and coastal areas are occupied by high-density buildings to meet commercial needs, and the cost is changes in the natural coastal environment.

- Dubai

Dubai Palms (Achim,2014)

As a global city, Dubai has had many different development stages. From 1890-1930, Dubai relied on coastal resources and the maritime transport industry as the main way to achieve economic development. The discovery of oil in 1966 brought Dubai to a high-level development stage, making it into a modern city. However, due to limits on the economic contribution of the energy industry, by the late 1980s Dubai began a transformation away from being an oil-based economy, to intense urban development, with a focus on tourism and the retail industry (Sharpley, 2008). As a desert region, Dubai has a very harsh natural environment, therefore its coastal zone has become an important tourist destination for development. Dubai's coastal development is based on the creation of artificial islands, purpose-built resorts and retail to attract visitors from all over the world. For example, Palm Island, World Islands and a series of coastal developments make Dubai the world's seventh largest major tourist destination, in 2015, the country recorded over 15 million visitors (Balakrishnan, 2008 & Sanbidge, 2009).

Dubai itself has a desert environment, so the development of the large artificial islands project has increased its coastal environment, and enriched its coastal landscape. However, from an environmentally sustainable development perspective, these developments have created many problems such as the destruction of the original oceanic ecosystem.

San Ya, Phoenix (Kovaleva, 2o12)

- San Ya

San Ya is an important tourism destination due to its natural and cultural attractions and burgeoning accommodation industry (Xie & Wall, 1999). It is located in Hainan - the only tropical island province of China. San Ya Bay encompasses a high diversity of natural habitats, such as coral reefs, rocky and sandy shores and mudflats to mangroves (Huang, et al, 2003). In 1993, with the nation's economy taking a 'soft landing', the tourism industry became the pillar of this coastal city. San Ya has been transformed by its tourism infrastructure and the construction of facilities, and this small town is now a modern coastal city (Li, 2003). In 2014, San Ya attracted over 40 million overnight visitors, and tourism generated over $7.8 billion (XinHua News Agency, 2015).

However, San Ya differs from other coastal development regions, relying on cultural and environmental tourism as the main driving force. For example, Nanshan Culture Tourism Zone highlights China's Buddhist culture, Tianya Haijiao ('edge of the sky, rim of the sea') features a unique geographical environment and Taoist Fairyland Park reflects the traditional Chinese Taoist culture. Tourism has also created many challenges for San Ya's coastal environment, urban sprawl has brought high-density residential construction and a substantial transformation of the natural environment, destroying original natural ecosystems. Local residents' lack of environmentally sustainable development awareness, as well as the government's policy have resulted in a lack of effective management of coastal development in San Ya (Graci, 2010).

2.2.3 Conclusion

Coastal development in the world has many different patterns. This section introduces the Gold Coast, Dubai and San Ya, as three case studies where it can be seen that the tourism industry offers a lot of advantages in coastal development. However, these case studies also show that coastal development has brought many disadvantages in terms of coastal environmental changes. This project will follow the theory of environmentally sustainable development to put forward a sustainable development model for the coast. 2.3 Environmentally sustainable tourism. This section aims to understand the definition and characteristics of environmentally sustainable tourism, and analyse its advantages in coastal zone development. The research will also discuss the ways in which environmentally sustainable tourism criteria can be applied to the development of a research methodology study.

2.3 Environmentally Sustainable tourism

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2.3.1 Definition:

The World Tourism Organisation (WTO) definition of sustainable tourism is: "Environmentally sustainable tourism development meets the needs of present tourists and host regions while protecting and enhancing opportunity for the future". It is envisaged as leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems (World Tourism Organization, World Travel and Tourism Council, and the Earth Council, 1996). "Nature-based and heritage-orientated tourism is given considerable prominence in New Zealand's domestic and international tourism marketing strategies." (Cater & Lowman, 1994).

However, another explanation of environmentally sustainable tourism is Butler's definition: "Tourism which is developed and maintained in an area (community, environment) in such a manner and such a scale that it remains viable over an indefinite period and does not degrade

or alter the environment (human and physical) in which it exists to such a degree that it prohibits successful development and wellbeing of other activities and programs (Butler, 1993, p. 29). In summary, environmentally sustainable tourism can contribute to the development of a sustainable development concept

2.3.2 Environmentally sustainable tourism advantage with coastal zone development

With the rapid development of tourism, the ensuing environmental damage can be very serious. In order to both meet people's needs and protect ecologically sustainable development, environmentally sustainable tourism has become the ultimate choice.

According to the definition of environmentally sustainable tourism, it can be used as an important means to balance economic development and environmental protection. The United Kingdom's Department of Environment has developed guiding principles for environmentally sustainable tourism strategies (as cited in Hassan, 2000):

- The environment has an intrinsic value that outweighs its value as a tourism asset. Its enjoyment by future generations and its long-term survival must not be prejudiced by short-term considerations.
- Tourism should be recognized as a positive activity with the potential to benefit the community and the host site as well as visitors.
- The relationship between tourism and the environment must be managed so that the environment is sustainable in the long term. Tourism must not be allowed to damage the resources, prejudice its future enjoyment, or bring unacceptable impacts.
- Tourism activities and developments should respect the scale, nature, and character of the places in which they are sited.
- In any location, harmony must be sought among the various needs of visitors, the place, and the host community.
- In a dynamic world, some change is inevitable, and it often can be beneficial. Adaptation to change, however, should not be at the expense of any of these principles.
- The tourism industry, local authorities, and environmental agencies all have a duty to respect these principles and to work together to achieve their practical realization (Hassan,2000, p. 243)

These criteria clearly shows the advantage of environmental protection and of having a sustainable development plan. In addition, Honey, M (2008) argues that sustainable tourism should have these characteristics: involve travel to natural destinations, minimize impact, build environmental awareness, provide direct financial benefits for conservation, provide financial benefits and empowerment for local people, respect local culture, support human rights and democratic movements.

Coastal development is usually accompanied by damage to the natural environment to achieve human needs, while ignoring the many potential environmental problems, such as climate change (Hitchcock, et al, 2012). However, there is research showing that environmentally sustainable tourism is a good way to address those problems. For example, Weaver (2011) argues that environmentally sustainable tourism builds destinations to become 'carbon neutral', helping to survive climate change. Loppolo, et al (2012) also argues that environmentally sustainable tourism can enhance the value of the coastline resource as well as offering environmental protection.

2.3.3 Criteria of environmentally sustainable tourism

The definition of environmentally sustainable tourism includes environmental protection as well as tourism development. Hassan (2000) argues that an environmentally sustainable tourism plan should aim to achieve the following goals:

- To promote an awareness and understanding among key stakeholders (e.g., citizens, developers) of the critical link between any tourism development effort and sustaining the environment;
- To promote equity in the development opportunities among local and international developers of quality tourism projects;
- To maximize tourist satisfaction through the delivery of total quality experience;
- To broaden the support from the host community through citizen/NGO involvement programs;
- To develop and sustain the quality of life for the local communities;
- To provide balance among economic, social, and environmental needs in all tourism planning and development programs;
- To define the limitations to tourism development in terms of both physical and social carrying capacity of each destination;
- To develop high-quality environmental impact assessments for both existing and proposed tourism developments;
- To maintain the local culture and promote the image of its values, heritage, traditional way of life, indigenous behavior, and local sociopolitical fabric; and
- To enhance the development of the human resource base in tourism through management, education and training.

These conditions can serve as a guide to develop criteria for environmentally sustainable tourism development. They will be used for developing specific criteria for environmentally sustainable tourism that can be applied in this project (Hassan, 2000, p. 244)

2.3.4 Summary

By understanding the definitions of environmentally sustainable tourism, we can further define the methods and advantages. Using these theories and case studies to identify the way environmentally sustainable tourism works is a better way to achieve sustainable development in coastal zones.

2.4 Conclusion

The literature review has been divided into three parts.

The first part is understanding the definition of sustainable development , learning about environmental sustainability and social sustainability criteria. These criteria will be used to guide the development of a coastal zone sustainable development methodology and design process.

The second part is to understand coastal zone ecological conditions, as one of the main causes affecting the coastal environment. Then, through the study of different cases of coastal development we can show coastal environment changes.

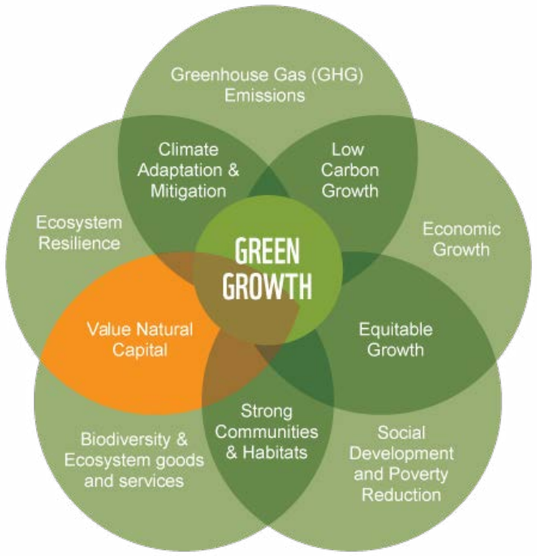
Thirdly, by understanding the definition of environmentally sustainable tourism, its application and criteria can be used. These ideas will help develop the research methodology, to address the research question.

The literature review study will further improve the understanding of the purpose and background of this project

3.0 Methodology

3.0 Methodology

3.1 Introduction



Green Growth (Pannadopoulos ,2013)

This research methodology has been developed from the literature review study, which includes the topics of sustainable development, coastal ecology, environmentally sustainable tourism. The research methodology will help guide; the site selection, design application and programme planning. Specifically, this research methodology will be divided into four aspects.

- Firstly, sustainable development theory will help in understanding the importance of both environmental sustainability and social sustainability in coastal zone sustainable development. Criterion from this study will guide the investigation and resolution of the coastal zone's design case study.
- Secondly, discussing the sustainable development model will help guide the coastal zone case study planning.
- Thirdly, summarising the environmentally sustainable tourism criterion will help in the development for of the coastal zone case study design .
- Finally, the methodology will guide the explanation of the data collection and analysis.

3.2 Coastal zone's sustainable development criteria

It is important to understand each element of coastal zone sustainable development., Through the study of environmental sustainability and social sustainability –a sustainable development criteria will be developed. These criteria will be used to analysis each coastal zone's development conditions. The criteria will also help identify the optimal sustainable development conditions of the coastal region to connect to the design approach.

3.2.1 Environmental sustainability index

As the key factor for driving regional sustainable development, environmental sustainability will also be used in the coastal zone development process. The report on 'How to understand and measure environmental sustainability indicators and targets' (Moldan, Janoušková, & Hák, 2009, p. 6) show that: "The environmental sustainability is correctly defined by focusing on its bio-geophysical aspects, which means maintaining or improving the integrity of the Earth's life supporting systems. "

Coastal zone development is often accompanied by huge environmental costs, for example, soil erosion, climate change with the resultant rise in sea levels, sediment pollution, and negative impacts of ill-considered coastal development.

Therefore, to better develop coastal zone sustainable development strategies in this project, environment sustainability should be considered more than historical evidence. . Environmental sustainability criteria should include the following aspects:

- Natural flora and fauna (native forest, planted forest, grassland, mangrove, marine area, significant wading bird area)

The presence of natural flora and fauna is the main part of environmental sustainability criteria that will directly affect the development of the coastal zone. Protecting the distribution of natural flora and fauna and enhancing its renewable abilities are very important for the environmental sustainability of the coastal zone.

- Geography character (Wetland, river, contours, slope)

To understand the topography of a region is the most important task for the regional planning of coastal zones. Special terrain conditions such as sand dunes, or cliffs limit many urban development strategies.

Potential natural disaster (Flood, Sea level rise, Erosion)

Natural disasters are one of the main hazards affecting environmental sustainability, therefore to distinguish between different types of potential hazards and their impact areas will provide an important reference for coastal zone environmental sustainability.

Summary

Environmental sustainability is based on the analysis of the distribution of natural environmental conditions and potential hazards. Coastal areas are a special case, so there environmental sustainability needs to be considered in a sustainable development strategy. Specific environment sustainability criteria for the design case studies of coastal development include;

- Avoid ecologically sensitive areas such as wetlands, forests, rivers, wildlife, wild plants.
- Consider environmental pollution and population growth. The new site will be required to be environmentally sustainable so a description of a healthy natural environment is important.
- Analysis of potential natural disasters will serve as an important criterion for selecting a site. Analysis should identify potential natural disasters (flood, sea level rise), and potentially affected areas.
- Geographical features including slope and elevation analysis (slope < 5/ Contours < 20m). will help guide building planning criteria.

3.2.2 Social sustainability index

"Social sustainability is a life-enhancing condition within communities, and a process within communities that can achieve that condition." (Mckenzie, 2004, p.12).

Social sustainability also plays a key role in guiding coastal zone sustainable development. Social sustainability mainly focuses on non-natural environmental factors, such as traffic conditions, government policy, and the historical and cultural background.

Social sustainability can be divided into five areas, including 'natural resources and values, population distribution, social ties and values, private and public space relationship, as well as the built environment and product resources'. (Mckenzie, 2004) However, New Zealand's coastal zones also have a unique social environments, as seen in the ways they are used by cultural groups, the different lifestyles, and different stages of urban development

The social sustainability criteria for a coastal zone case study, should include the following aspects:

Cultural environment (historic heritage, Maori heritage, Maori land)

The coastal zone has a unique history and cultural value in New Zealand; for example, it has been used for many purposes in the past, such as main transport routes and recreational yachting.

- Policy (conservation, local planning, land use condition, land ownership)

Policy will affect the main direction of social sustainability, for instance, the nature of land division, regional planning, and conservation planning.

- Transport (highway, airport, ferry, train station)

Transport is the connecting system for each region, transportation is an increasingly important factor in urban development. In terms of social sustainability, transport as a contact platform for coastal zone development will be an important reference.

- Population (settlement, population)

Population analysis is indispensable for social sustainability; it can directly show the level of regional development.

- Manufactured goods (crop land, marine farms)

As the foundation of an important manifestation of social behavior, this will provide evidence and data support of regional social sustainability.

Summary

The literature review shows that social sustainability is another important element for the sustainable development of the coastal zone. Analysis of coastal zone development will identify the environmental effects, helping to form better standards of sustainable development. Specifically, the criteria for social sustainability can be summarized into the following points:

- Maori culture and heritage is a special criteria in this project's site selection, especially marked Maori historical and cultural sites, according to official data on Maori reserve areas.
- Each region's future development plans, which includes regional and urban planning policy
- Modern transportation, is an important indicator of modern urban development. In addition to adding convenience for local life, it is also necessary for economic development. Therefore, the criteria for coastal site selection will include a variety of factors relating to transportation, such as the location of highways, ports, airports and railways.
- Supporting regional development through proximity to resources and industry support,
- Land ownership analysis will show land conditions for future development.
- Settlement distribution

3.3 Developing a coastal sustainable development model

The coastal ecology study shows that the coastal zone has a unique ecosystem, for instance, marine birds, marine mammals, dune systems and vegetation. However, the development of coastal urban areas often results in many structures being built along the coastal edge (Peart, 2009). Therefore, during the development of coastal zones these coastal ecosystems have to be respected.

In many coastal regions of the world, we can see that balancing protection of the ecology and developing the value of coastal zones is a big issue. It is difficult to protect the natural ecological environment of coastal areas, while developing and utilizing the areas to ensure maximum value from coastal areas. Thus, from the coastal ecology case study we can develop a new sustainable development model, and combine this with New Zealand coastal region's own characteristics to apply to the coastal zone case study.

The review will lay out three case studies (Gold Coast/Dubai/San Ya) as examples of different coastal zone development models. The review will then explain a new sustainable development model for the coastal zone case study

3.3.1 Gold Coast

The Gold Coast, as a world-famous destination, has been developed by the tourism industry as a coastal city since 1975. Tourism development has brought many achievements, for example, rapid urban development in a short time, has resulted in the Gold Coast becoming the the fifth largest city in Australia, plus gaining a large annual income from tourism.

The Gold Coast development model is to build on the coastal edge area and use this land for commercial purposes, creating a high-rise holiday resort and high-rise residential development Nowadays, the Gold Coast has over 250 high-rise buildings with good views of the coast. However apart from the economic benefits, the whole coastal region's environment has been damaged. For example, the high-rise buildings cause serious shading of the beach in the afternoon, and there is a high density of population.

In conclusion, the Gold Coast tourism model, as an urban development driver, has brought success however at a considerable cost to the environment

Gold Coast (Tourism City) = High-rise resort + High-rise resident department+ Beach Zone

3.3.2 Dubai

In the last 10 years, Dubai has undergone a massive urban transformation nowadays, for many people visiting Dubai, the first thought is of a luxurious hotel with a sea view and the unique shape of an artificial island.

Specifically, the Dubai development model uses high-value tourism projects, such as Burj Al Arab Hotel and Jumeirah Beach Hotel project to attract visitors. Through tourism it is further developing new properties such as the Palm Island and the World Islands project, thus forming a unique coastal area development.

Overall, as a coastal city developing its coastal areas, Dubai has had great success in its urban transformation, with benefits for tourism and real estate. However, from the perspective of coastal zone ecology, Dubai's planning has not met the necessary standards

Dubai (Commercial City) = High-value tourism project + Beach zone + Real estate development (Artificial Island)

3.3.3 San Ya

As a new tourist city, San Ya is becoming a very popular tourist destination in China. Unlike the other case studies, San Ya as a new coastal city has considered environmental sustainability in planning and design, such as setting greenbelt protection systems before any urban development. In addition, government policy also drives this city development, especially with regard to the tourism industry. However, the development of a tourism industry has brought a series of challenges, such as high-density residential development and tourism projects transforming the environment and destroying some ecosystems.

San Ya's development model is based on prior planning, setting up ecological protection areas and using policy-oriented tourism development as an engine of urban development, followed by the development of a large number of real estate projects to expand urban development. Therefore, the development of coastal areas of San Ya has included a certain degree of planning protection for the environment. However for sustainable coastal development, high population density and concentration of environmental pollution caused by traditional tourism should be eliminated.

San Ya (Tourism City) = Conservation Zone + Policy of tourism industry + High density resident area + Beach Zone

3.3.4 Summary

New sustainable development model

The sustainable development of coastal zones for the protection of coastal ecology is very important. The coastal zone development model case studies show that coastal land use value is better when an environmentally sustainable development plan is put in place before urban construction. Traditional tourism has had numerous environmental impacts, so the future development of New Zealand's coastal areas should consider environmentally sustainable tourism methods. According to an environmentally sustainable development standard and the coastal zone development model case study, a coastal zone sustainable development model should be:

Sustainable Development Model= Low Density Resident Development Zone+ Safe Zone (Conservation + Environmental sustainable tourism) + Beach Zone

This formula is taken from the perspective of protecting the coastal zone ecology and considering coastal zone development case studies, the aim is to plan a model for coastal zone sustainable development. This model will be used to guide the planning and design of an environmentally sustainable coastal zone.

3.4 Method of environmentally sustainable tourism

According to the literature review, the development of coastal areas is always around the development of the tourism industry. However, traditional tourism does not meet many environmentally sustainable development requirements, especially in respect of coastal ecology and local residents' lifestyle. Therefore, this project will use the approach of sustainable development in coastal areas, and the use of environmentally sustainable tourism as development criteria.

This review shows environmentally sustainable tourism criteria in coastal zone developments, and how these criteria will guide the coastal zone case study design.

"Environmentally sustainable tourism is responsible travel to natural areas that conserve the environment and improve the well-being of local people." (International Ecotourism Society, 1990).

The environmentally sustainable tourism definition clearly shows includes the natural environment and local community. In addition, the case studies of environmentally sustainable tourism show how it includes minimum environmental impact, maximum advantage for the host culture, maximum economic benefit to the host region and maximum recreational satisfaction for participating tourists. Differing from traditional tourism, environmentally sustainable tourism also considers ecological design, which means designing with nature, culture and ecology.

In this project, environmentally sustainable tourism criteria will be used when designing an environmentally sustainable coastal zone case study, based on the coastal zone environment and local community. The criteria of environmentally sustainable tourism with ecological design should include:

- Connecting with nature:
  - Located in the natural environment
  - Low impact on the natural environment
  - Respect of existing eco-systems
  - Improving the local natural environment
- Efficient use of energy:
  - New technology for saving energy
  - New type of energy use
  - Renewable technology use
- Waste and pollution management:
  - New technology for waste and pollution management
- Respecting the local community:
- Respect local lifestyle
- Respect local culture

3.5 Data collection and analysis method

3.5.1 Data collection method

"GIS is an integrated system of computer hardware, software, and trained personnel linking topographic, demographic, utility, facility, image and other resource data that is geographically referenced." (NASA).

This research uses GIS (Geographic Information System) as the data analysis tool. It has been used for many academic studies, such as relating information from different sources, data representation, and data capture. In this project, GIS will be used for data analysis and the design

process.

3.5.2 Data analysis method

In this research project the data analysis method will include three steps. Firstly, it is based on the research range searching different data resources. Secondly, it uses the GIS analysis tool to form the data into maps. Using sustainable development criteria, the maps will show coastal regions with potential for sustainable development. Lastly, by visiting each potential site the author will ground truth the GIS maps and identify an environmentally sustainable development sites

3.5.3 Searching resource

Based on the research project requirement, the data resource will be concentrated on the East coast of the North Island coastal zone. The data resource will include government coastal zone planning documents, local board planning documents, and online resources. These data resources come from Auckland Council documents and websites, Statistics New Zealand, New Zealand government documents, and GIS online resources.

3.5.4 Mapping

The mapping will be divided into three scales – the regional scale of 1: 1,200,000 for understanding the range of coastal environments and obtaining general information on coastal development stages. The district scale of 1: 450,000 showing more clearly the coastal zone's conditions; and specific town scale, from 1: 150,000 for surveying the coastal zone with potential for sustainable development. The maps will also include two other conditions– natural environmental conditions and urban infrastructure conditions.

3.5.5 Site visit

After the mapping analysis, the next stage will include a visit to each coastal site which has the potential for sustainable development. After visiting and photographing the sites, collecting site information, and analyzing the sites against sustainable development criteria, the most suitable coastal site for sustainable development will be identified. This process will also show how sustainable development criteria can be applied to the development of environmentally sustainable coastal zones.

3.6 Conclusion

This project will use sustainable development criteria to help define coastal zone sustainability, and understand coastal ecology. This will lead to a method to develop a sustainable development model. Finally, by using these two criterion a suitable site will be selected and use the environmentally sustainable tourism study to develop criteria to guide the site design test. This project will use GIS mapping analysis to determine both the analysis and the design

4.0 Design Exploration

1: Regional coastal zone case study

4.0 Design Exploration 1: Regional coastal zone case study - Whangarei to Whakatane

The first stage will test the research method with two design case studies, the regional coastal zone case study and a Pakiri case study. These two case studies will use the research methods as outlined to carry out the analysis of the coastal zone and use environmentally sustainable development criteria for testing how environmentally sustainable tourism can be used to preserve the coastal environment.

Regional coastal zone review

The first mapping exploration is concerned with the status of the coastal areas in Auckland and the surrounding region, by conducting investigations and data collection. The analysis is used to understand the current status of development of the coastal zones, as well as the status of the natural environment. After analysis of coastal zone data, the results will be combined with the environmentally sustainable criteria to help select a coastal zone with optimal potential for a field visit. The analysis will also be used to choose a suitable site for design tests.

The coastal zone of Auckland

Auckland is in a period of rapid development, with both the Auckland Council plan and current development plans showing it continuing to expand. North-Long Bay, West-Waitakere, South-Manukau are areas where the coastline is prominent. For instance, Orewa and Omaha have holiday homes development and new settlements in Long Bay and Weiti Bay are popular

"The Big Banana" (Bogunovich, 2013) theory shows that population density, transport and landscape factors suggest the future direction of Auckland City should be along the East Coast of the upper North Island, from Whanagarai to Whakatane. .Bogunovich suggests that a variety of natural landscapes, in particular the harbors and coasts of the Auckland region will determine the future development of the city. The Auckland region has a 3,100km coastline, 75% of the land and sea are connected, and the surrounding area has number of excellent coastal towns. How we observe and understand the development of coastal areas from the perspective of sustainable development is very important.

This phase of the case study mainly focuses on the regional coastal zone, and uses GIS map analysis and sustainability criterion to identify the potential for both environmental and social sustainability. Combining these maps produces what would be an optimal coastal zone map from an ecological viewpoint.

4.1 Mapping

Firstly as a major investigative tool, GIS will be used primarily for data collection.

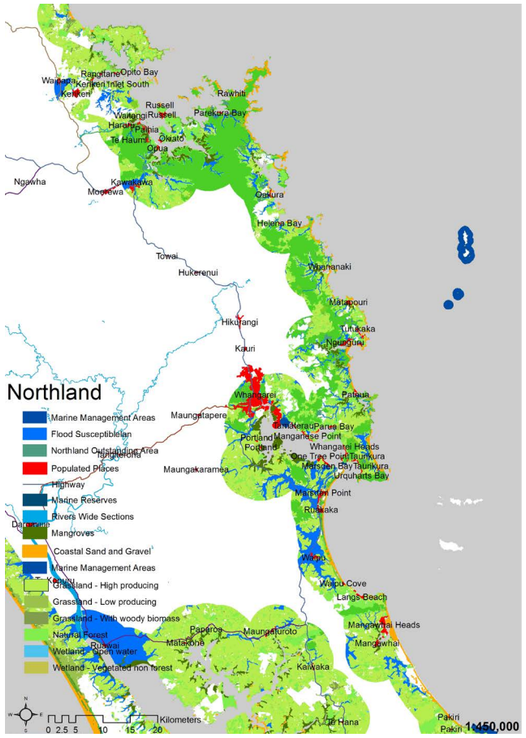
The map will be divided into three scales– the large regional scale of 1: 1,200,000; district map at 1: 450,000; and specific tow scale at 1: 150,000. In addition, the maps include two main conditions – natural environmental conditions (Significant wading bird area; Marine Reserves; River Wide Sections; Mangroves; Coastal Sand and Gravel; Flood Susceptible Areas; Grassland; Natural Forest; Wetland; Natural Outstanding Areas), and urban infrastructure conditions (Historic Place; Maori Cultural Heritage; Highway; Conservation Place; Populated Places; Cropland; Planted Forest; Settlements).

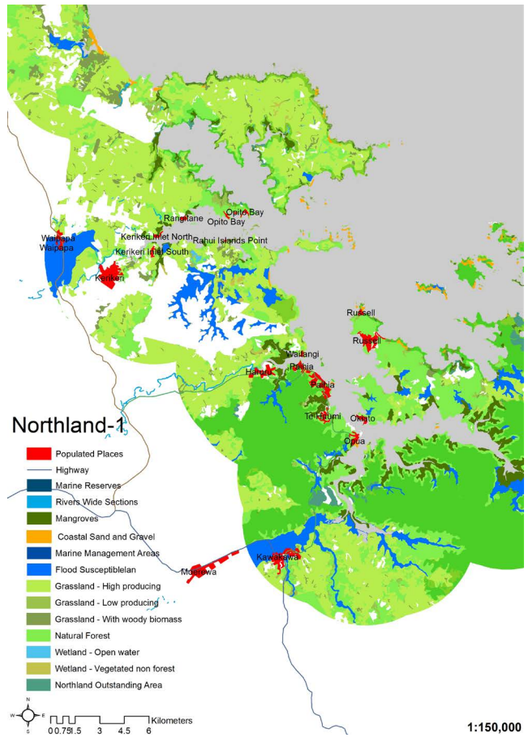
4.1.1 Northland

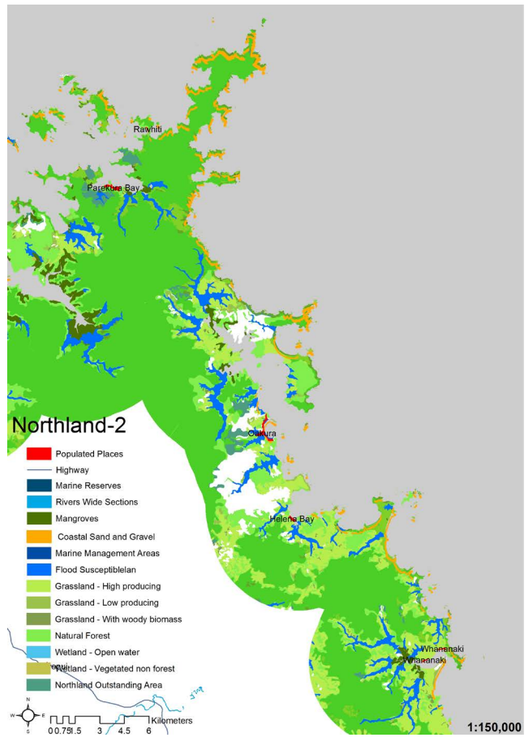
Environmental sustainability conditions (1: 450,000 & 1: 150,000):

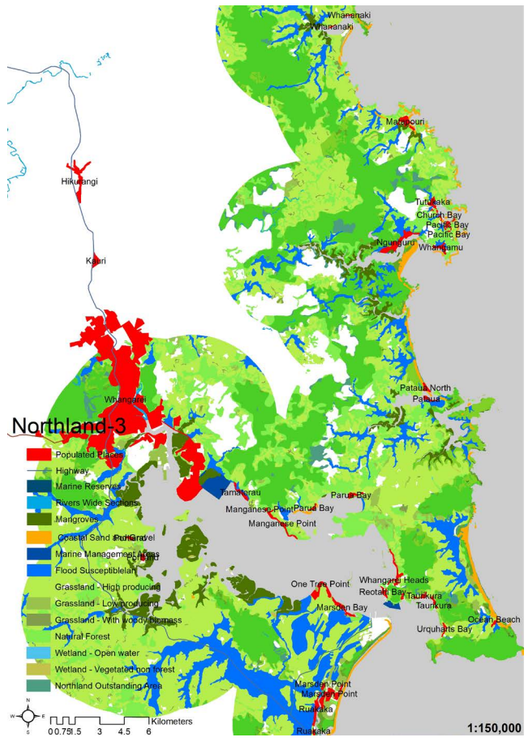
The Northland region has an important natural environment, with much of the original natural vegetation, as well as wetlands, rivers and other natural features. The geographical formations of the coast are very rich, for example, cuspate foreland, tombolo, spits, bays, lagoons, and barrier islands. In addition, there is a wealth of mangrove distribution throughout the Northland region of the coastline. It is clear from the maps that the Northland region's coastline is also dotted with numerous flood-sensitive areas, especially in central and southern parts. There are also many mostly steep coastal areas that are not suitable for coastal town construction.

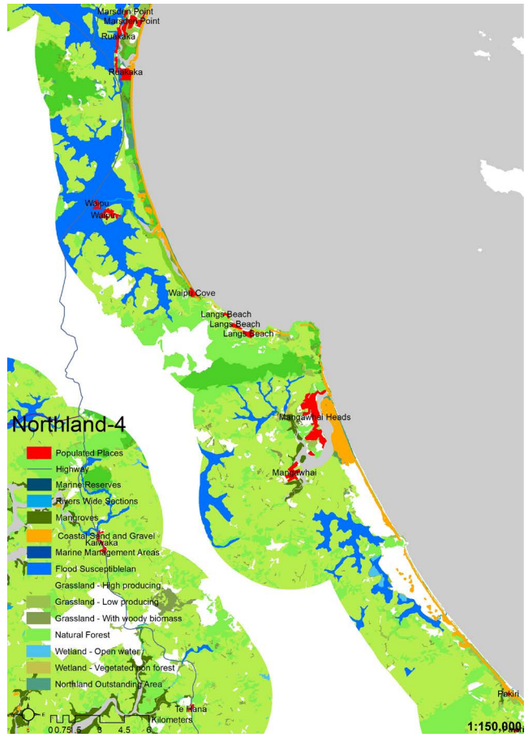
Overall, Northland has a lot of outstanding natural areas. The central and southern coastlines are not suitable for more coastal town development, whether to protect the natural ecology or to prevent and control natural disasters.







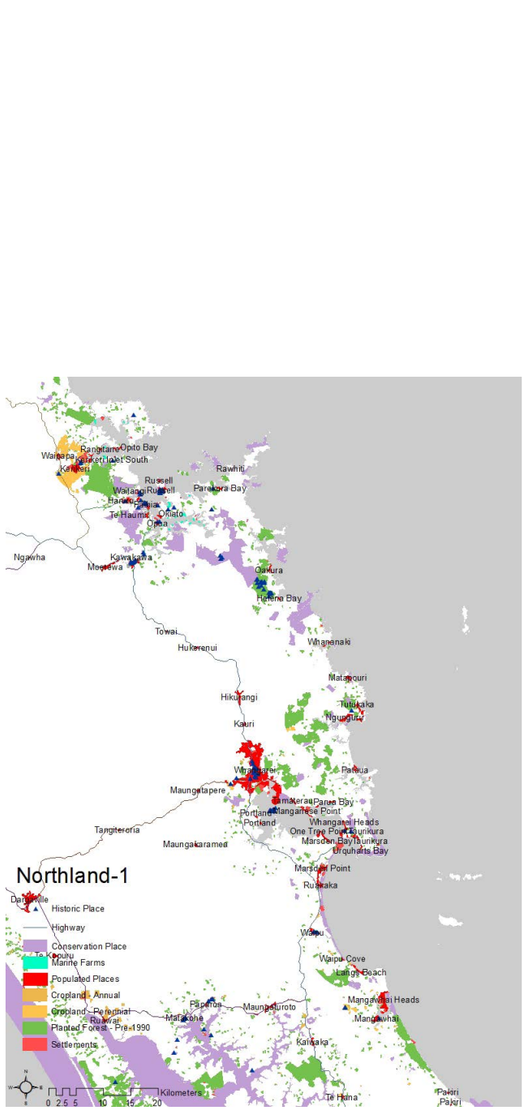


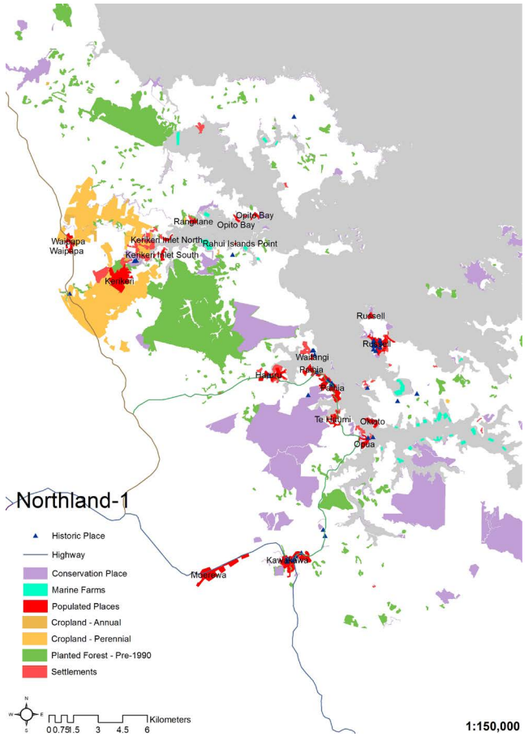


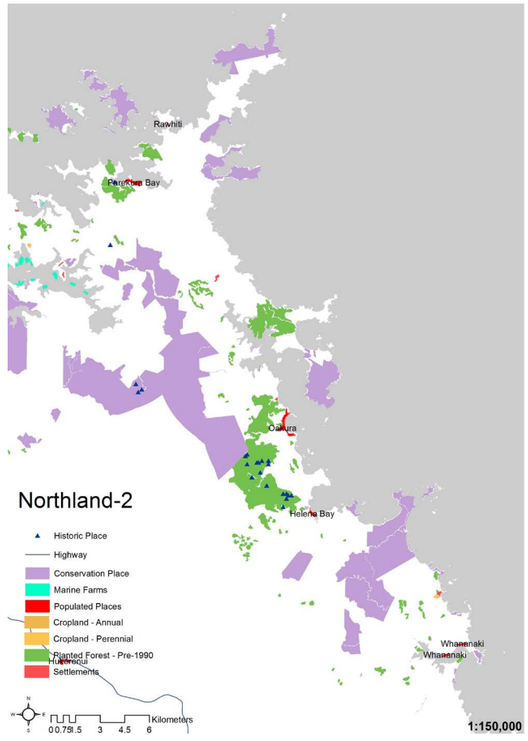
Northland Social sustainability conditions (1: 450,000 & 1: 150,000):

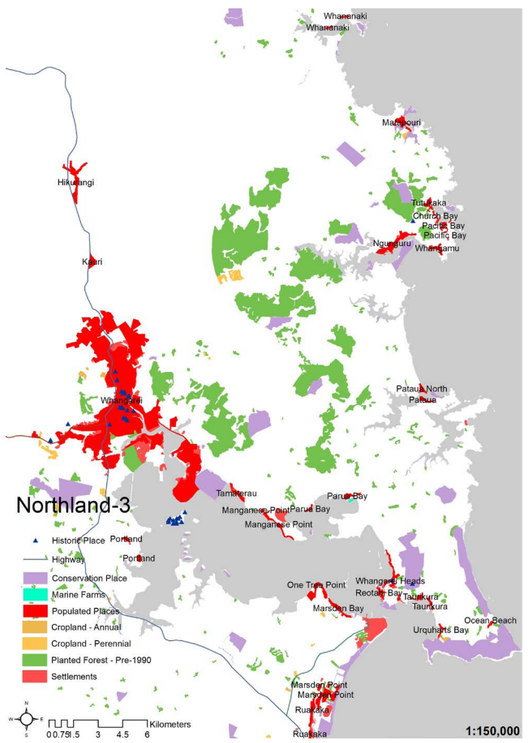
The Northland region has a lot of undeveloped coastline most towns are located in the Whangarei and Kerikeri areas. The coastlines of northern and southern Northland have more conservation and farming areas. Historical and cultural sites in the Northland region are mainly concentrated around Whangarei. Transport in the Northland region is mostly concentrated on the coast, and the southern area.

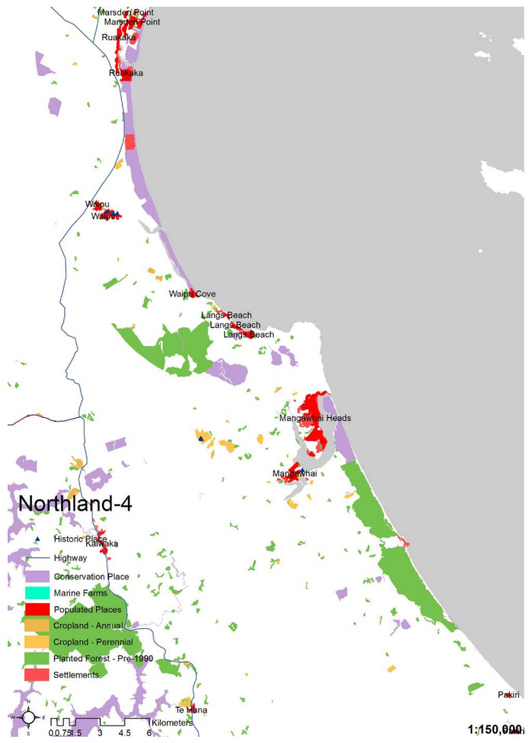
Overall, looking at this range of maps, and the selection criteria, shows that in the future, the focus for development will be around Whangarei.









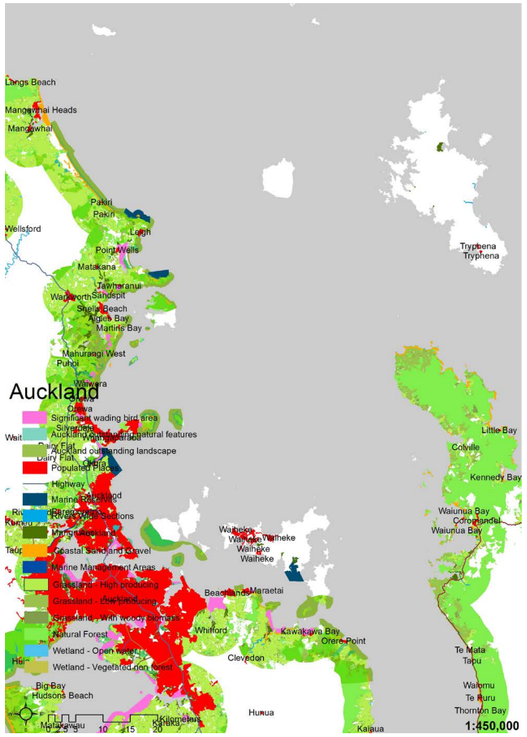


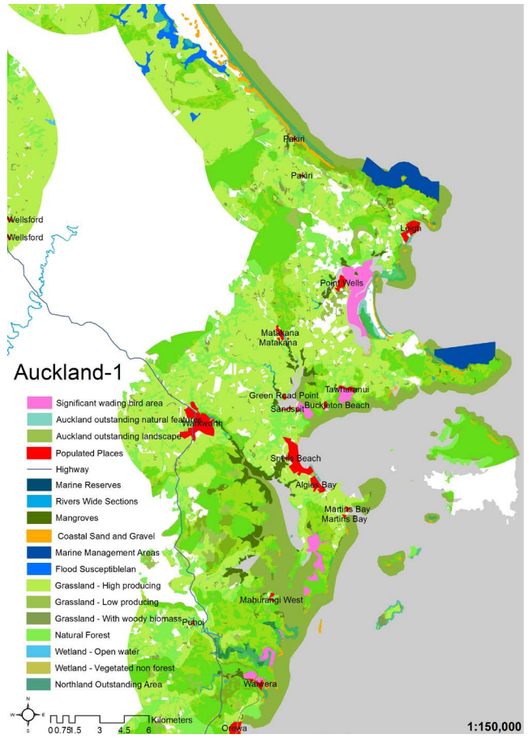
4.1.2 Auckland

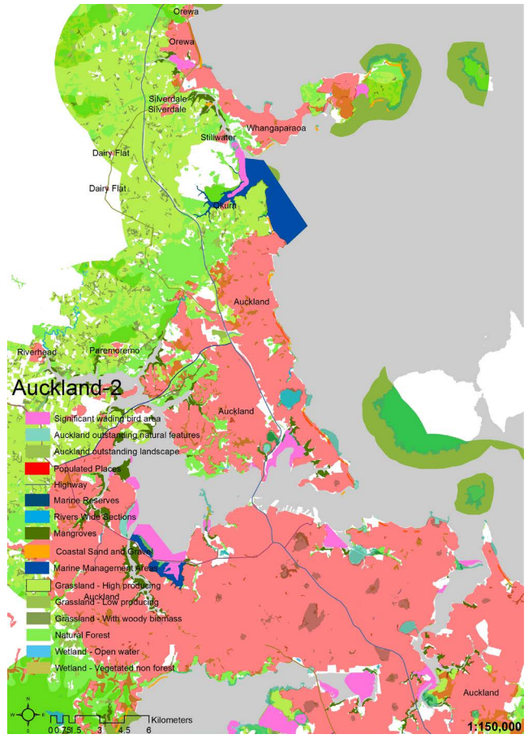
Environmental sustainability conditions (1: 450,000 & 1: 150,000):

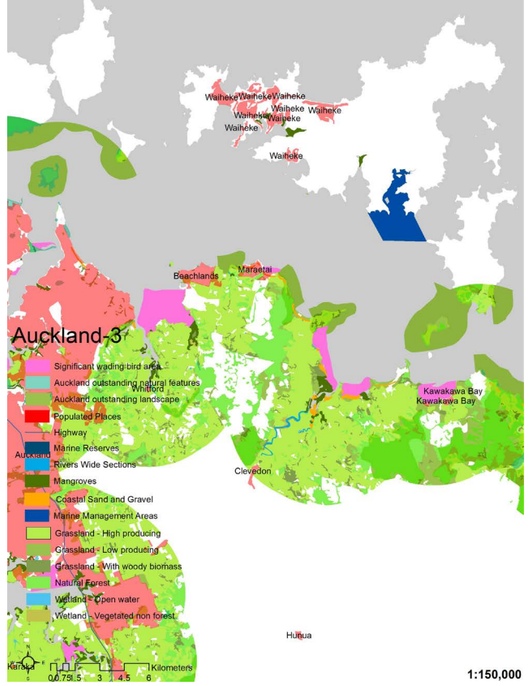
The Auckland region has abundant natural resources, especially in the coastal areas, bird and marine reserves, numbers of islands, and a variety of beaches. The northern part of Auckland's coastal area has more flat terrain and beaches, while the southern coastal area has, narrower beaches. Vegetation in the Auckland region is evenly distributed, natural forest, grass, and mangroves. However, from the analysis of potential natural hazards, the main problem for the Auckland region is rising sea levels. According to the GIS maps, other than Auckland city, most coastal areas are at a safe altitude.

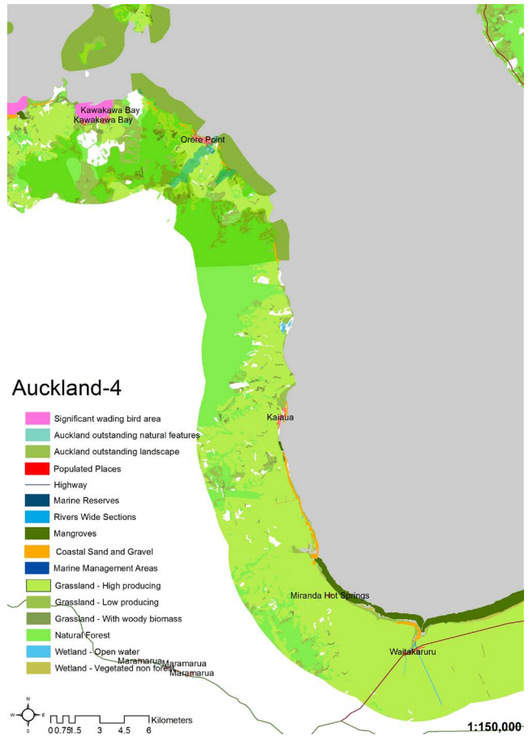
According to the analysis of the Auckland region's natural environment, the northern part is more suitable for a new coastal town development, especially with favorable geographical features, such as a wealth of coastal resources and gentler beach terrain. In the southern part of Auckland region, it is more appropriate to protect the ecological environment in order to maintain the existing ecological balance.





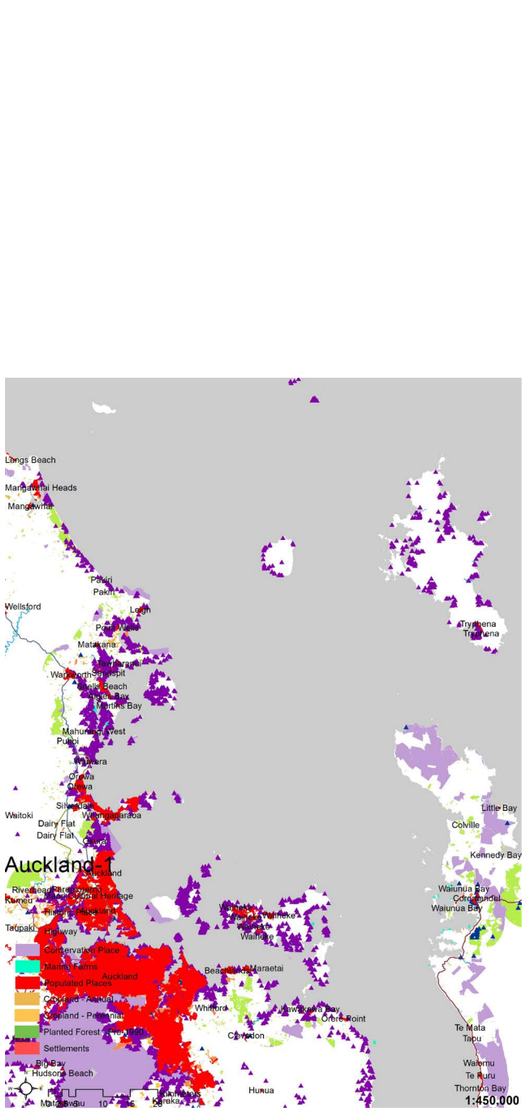


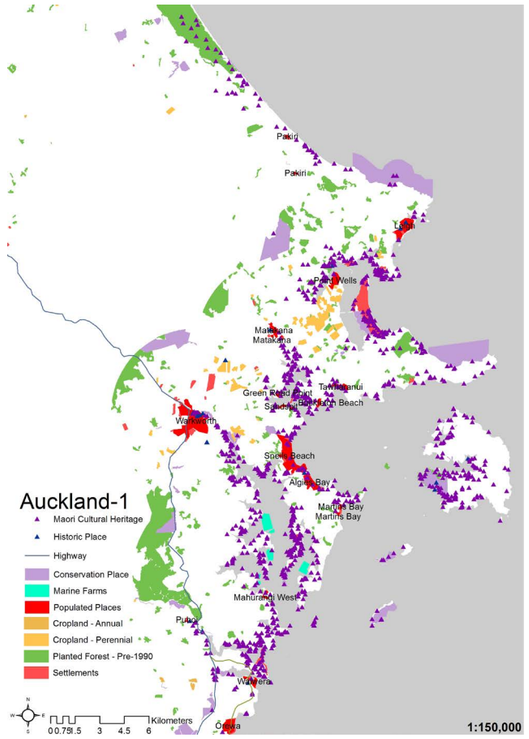


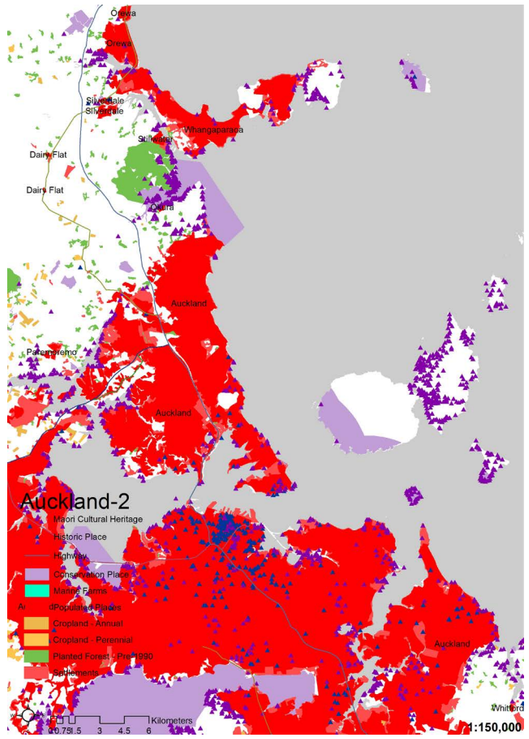


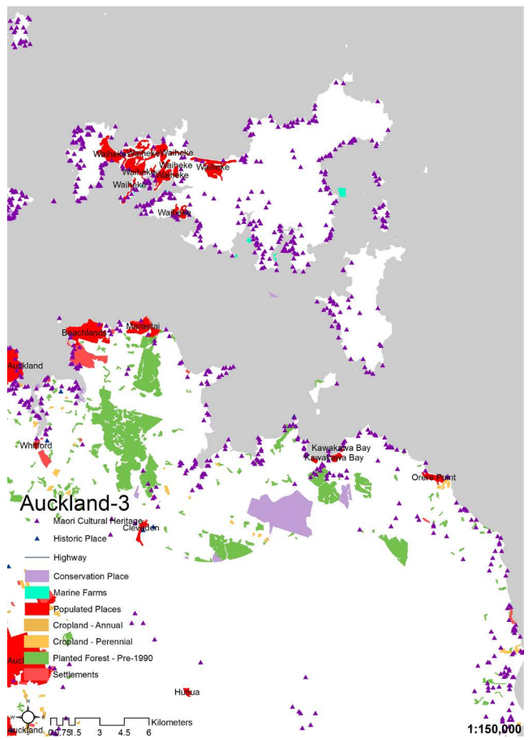
Auckland social sustainability conditions (1: 450,000 & 1: 150,000):

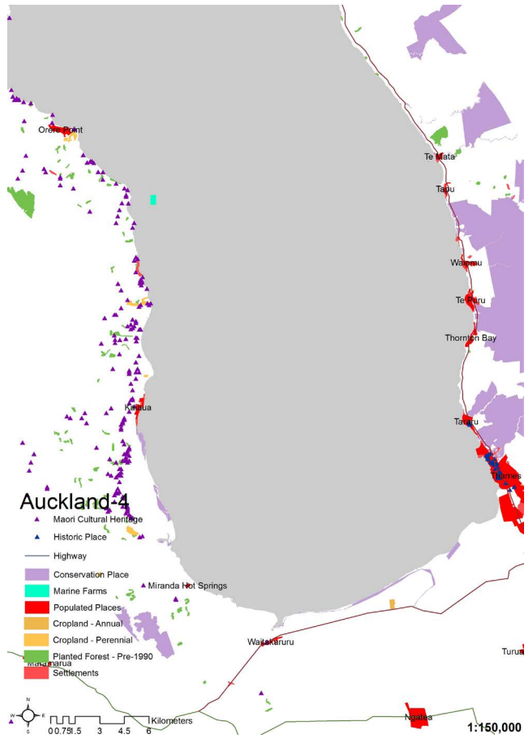
The Auckland region has a highly developed coastal urban condition which is mainly embodied in the Auckland super city. However, like Northland, the northern and southern parts of the Auckland region still have many potential areas for developing a coastal town. The maps shows transport in the north of the Auckland region is better than the south, and there are a lot of existing coastal residential areas, for example, Orewa, Snells Beach, Omaha, and Leigh. At the same time, the northern part of the Auckland region has a lot of historical and Maori cultural heritage and agricultural areas. In comparison with the northern part of the Auckland region, the southern area is more undeveloped, in terms of existing town size. The result of the mapping indicates a potential coastal town in the Auckland region will be located in the north.







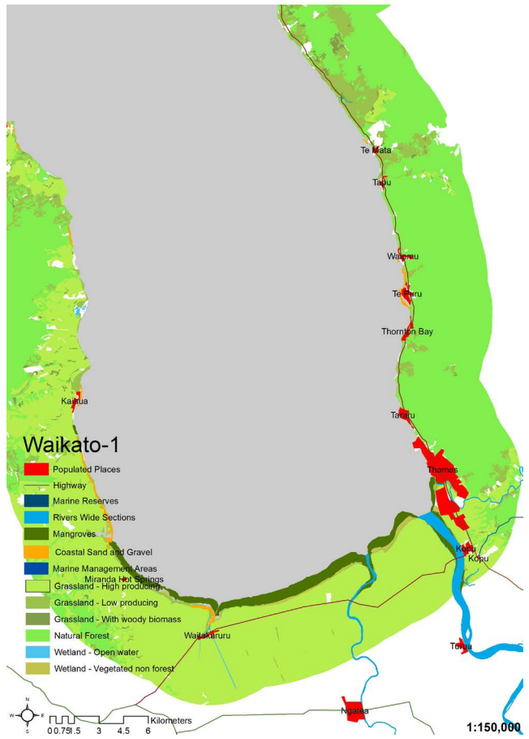


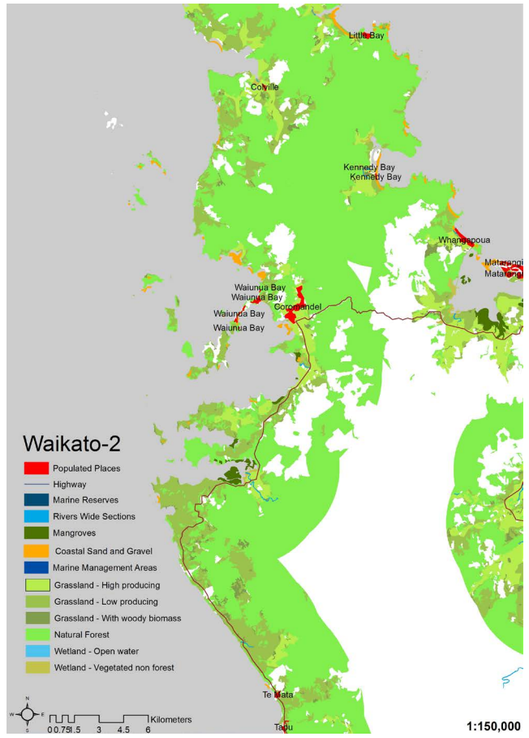


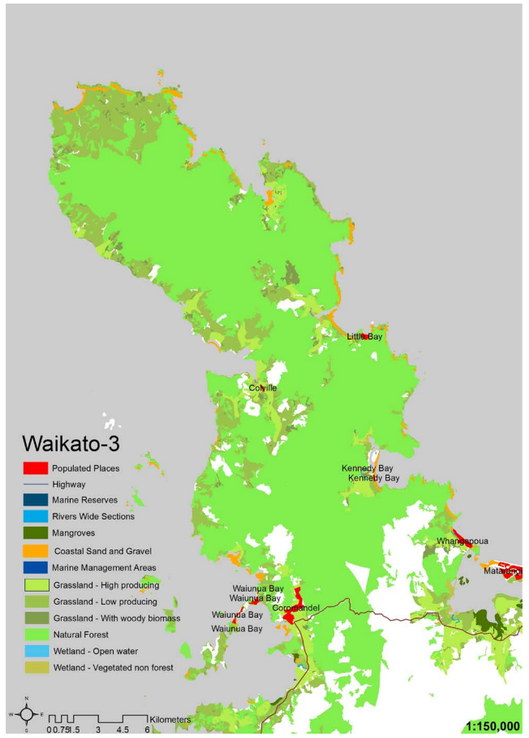
4.1.3 Waikato

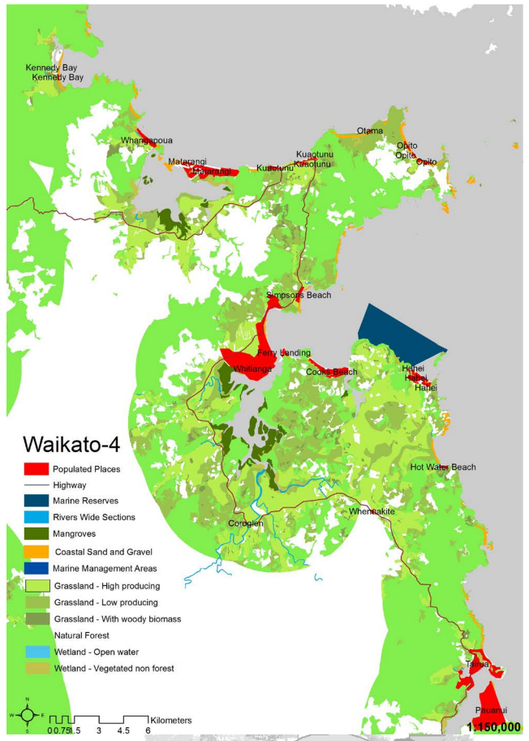
Environmental sustainability conditions (1: 450,000 & 1: 150,000):

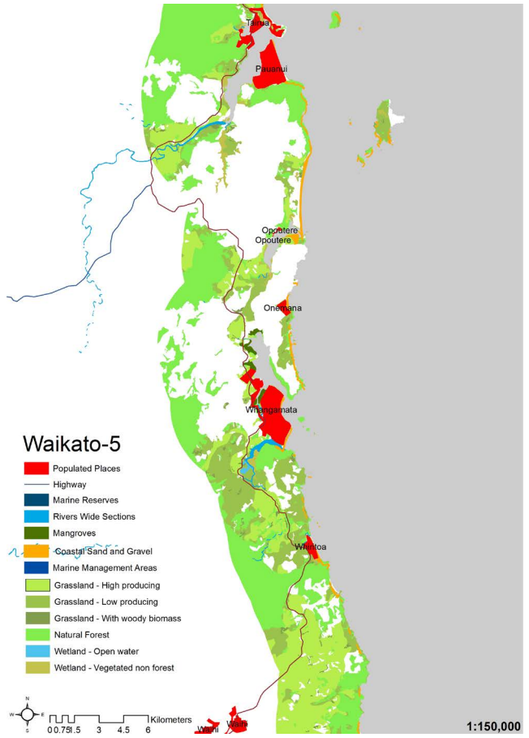
According to the mapping, the entire east coast area in the Waikato region is rich in vegetation, such as agricultural plains, mangrove forests, and the Coromandel peninsula with native forests There is an important river estuary, the Waikato, , From the mapping analysis of the natural ecological protection requirements and the regional development strategy, the entire northern coastal area of the Waikato region is available, for development on the basis of expanding existing towns.

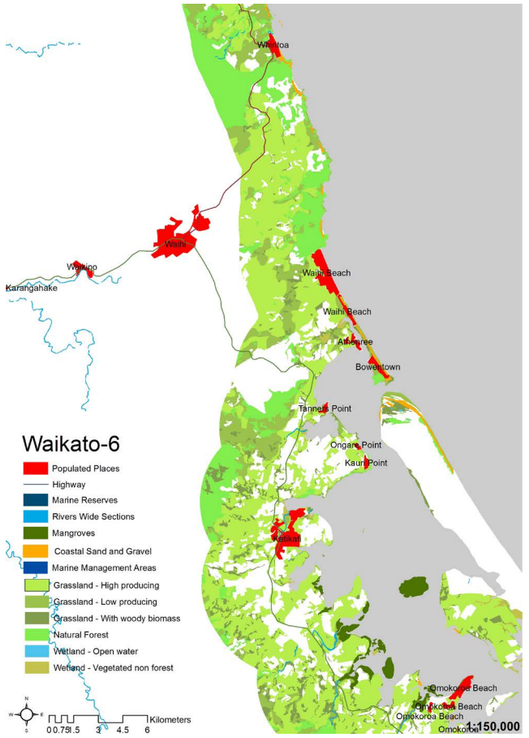






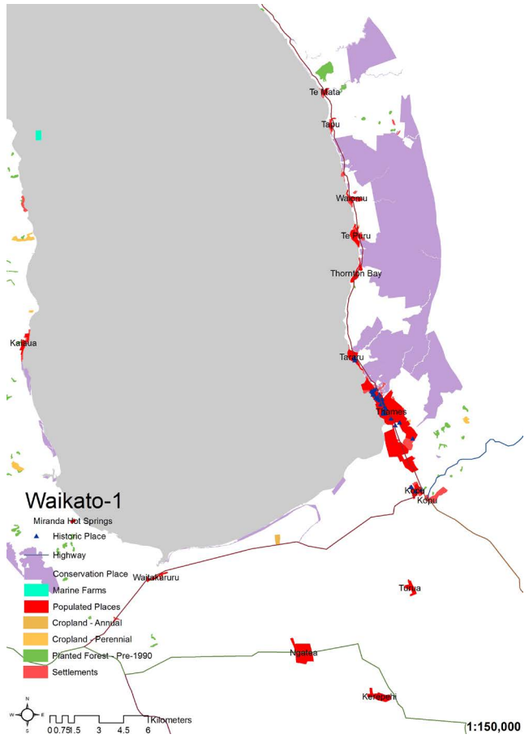


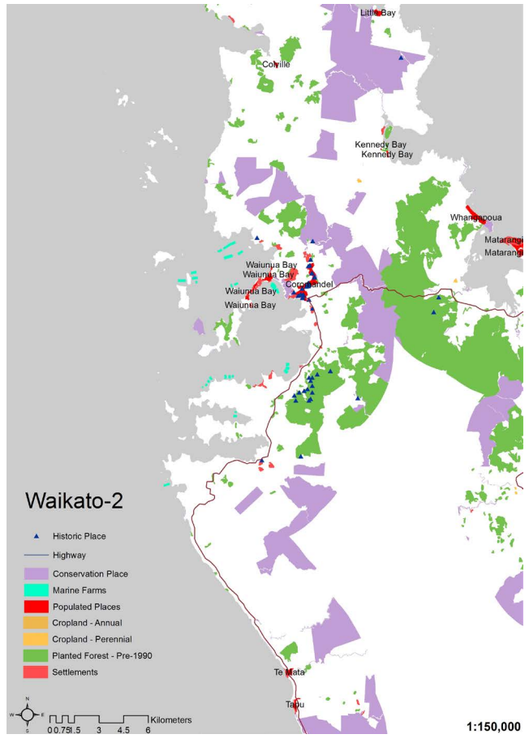


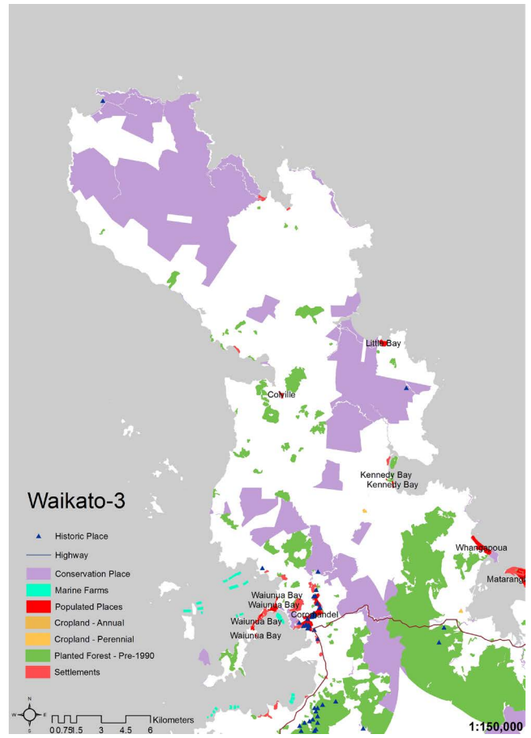


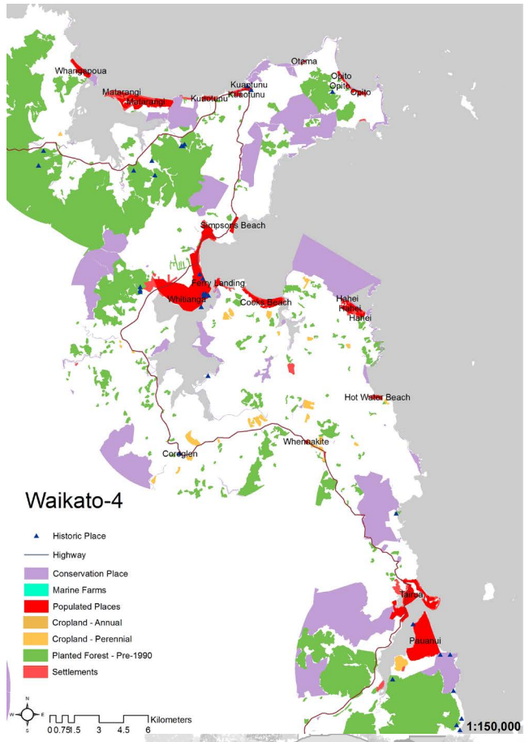
Waikato Social sustainability conditions (1: 450,000 & 1: 150,000):

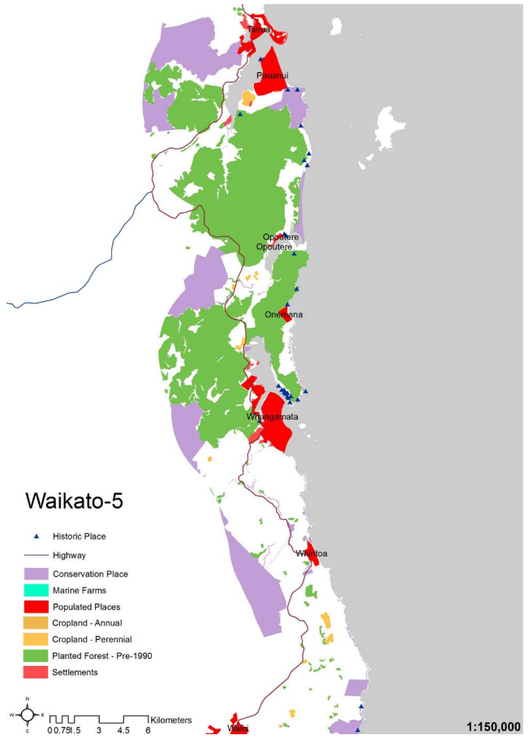
Waikato's northern coastal region has a special environment in transport infrastructure and urban development. Because of the excellent natural environment, most of the coastline is conservation reserves, and this limits urban development. As is shown in the mapping, most coastal towns are small scale, and the distribution is fragmented. Most historical and cultural heritage is concentrated in the vicinity of existing towns. . Overall, the future trend of Waikato region's coastal town planning will be in the northern part.

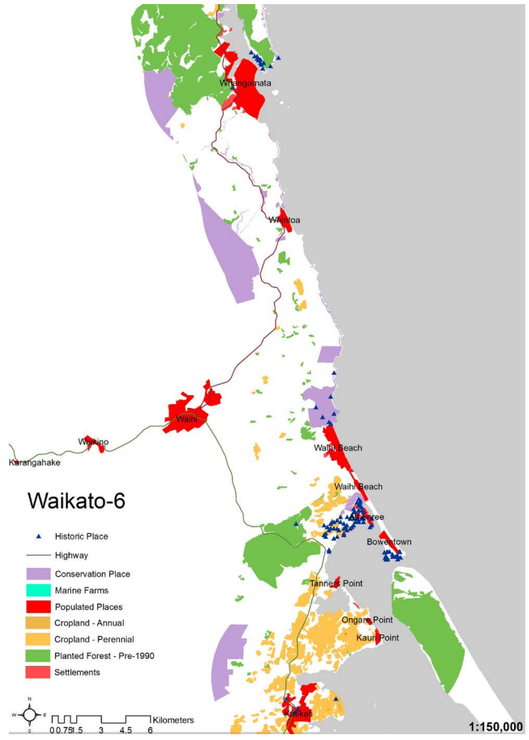








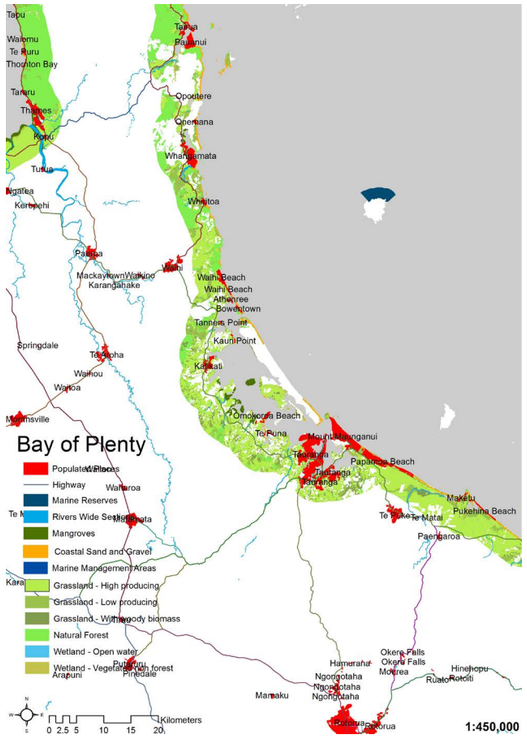


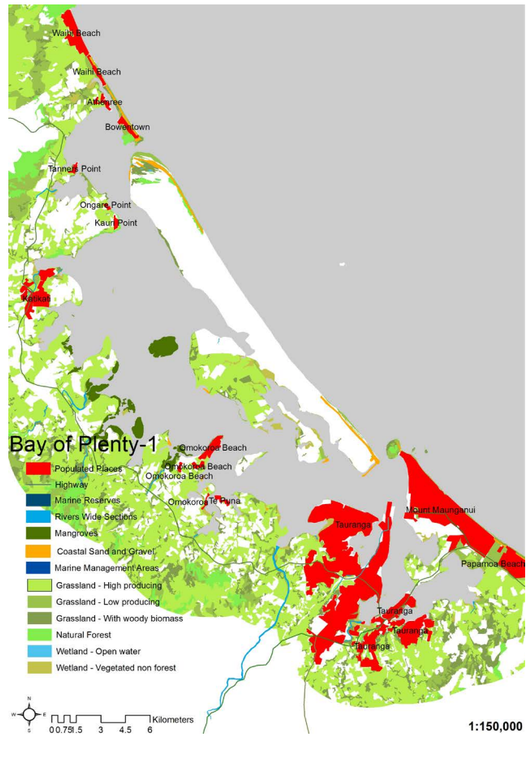


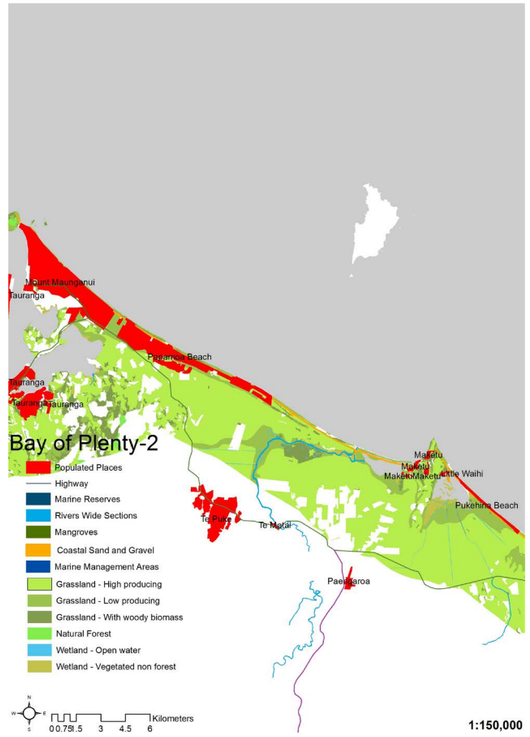
4.1.4 Bay of Plenty

Environmental sustainability conditions (1: 450,000 & 1: 150,000):

The northern coastal Bay of Plenty region has special geographical features, such as a variety of bays flatter terrain, The vegetation is, mainly mangroves, pasture and other low-level planting. The Bay of Plenty has excellent beaches and other types of coast. The main development area of this region is concentrated in Tauranga, so for the analysis of the natural ecological environmental conditions, the Tauranga perimeter will also be the main focus.

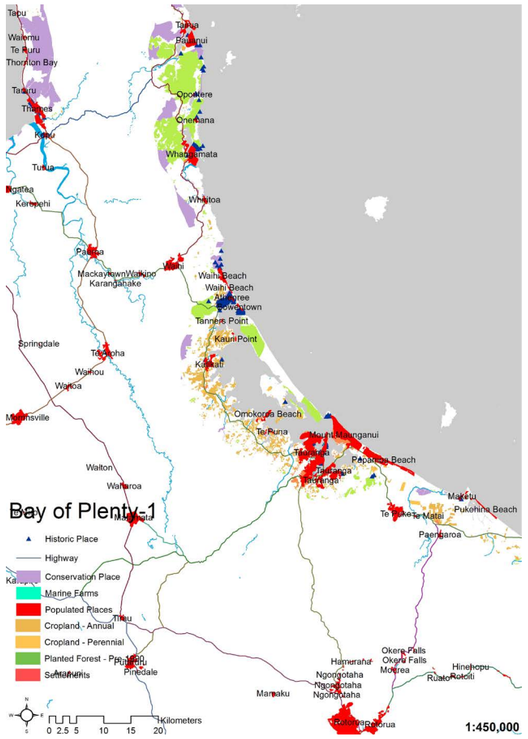


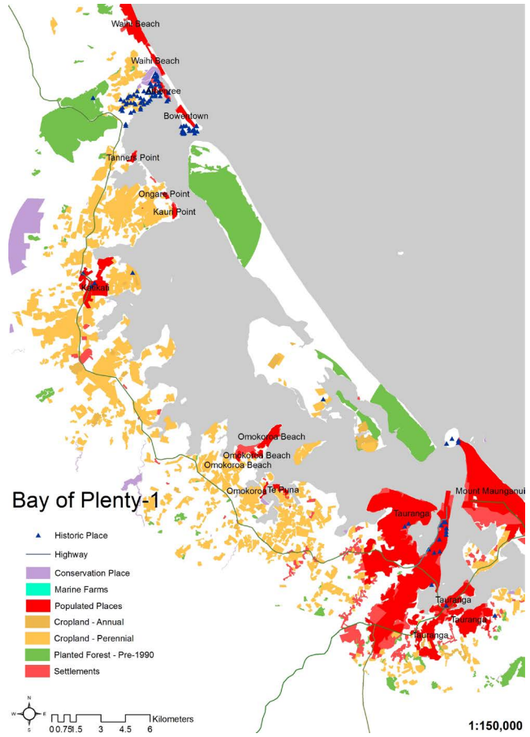


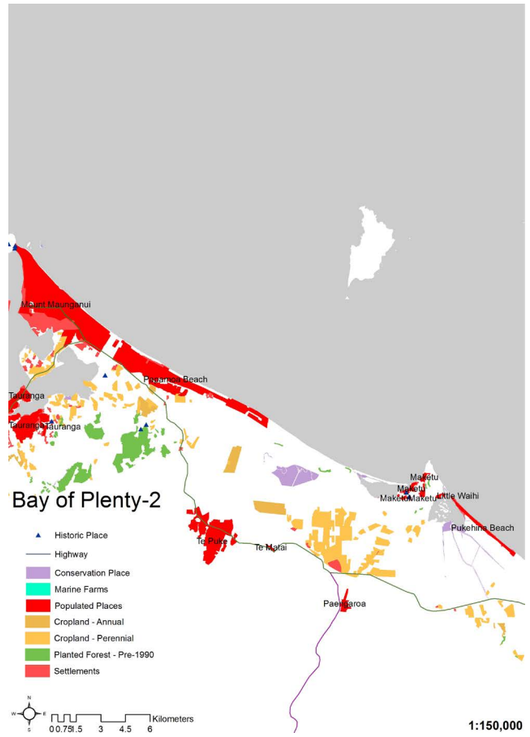


Bay of Plenty Social Sustainability Conditions (1: 450,000 & 1: 150,000):

The Bay of Plenty mapping only selected the more developed northern part for analysis. The development of the northern Bay of Plenty is built around the coastline, and Tauranga is prominent, whether for transport or construction. At the same time, agriculture in the northern Bay of Plenty is well developed. Most historical and cultural heritage is concentrated in the northern Bay of the Plenty. The Bay of Plenty is well placed to develop coastal towns. The future direction of Bay of Plenty development will be mainly concentrated in the peripheral areas of Tauranga.







4.1.5 Combination Map:

After the analysis of each regional sustainability map, a further map combines sustainable development criteria This map shows the optimal range of coastal zones with potential for sustainable development.

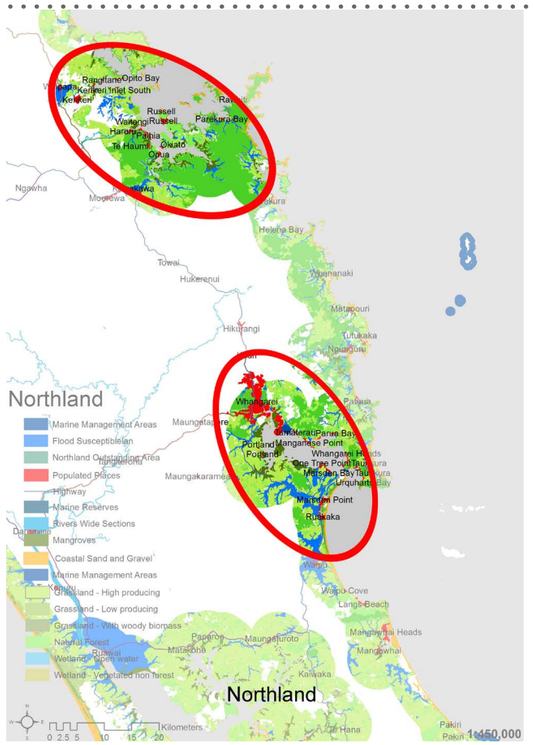
The criteria for both environmental and social sustainability aspect, which are :

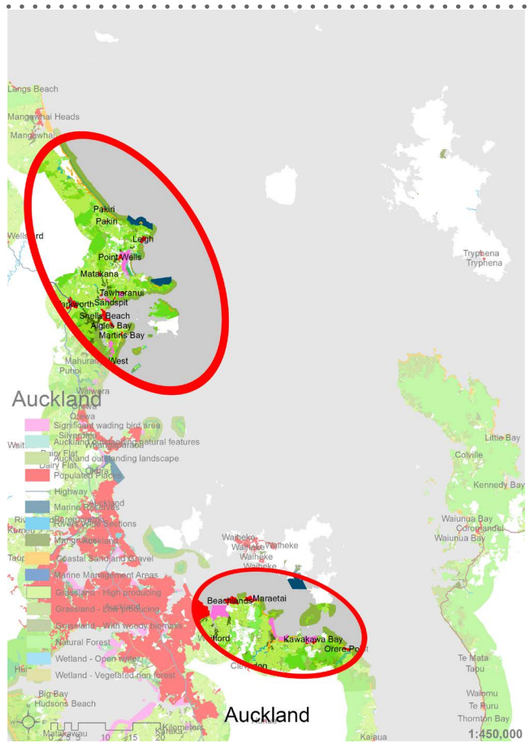
Environmental Sustainability Criteria:

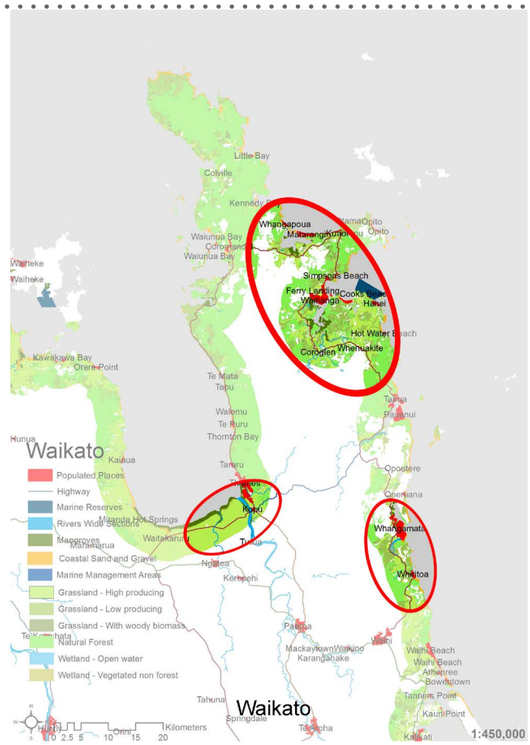
- Avoid ecologically sensitive areas aimed at protecting local ecological characteristics, such as wetlands, forests, rivers, wildlife, wild plants.
- Healthy and environmentally friendly, considering environmental pollution and population growth. The new site will be required to be green, so will include a description of a healthy natural environment, such as the distribution of vegetation, climatic conditions and population.
- Analysis of potential natural disasters will serve as an important criterion for selecting a site. Analysis should identify potential natural disasters (flood, sea level rise), and potentially affected areas.
- Geographical features, mainly urban planning requirements, include slope and elevation analysis, and each standard will follow the urban planning criteria (slope < 5/ Contours < 20m).

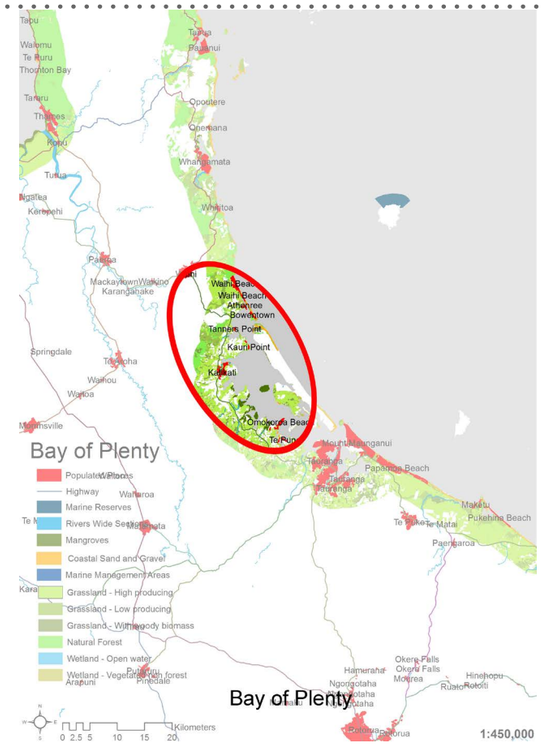
Social Sustainability Criteria:

- Maori culture and heritage is a special criterion in this project's site selection, and the specific method refers mainly to marked Maori historical and cultural sites, according to official data on Maori reserve areas.
- Each region's future development plans, which includes regional and urban planning.
- Transportation, as an important indicator of modern urban development, in addition to adding convenience to local life, is also necessary for economic development. Therefore, the criteria for site selection will include a variety of factors relating to transportation, such as highways, ports, airports and railways.
- Close to resources and industry support, because social sustainability includes supporting regional development.
- Land ownership analysis will show land conditions for future development.
- Settlement distribution.

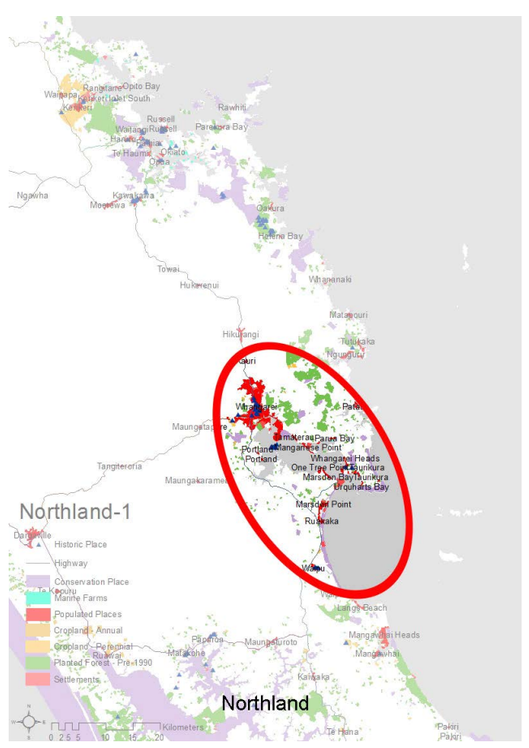


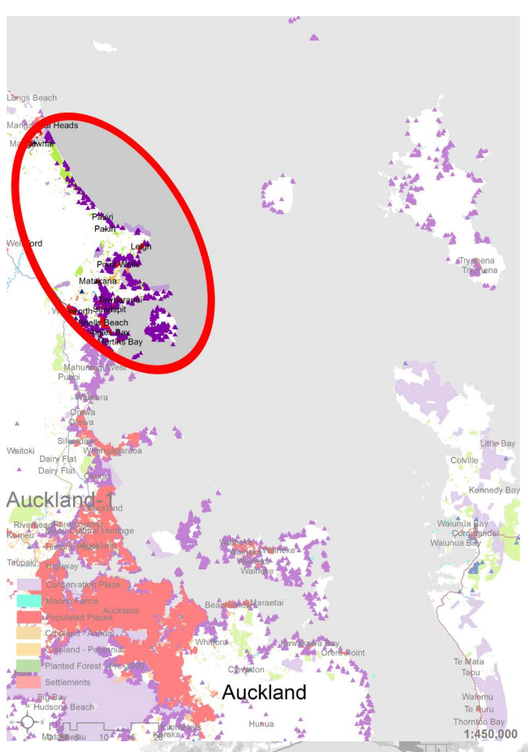


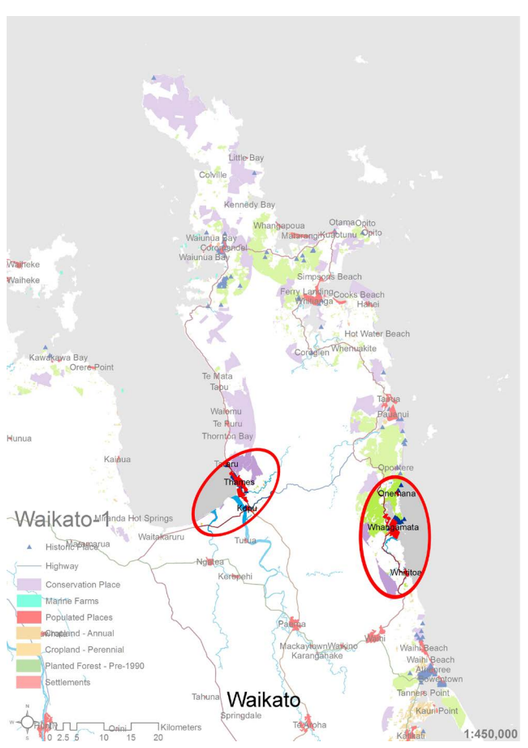


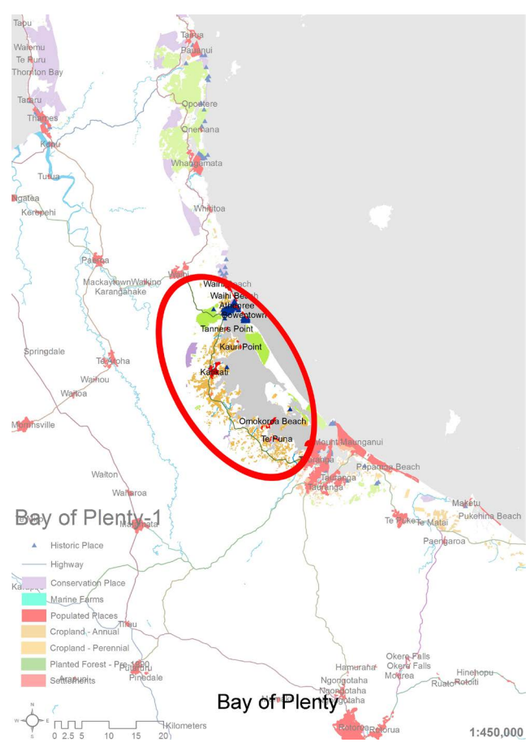


Environmental Sustainability Analysis Map









Social Sustainability Analysis Map

Potential Coastal Settlement Map (1:120,000,0):

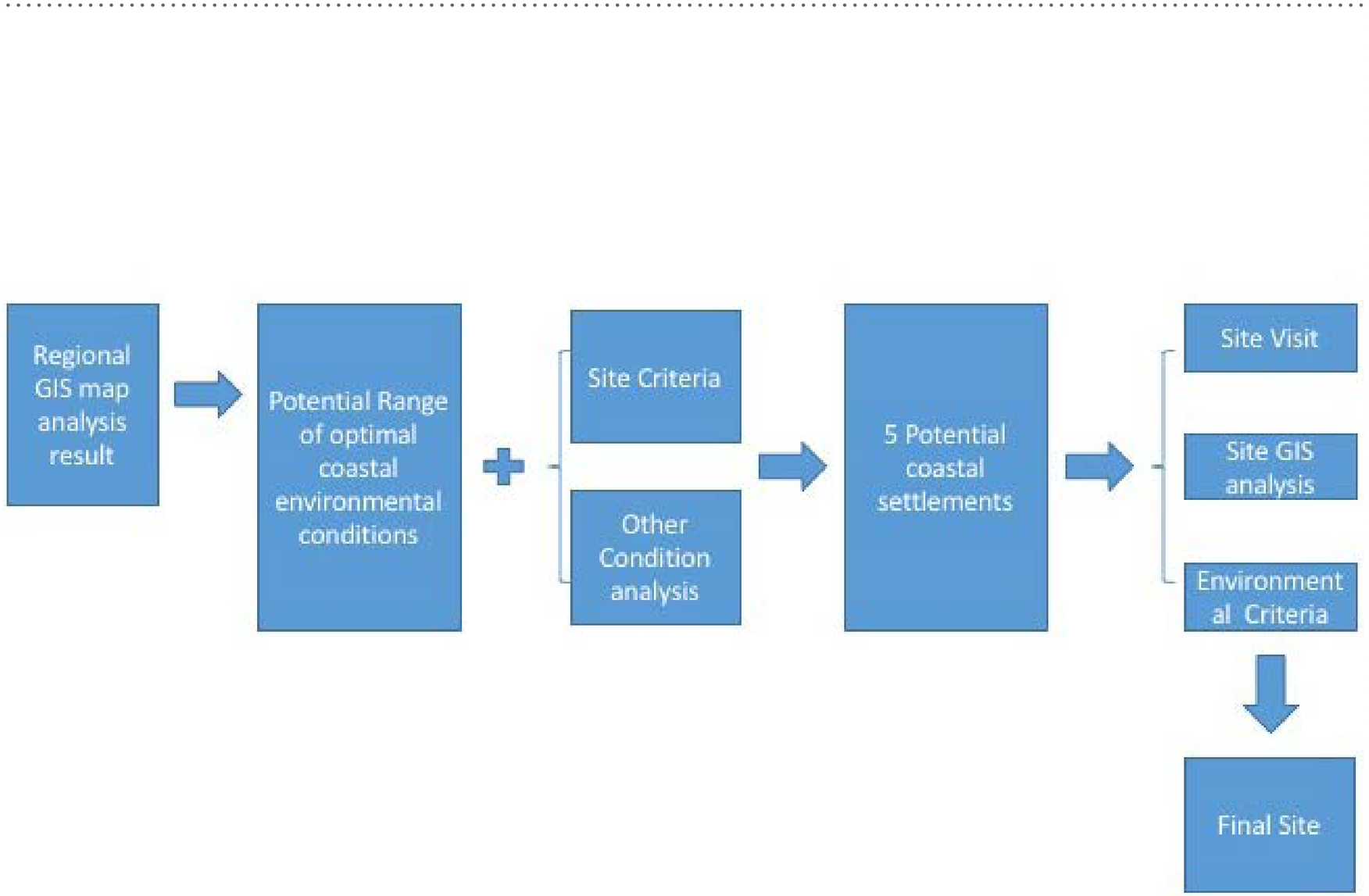
This map result shows the optimal range of coastal zones with potential for sustainable development.

The Potential Range include:

- South Northland
- North Auckland
- East Auckland
- West of Coromandel
- North Bay of Plenty

4.2 Site investigation

In order to select a site for an environmentally sustainable development case study, a ground truthing site investigation will be undertaken to analyze and critique the potential sites. This site investigation method has three aspects, which include setting the site criteria, developing the data analysis and making a site visit.



Site Investigation Framwork

4.2.1 The site criteria

The first part of the site selection methodology is to further develop site selection criteria. In order to meet the requirements of environmentally sustainable development, the criteria will include several parts.

- Avoid ecologically sensitive areas to protect local ecological ecotones, such as wetlands, forests, rivers, and wildlife,
- Acknowledge the importance of transport infrastructure. This is an important indicator of modern urban development, important to sustain local lifestyles, and is necessary for economic development. The criteria of this site selection will include highways, ports, airports and railways.
- Protect and enhance the natural environment. It's important to be aware of environmental pollution and population growth. Ann analysis of a healthy natural environment, including the distribution of vegetation, a study of climatic conditions and population is critical.
- Analysis of potential natural disasters will serve as an important criterion for selecting a site. Identifying a variety of potential natural disasters (flood, sea level rise), and where the potentially affected areas will be located.
- Geographical features, especially – slope analysis and elevation analysis maps
- Maori culture and heritage are special criteria in this project's site selection the protection of Maori historical and cultural sites, is important.
- The regional future development plans, which includes regional and urban planning.

4.2.2 Data analysis

Based on the criteria setting and the preliminary analysis of maps, this stage summaries new data from the mapping analysis data to help in the selection of appropriate sites. Specifically, this data will include four tables, which are derived from; the existing map of coastal towns, the transport analysis map, one-hour distance analysis maps and the critical site table.

The Existent Coastal Town:

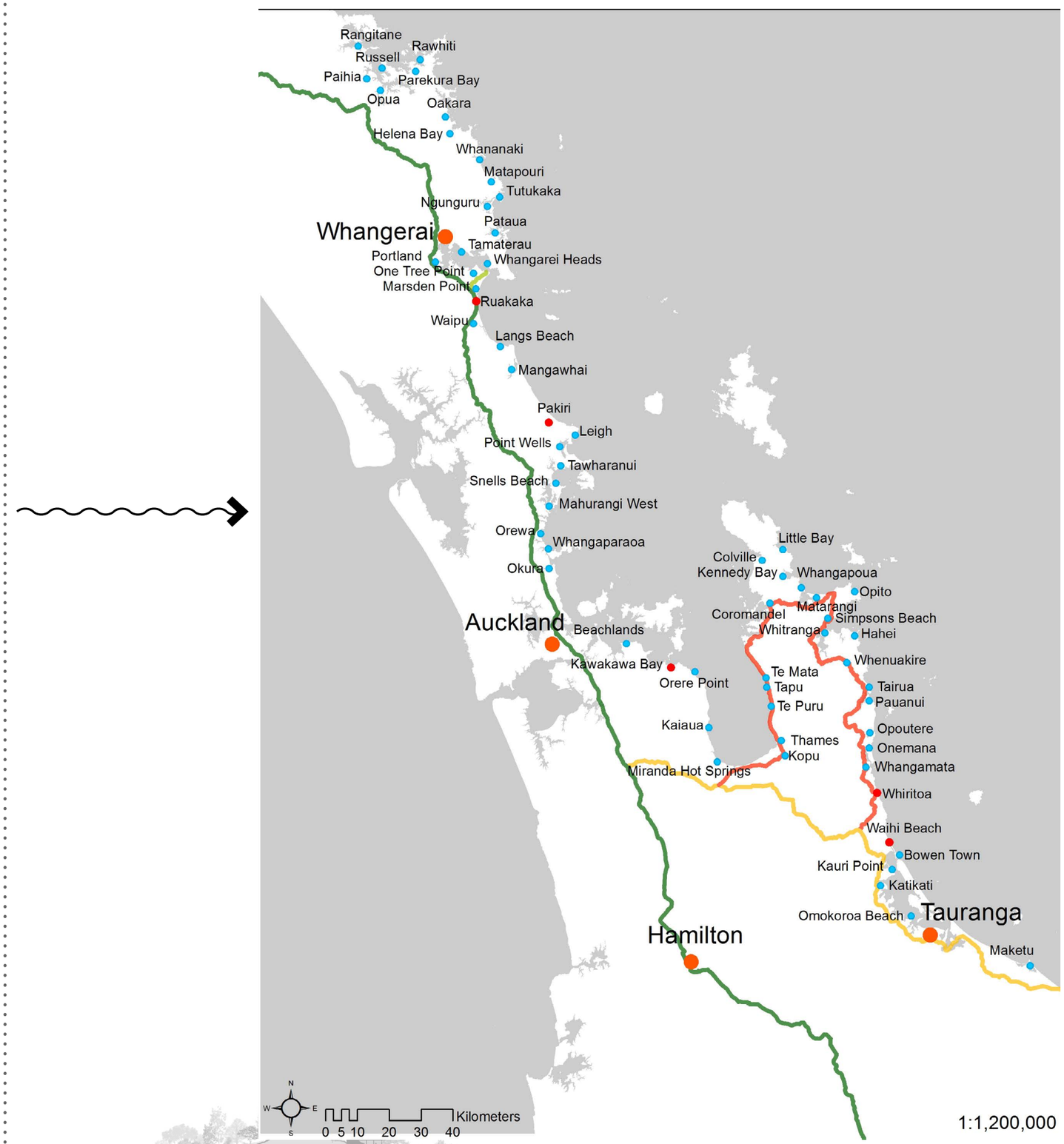


Table 1.0: The existing coast towns.

This table shows Auckland and three other existing regional coastal towns. The table has been used to analyse the towns' basic information, such as; location, town size, population and infrastructure, for help with the site selection.

The result of sustainable development coastal zone potential range analysis, combined with this table, will show potential development sites in the region

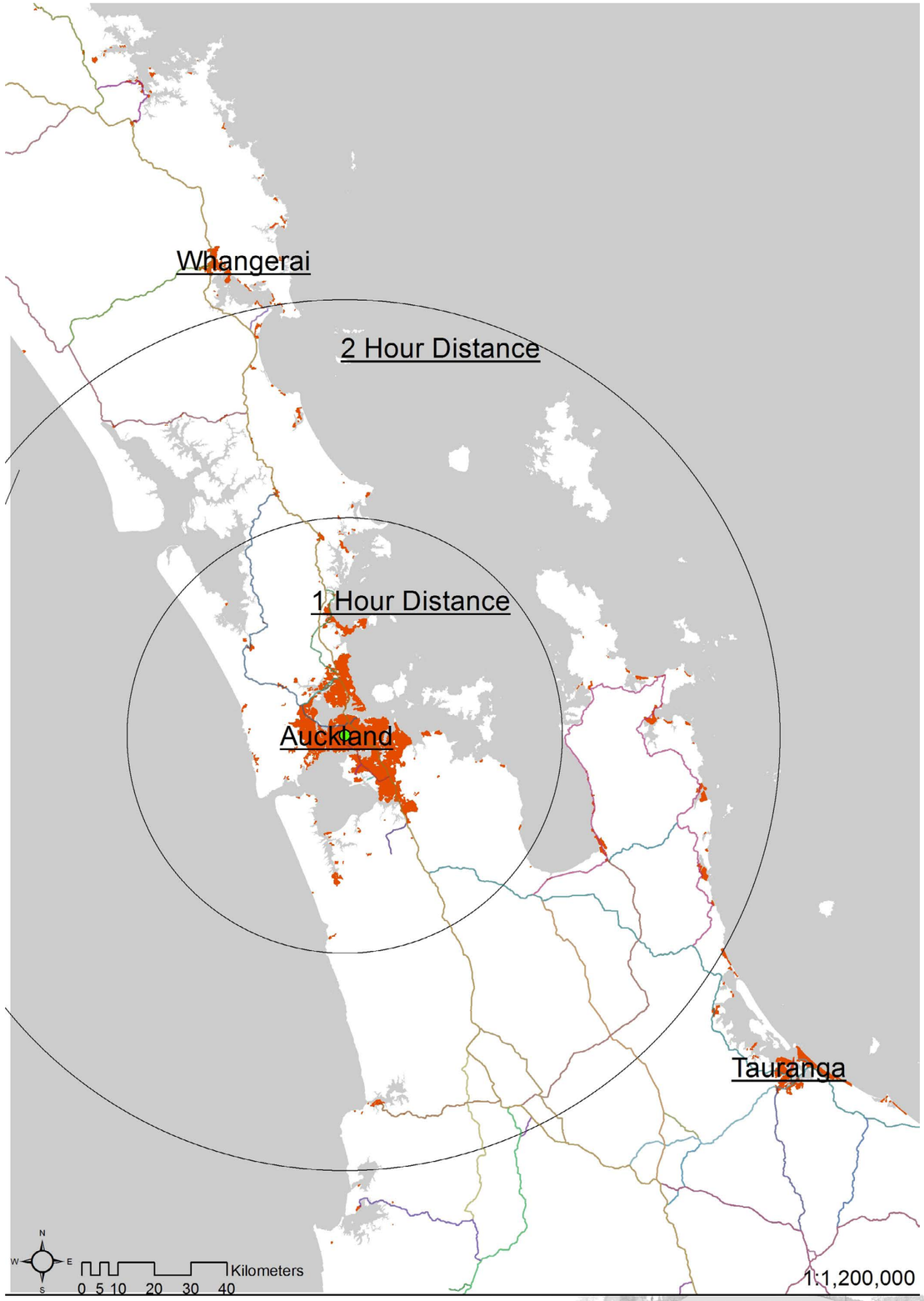
Northland: Pataua/ Ruakaka, Langs Beach/ Mangawhai Heads.

Auckland: Pakiri/ Leigh/ Maraetai/ Kawakawa Bay

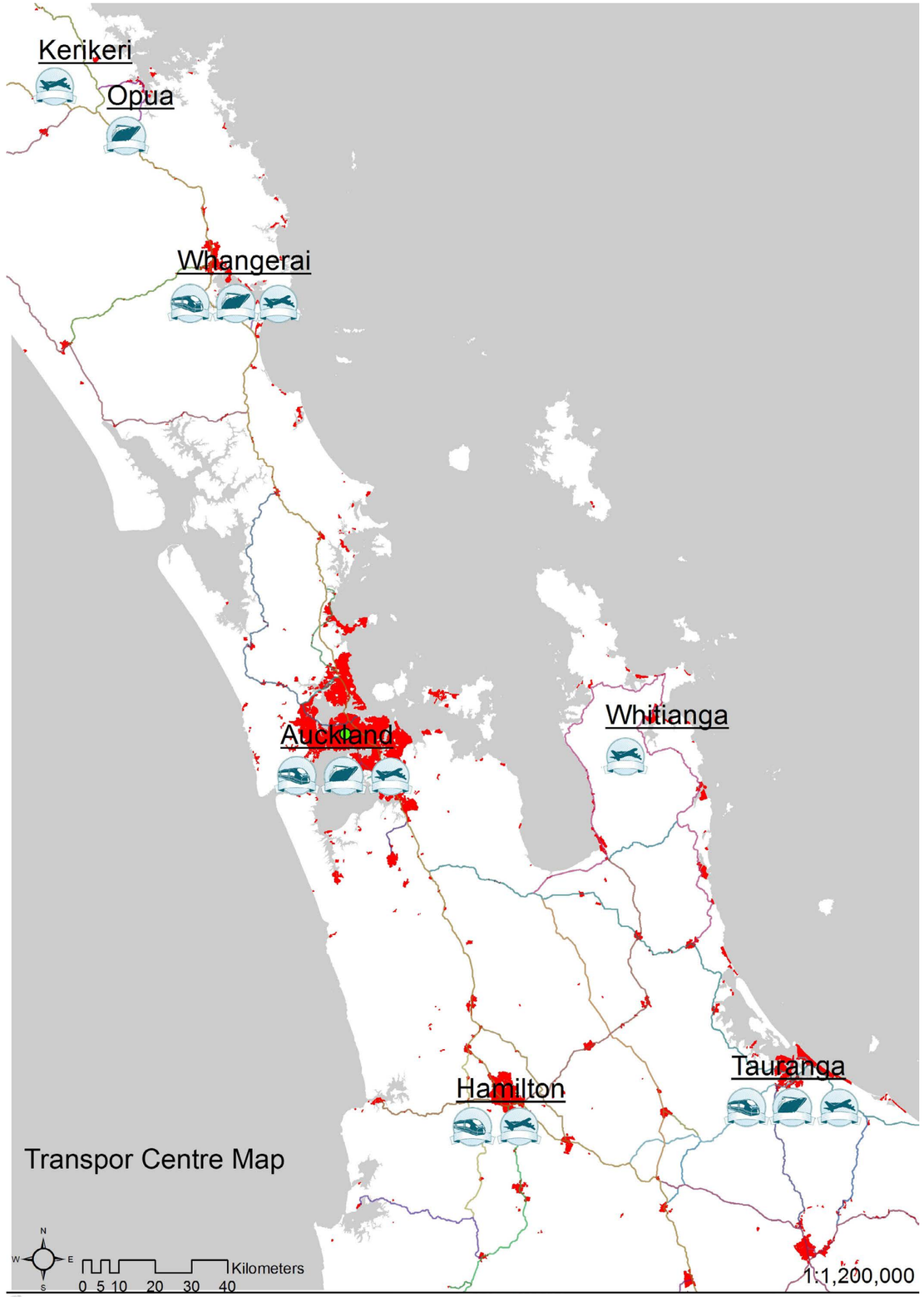
Waikato: Te Puru/ Whiritoa

Bay of Plenty: Waihi Beach/ Pukehina Beach

The existent coast towns			
Northland	Auckland	Waikato	Bay of Plenty
Opito Bay	Pakiri	Kaiaua	Waihi Beach
Rangitane	Leigh	Miranda Hot Springs	Athenree
Russell	Point Wells	Kopu	Bowentown
Waitangi	Matakana	Thames	Tanners Point
Haruru	Tawharanui	Tararu	Kauri Point
Paihia	Sandspit	Te Puru	Katikati
Te Haumi	Snells Beach	Waiomu	Omokoroa Beach
Opua	Algies Bay	Tapu	Te Puna
Okiato	Martins Bay	Te Mata	Maketu
Parekura Bay	Mahurangi West	Waiuna Bay	Pukehina Beach
Oakura	Wai wera	Coromandel	
Helena Bay	Orewa	Colville	
Whananaki	Beachlands	Little Bay	
Matapouri	Maraetai	Kennedy Bay	
Tutukaka	Kawakawa Bay	Whangapoua	
Maungura	Orere Point	Matarangi	
Pataua		Kuaotunu	
Parua Bay		Otama	
Manganese Point		Opito	
Portland		Simpsons Beach	
One Tree Point		Whitianga	
Taurikura		Cooks Beach	
Marsden Point		Hahei	
Ruakaka		Hot Water Beach	
Waipu		Tairua	
Langs Beach		Pauanui	
Mangawhai Heads		Opoutere	
		Onemana	
		Whangamata	
		Whiritoa	



1Hr Distance Map



Transport Centre Map

Transport Centre				
	Northland	Auckland	Waikato	Bay of Plenty
Rail Station	/	Auckland	Hamilton	Tauranga
Airport	Whangarei	Auckland	Hamilton	Tauranga
	Kerikeri	North Shore	Whitianga	
Port	Bay of Islands	Auckland		Tauranga
	Whangarei	Onehunga		
	Opua			

Table 2.0: The region transport centres.

The table shows the transportation centre in each region, and can be used as a reference to select a site near transport centres. This can benefit potential urban development

The distance between Auckland city and Coast towns (1hr Cycle)			
Northland	Auckland	Waikato	Bay of plenty
Opito Bay (1hr20min)	Pakiri (1hr10min)	Kaiaua (1hr20min)	Waihi Beach (45min)
Opua (1hr11min)	Leigh (1hr)	Te Puru (1hr)	Maketu (35min)
Oakura (50min)	Point wells (35min)	Tapu (59min)	Pukehina Beach (36min)
Helena Bay (40min)	Matakana (52min)	Whiritoa (1hr19min)	
Whananaki (46min)	Tawharanui (1hr)		
Pataua (30min)	Sandspit (49min)		
	Snells Beach (50min)		
	Algies Bay (52min)		
	Martins Bay (57min)		
	Mahurangi West (37min)		
	Waiwera (34min)		
	Orewa (30min)		
	Beachlands (37min)		
	Maraetai (39min)		
	Kawakawa Bay (1hr)		
	Orere Point (1hr)		

Table 3.0: The distance between Auckland City and coast towns

This table shows that the distance between Auckland City and coastal towns within an hour's range. It clearly shows each potential site in relation to Auckland City, and it will be used further for potential site selection.

Site		Enviroment						Build Up						Culture	Policy
		Vegetation	Slope	Wetland	Costalsand	Conservation	Disaster	Highway	Railway	Ferry	Airport	Settlement	Infrastructure	Histroic heritage	Planning
Northland	Pataua	•	<5	•	•		•					•	•		
	Ruakaka	•	<5	•	•	•	•	•				•	•		
	Langs Beach	•	>5	•	•							•	•		
	Mangawhai Heads	•	<5	•	•	•						•	•	•	
Auckland	Pakiri	•	<5		•							•	•	•	•
	Leigh	•	>5		•							•	•	•	
	Maraetai	•	<5		•	•						•	•	•	
	Kawakawa	•	<5		•	•						•	•	•	
	Orere Point	•	<5		•							•	•	•	
Waikato	Te Puru	•	>5		•	•	•	•				•	•		
	Whiritoa	•	<5	•	•		•	•				•	•		
Bay of Plenty	Waihi Beach	•	<5		•	•						•	•	•	
	Pukehina Beach	•	<5	•	•							•	•		

Table 4.0: The criteria of potential sites.

This table shows potential site conditions from a sustainable development criteria view. Each potential site will be screened in accordance with sustainable development criteria and site selection criteria. The result will show potential sites. These sites can be ground through site visits to help in the site selections for the final case study design.

Potential sites:

- Ruakaka, Northland
- Pakiri, Auckland
- Kawakawa Bay, Auckland
- Whiritoa, Waikato
- Waihi Beach, Bay of Plenty

These sites have the following characteristics:

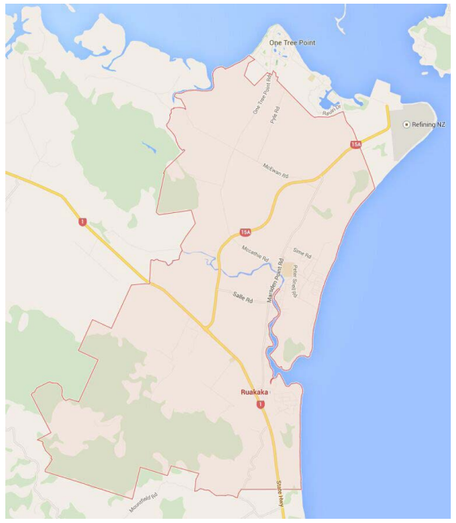
- High vegetation coverage
- High cultural value
- Existing infrastructure
- Short distance from the city centre
- Avoid potential natural disaster

4.2.3 Site Visit

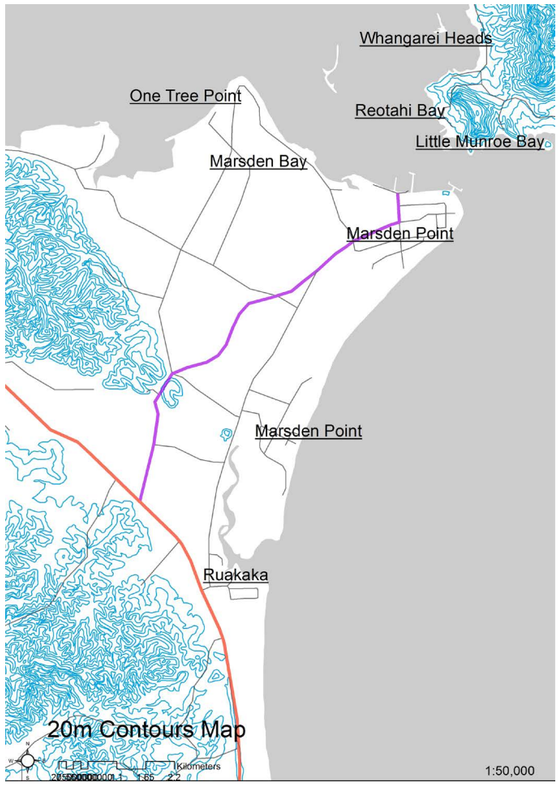
After GIS mapping analysis and site visits, the final site for the environmentally sustainable development case study will be determined.

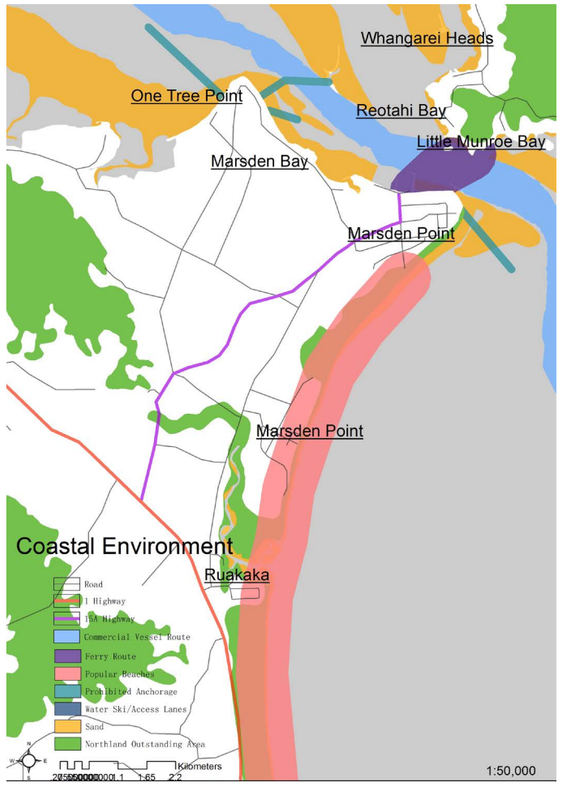
Ruakaka

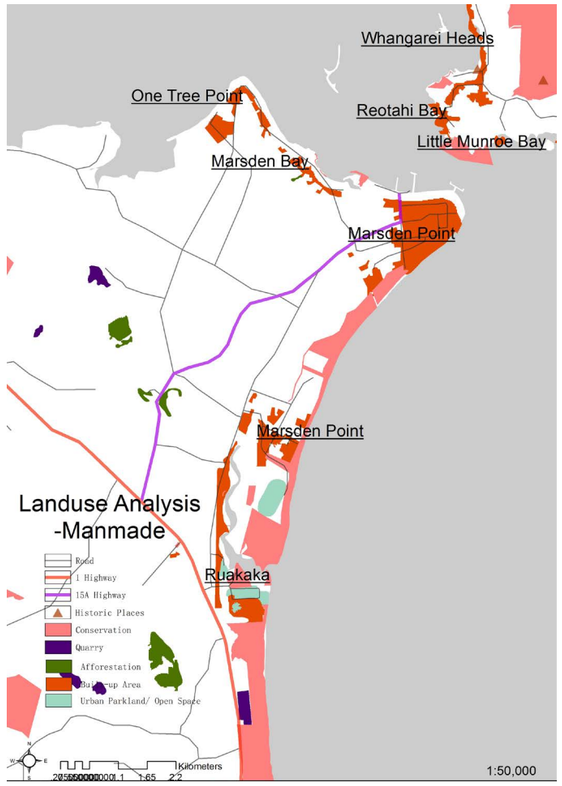
Ruakaka, is located south of Whangarei in the Bream Bay area. It has an existing population of 3,543 (2013). The town has good transport, infrastructure including a two-lane highway and a railway line. It has a major petrochemical enterprise in the northern part of the town, (Masdern Point) and its own port facilities. The distribution of vegetation and infrastructure still needs further improvement to meet the requirements for future development. The analysis of Ruakaka's potential for natural disaster found that most of the town is flood sensitive.

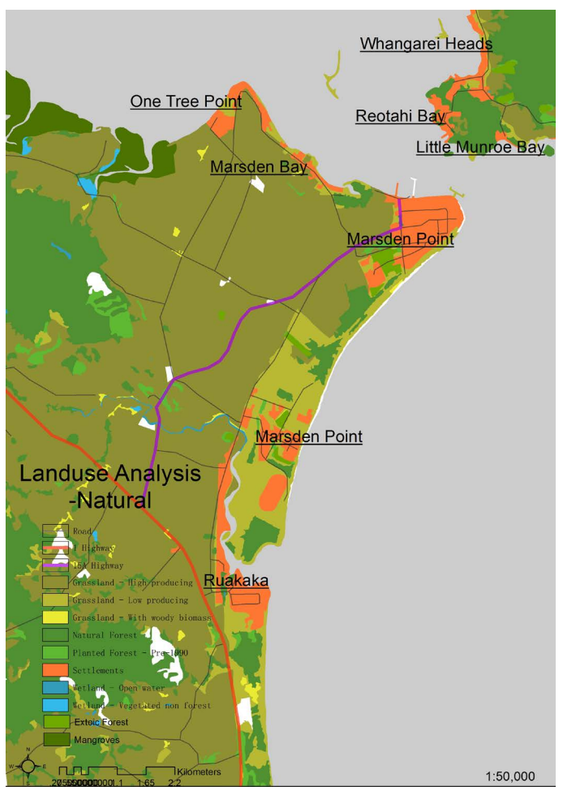


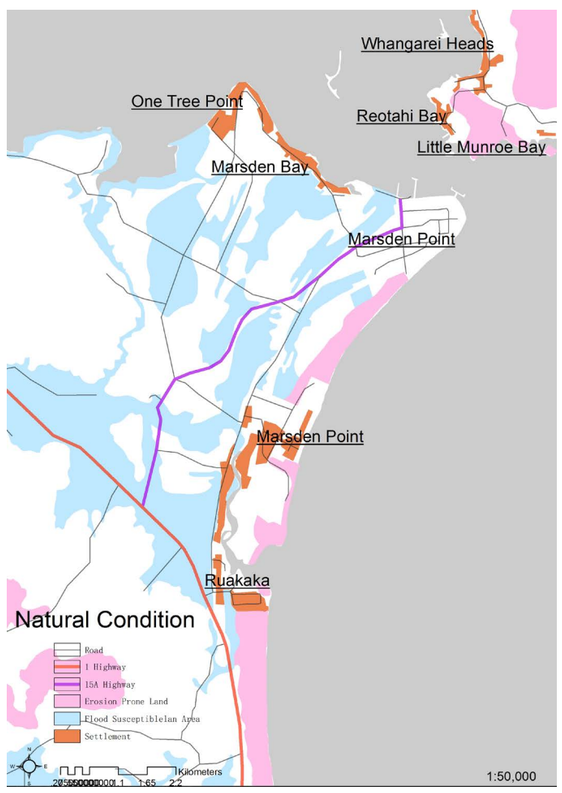
Ruakaka Site Photography









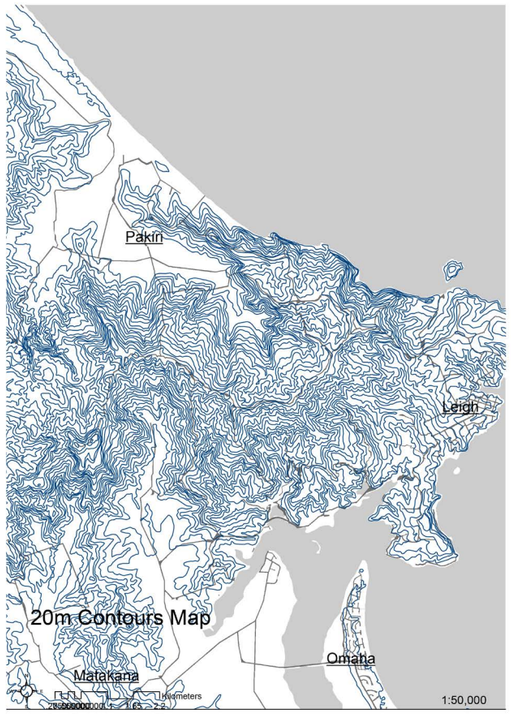


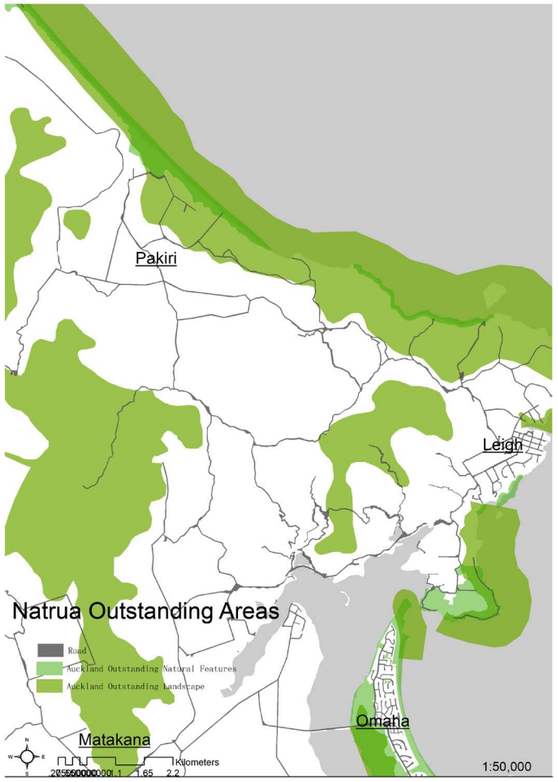
Ruakaka GIS Maps (1:50,000)

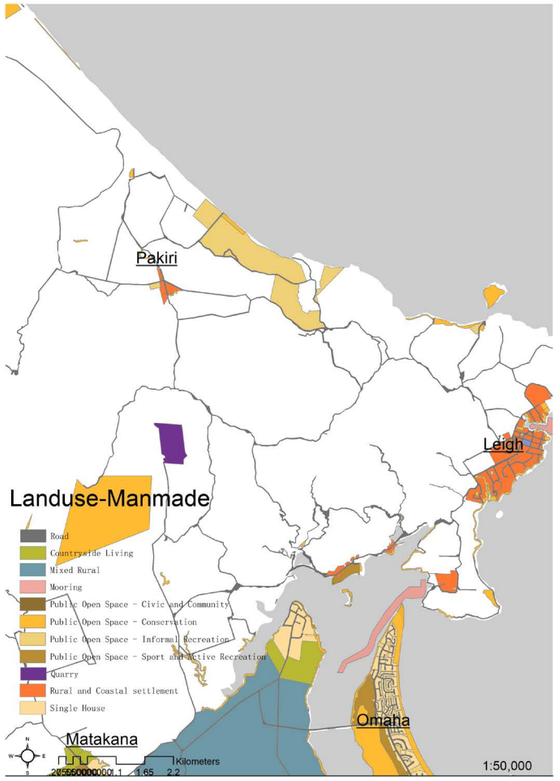
Pakiri

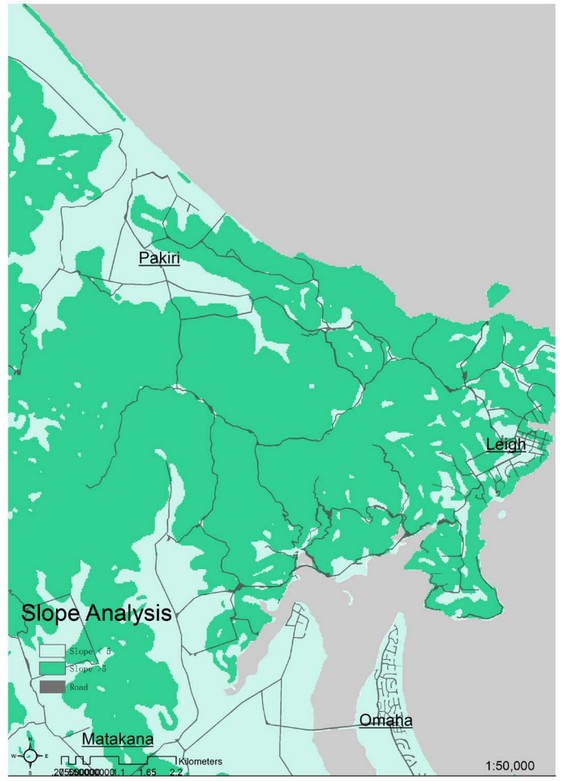
Pakiri, is located north of Auckland in the former Rodney District. It has a 14km-long white sandy beach, the Pakiri River flows through the middle of the beach and into the Hauraki Gulf. The population of Pakiri is in the low hundreds. As Auckland City's northernmost coastal town, Pakiri has a good natural environment and plant resources for the development of tourism. A visit to Pakiri found that traffic conditions need improvement. In terms of infrastructure, Pakiri needs to plan future infrastructure to meet development needs. Finally, the potential natural disaster analysis of Pakiri shows that the area north of Pakiri River estuary is a flood-sensitive zone.

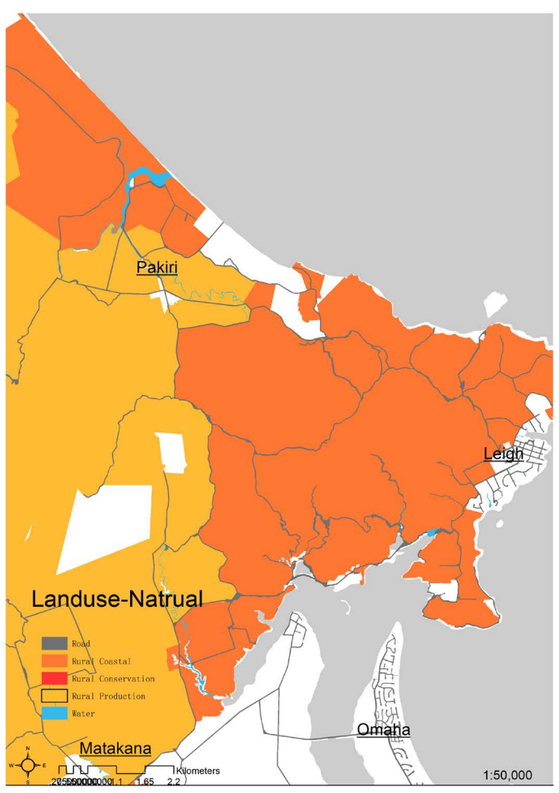
Pakiri Site Photography

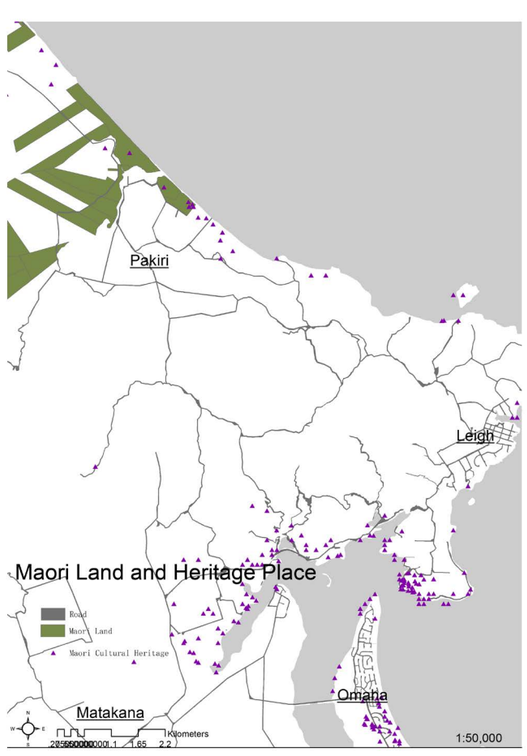


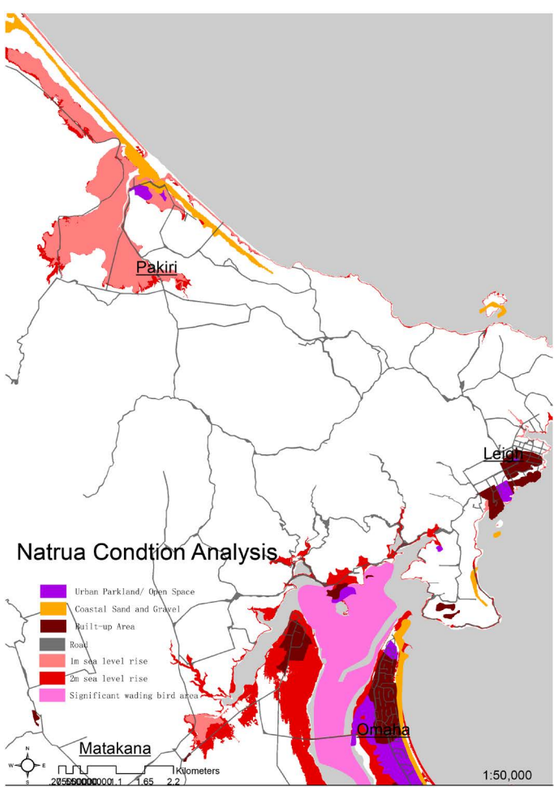


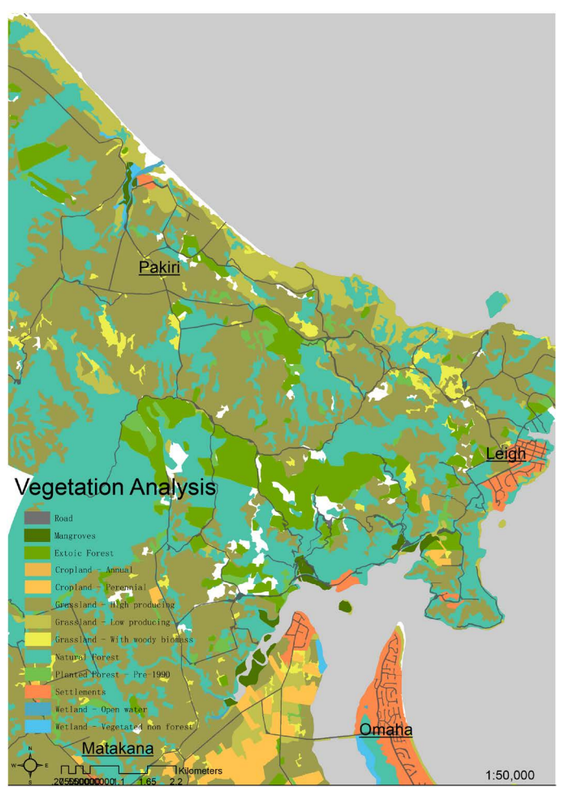










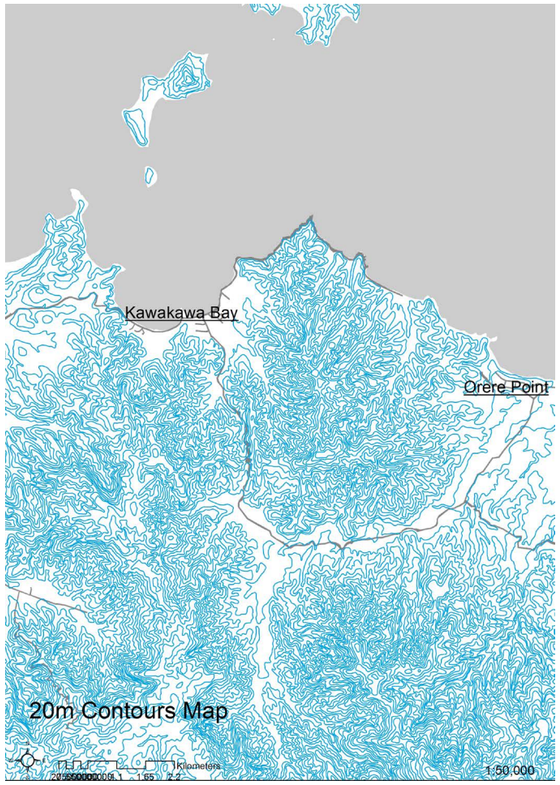


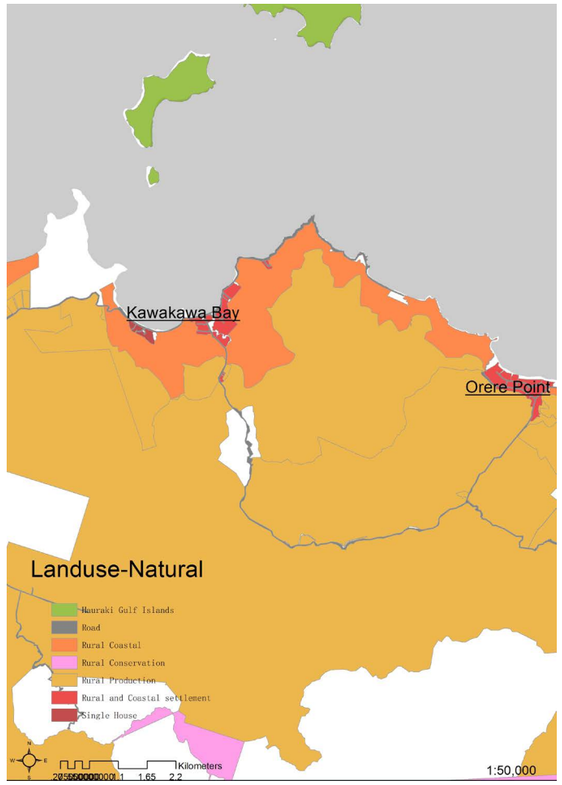
Pakiri GIS Maps (1:50,000)

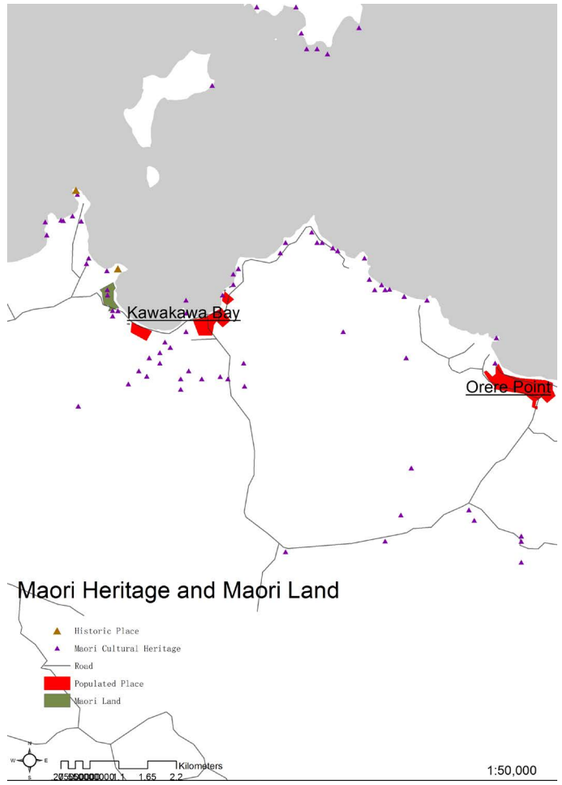
Kawakawa Bay

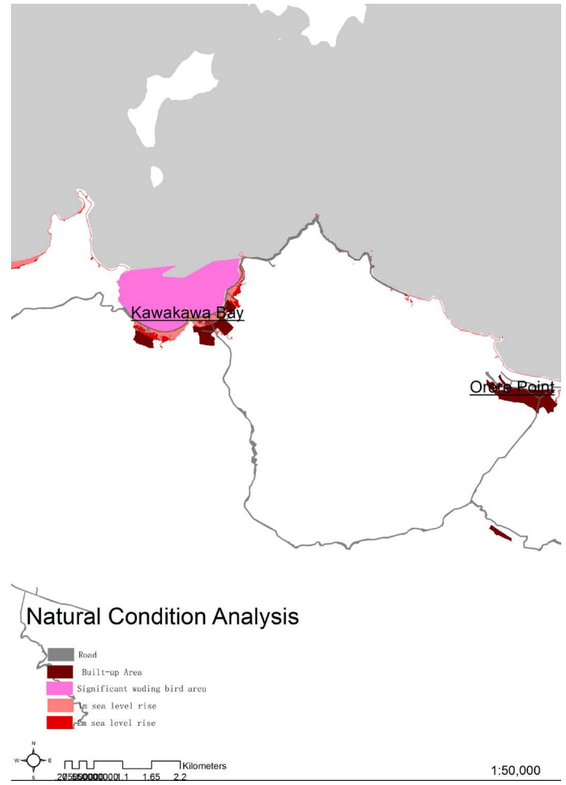
Kawakawa Bay is a small coastal village facing north on the Hauraki Gulf, The population of Kawakawa Bay is in the low hundreds. Kawakawa Bay was settled by the Maori, and has many Maori cultural sites, and some Maori-owned land. The transport infrastructure is not satisfactory for visitors However, it has abundant natural vegetation. The the town has developed with the transit road, and needs further improvement. Finally, the analysis of natural disasters shows that a small part of the site located on the beach side has a flood-sensitive area.

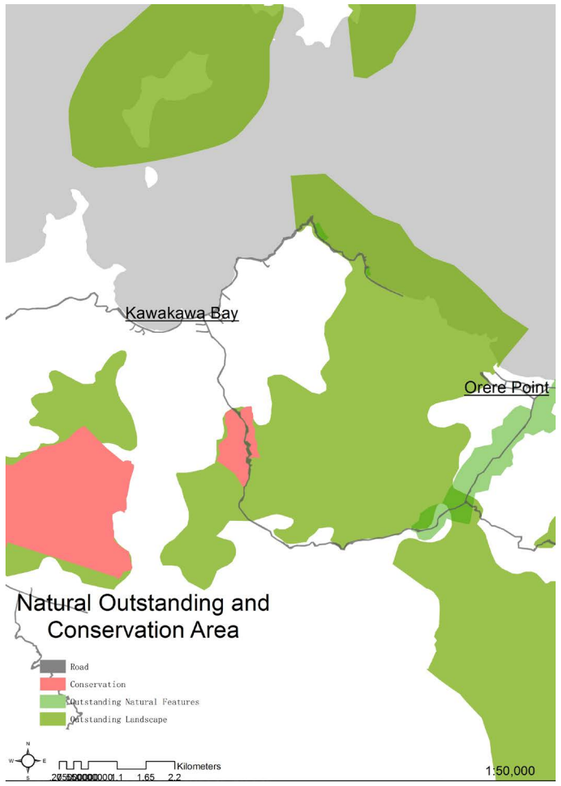
Kawakawa Bay site Photography

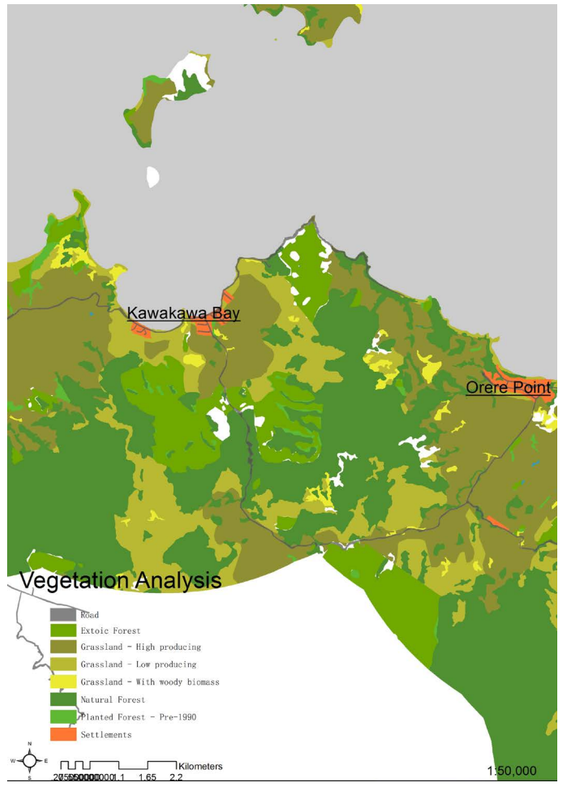


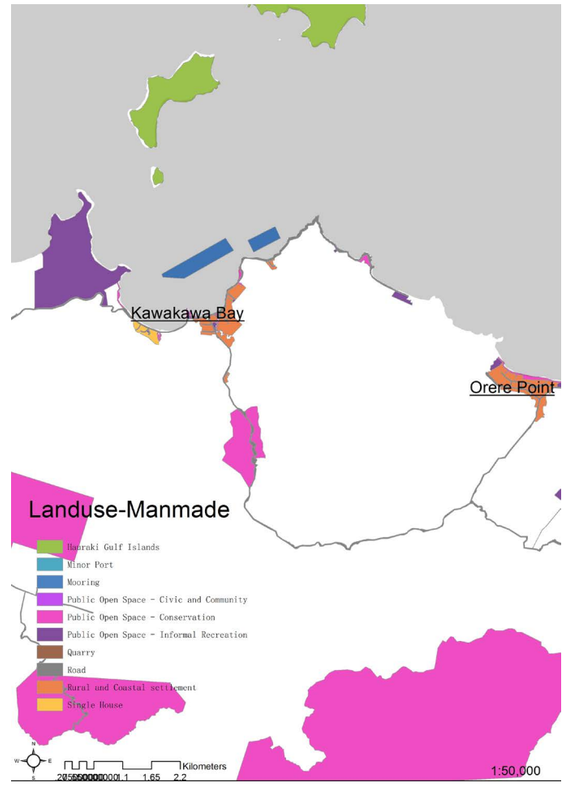










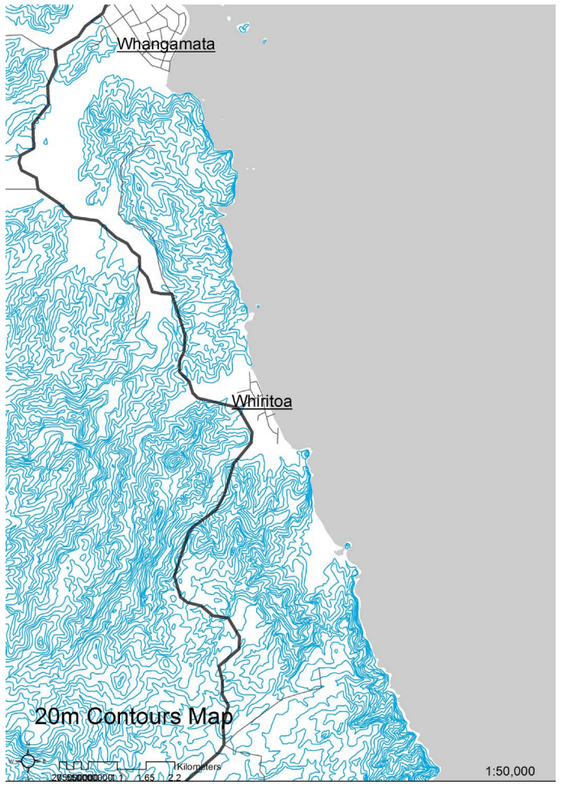


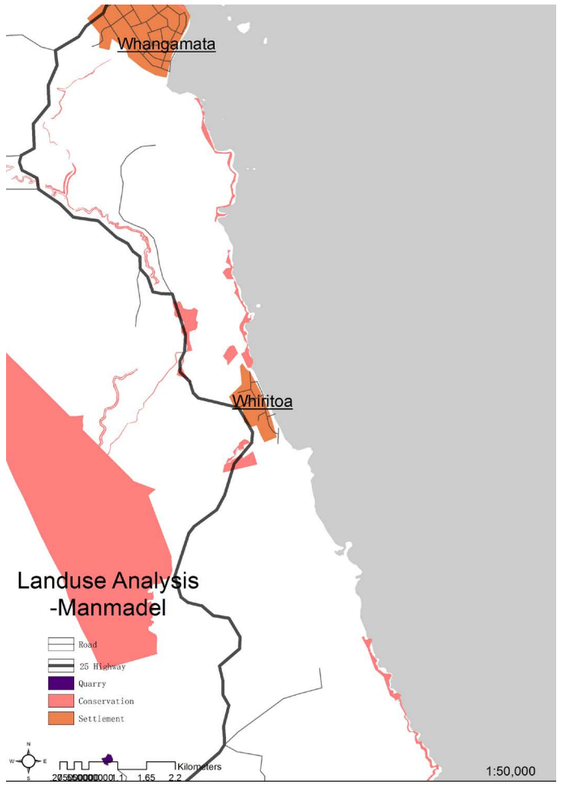
Kawakawa Bay GIS Maps (1:50,000)

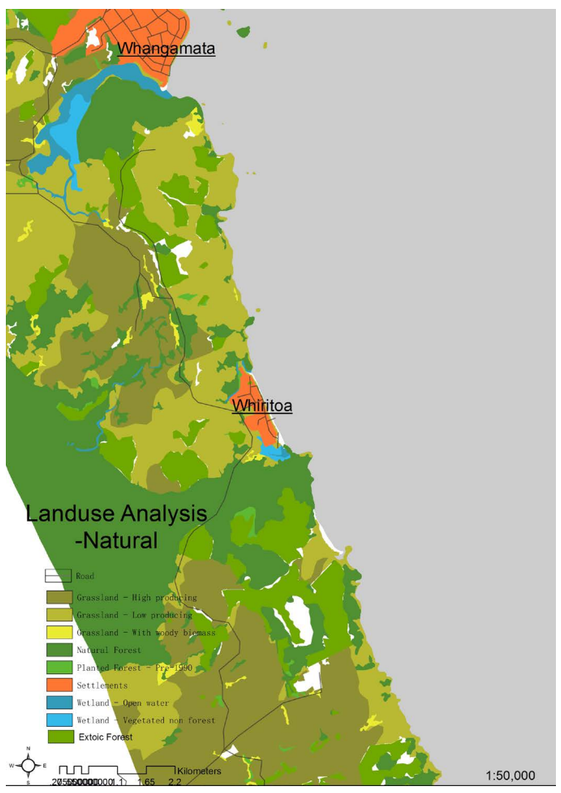
Whiritoa

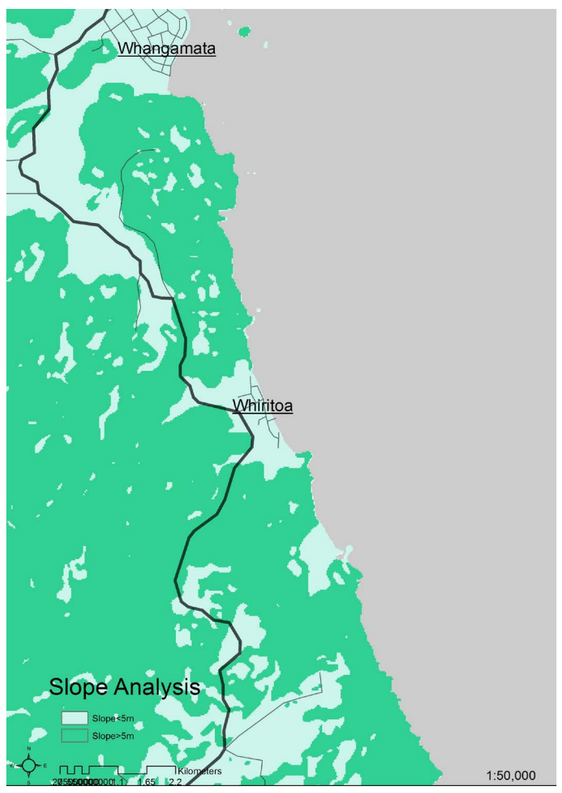
Whiritoa is a small coastal town located on the Coromandel Peninsula between Whangamata and Waihi Beach. It is a popular holiday destination. The population of Whiritoa is in the low hundreds. Whiritoa is connected with two highways, however it is still not convenient for visitors, because it's located in a steep area. It has abundant vegetation cover, growing well, with an attractive bush environment. Because it is a holiday destination, Whiritoa has good infrastructure. Finally, an analysis of natural disaster potential found it is in a coastal erosion needing restoring and rebuilding.

Whititoa Site Photography







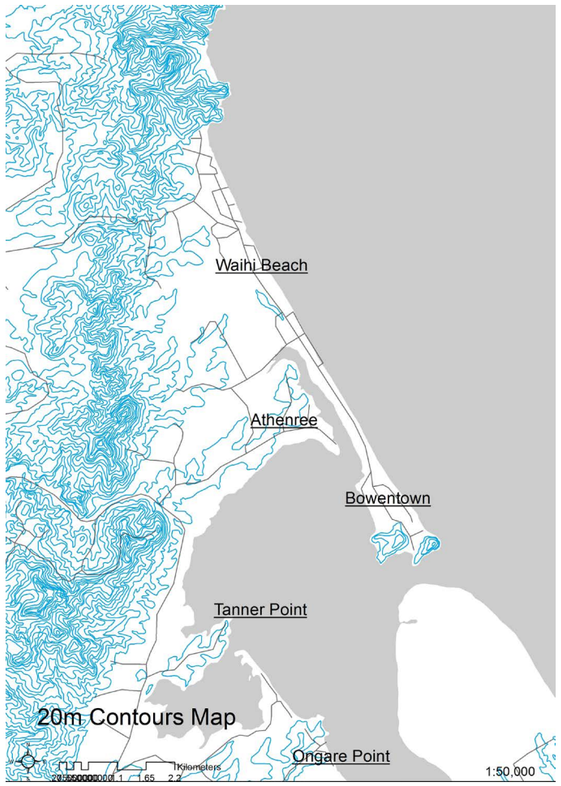


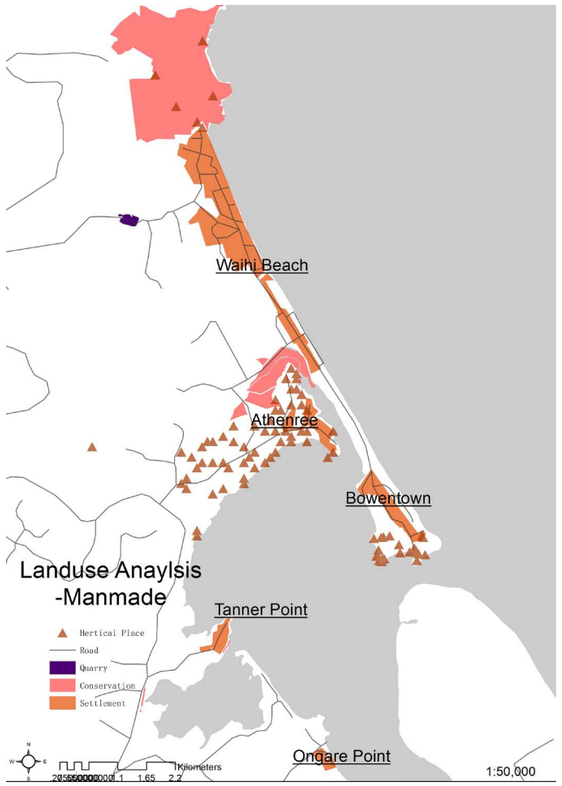
Whiritoa GIS Maps (1:50,000)

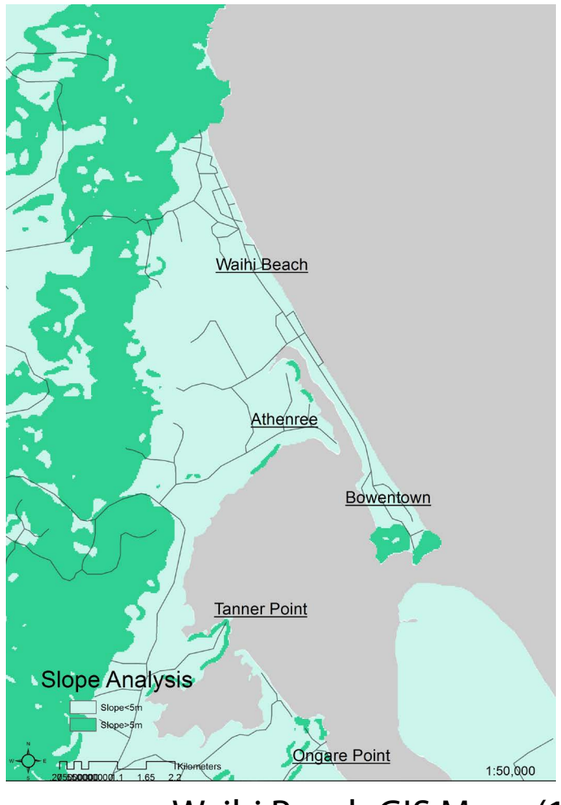
Waihi Beach

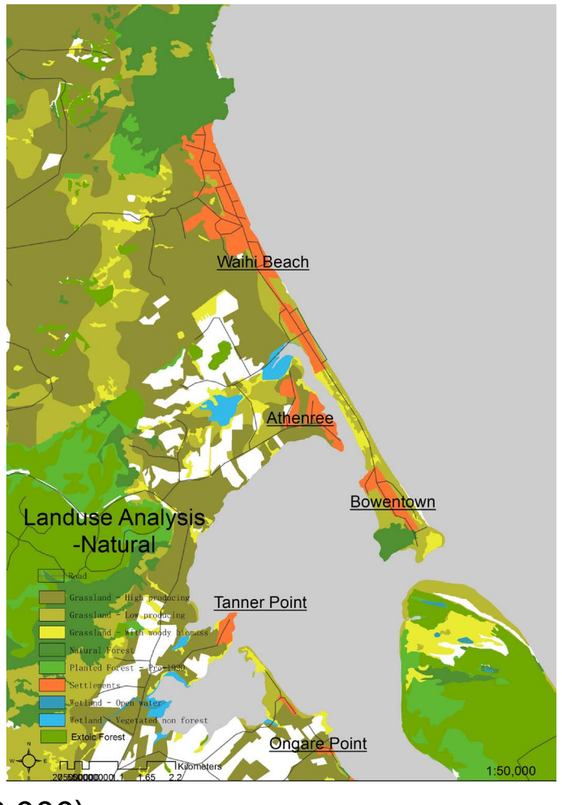
Waihi Beach is a coastal town located in the western end of the Bay of Plenty, with a population of 1773 (2006), but in summer this will rise to 16,000. Waihi Beach is a popular holiday destination, with several cafes and eateries. The Waihi Beach Hotel was built in 1967, there is also two holiday parks and hot springs at Athenree. The town has good traffic infrastructure convenient access, and the surrounding towns are also well-known tourist destinations. Waihi Beach has abundant vegetation coverage and meets the environmental sustainability criteria. It has full tourist service facilities. Finally, the main potential natural disaster impact on Waihi Beach is a tsunami.

Waihi Beach Site Photography









Waihi Beach GIS Maps (1:50,000)

Site Findings:

Site	Development Average	Natural Condition	Urban Space	Geographic Feature	Transport Condition
Ruakaka	High	×	√	×	√
Pakiri	Low	√	√	√	×
Kawakawa Bay	Low	√	×	×	×
Whiritoa	Low	√	×	×	√
Waihi Beach	High	√	√	√	√

Table 5.0: The site findings

This table shows each potential site's conditions according to the site analysis and site visits, By considering all the criteria of sustainable development and project goals, Pakiri is the best-qualified site, which has lower development average, good natural conditions, and eough urban developing space, excellent geographic feature for coastal tourism developing. However, from the table result shows that Waihi beach has the highest mark, but this coastal town already has the next 25 year's plan, therefore it will not be chosen as research testing site.

4.3 Conclusion

Through the case study review, it can be seen the Whangarei to Tauranga coastal zone has good environmental conditions, but the development potential is quite different, due to the many variables of transportation and urban infrastructure. To carry out the review GIS was used as the main data analysis tool with sustainable development criteria to select the final development site.

The case study review shows the coastal region's environmental and development conditions. These results were also considered in the site selection for the final design work. This case study review method can be applied to other regional coastal development analysis.

5.0 Design Exploration 2: “Pakiri” case study

5.0 Design Exploration 2: "Pakiri" case study

Introduction

After the case study review for an environmentally sustainable development site in the coastal zone, five potential coastal development sites were identified. After further analysis Pakiri was selected as a case study to investigate how a sustainable urban development could be planned. .

In the regional coastal zone case study, the method of environmentally sustainable development criteria was applied to help in the site selection and investigation. In this section the criteria will be used for the Pakiri site to select a sustainable development area and to test how environmentally sustainable tourism can be used for coastal preservation.

Environmentally sustainable development criteria:

- High quality of existing vegetation region
- No potential for natural disasters affecting the zone ie sea level rise flooding area
- Suitable geographic conditions for urban development ie slope lower than 5 degrees
- In line with the urban planning of land use conditions ie under the 20m contour line

The sustainable development of the environment is not only about protecting the local environment, but also ensuring that an environmentally protected development contributes to regional development. Therefore, this case study is divided into two parts, firstly to understand the idea of environmentally sustainable tourism in a coastal zone reserve. A holiday park in Pakiri is designed and tested The second part of the study looks at the surrounding network planning, exploring how through developing a sustainable urban plan for Pakiri the benefit of regional development interaction and a new life cycle for the Pakiri region, can improve the regional development

Three criterion are used for this case study design, Firstly, an environmentally sustainable development criteria I used to help build up the sustainable development zone for the Pakiri site. Secondly, using environmentally sustainable tourism criteria, to help in the design of a holiday park to preserve and improve the Pakiri coastal zone environment. Thirdly, using sustainable development criteria for improving regional development interaction, showing the way in which Pakiri as a new urban area will impact both Whangarei and Auckland City.

Pakiri

Pakiri, located north east of Auckland city in the former Rodney District of New Zealand, is close to Leigh, Omaha and Goat Island resort. Pakiri is within an hour of Auckland, and 24km from Highway One.

Pakiri has the longest coastline in the Auckland region, a 14km-long white sandy beach. Since the 1950s sand has been mined from the sea floor off the coast. In 2005, Auckland Council purchased two blocks of land in Pakiri to protect and restore the ecological environment of the coastal zone and to develop a regional park.

Most land in Pakiri is privately owned, with a small percentage government owned or Maori land. As a small coastal village, Pakiri has a lot of potential for an environmentally sustainable development, especially because it has a rich landscape and resources such as Pakiri River, farms, hills, and villages. Plus it is the middle point between Whangarei and Auckland.

It is a popular local destination, and it has lots of popular activities, for instance, for wedding photos, surfing, hiking and horse riding on the beach.

5.1 Site photography

Pakiri Park

Pakiri old church

Pakiri River

Pakiri country road

Pakiri beach

Pakiri Park

Pakiri Old Church

Pakiri Beach

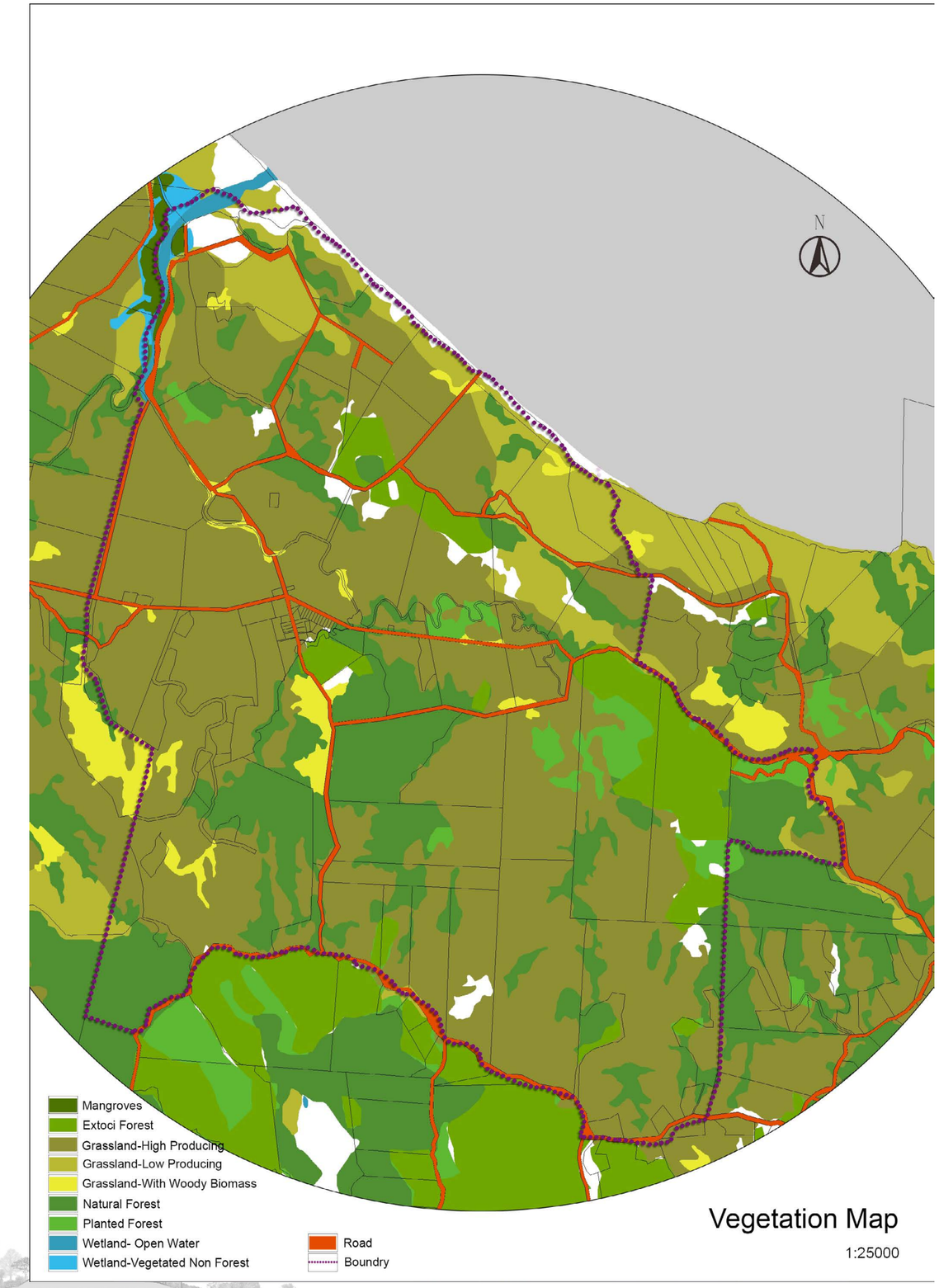
Pakiri Country Road

Pakiri River

5.2 Maps of Pakiri

5.2.1 Existing vegetation condition

This map shows that the Pakiri site has a variety of type's plants, but most areas are grassland, and some of the coastal region has native and exotic plants.

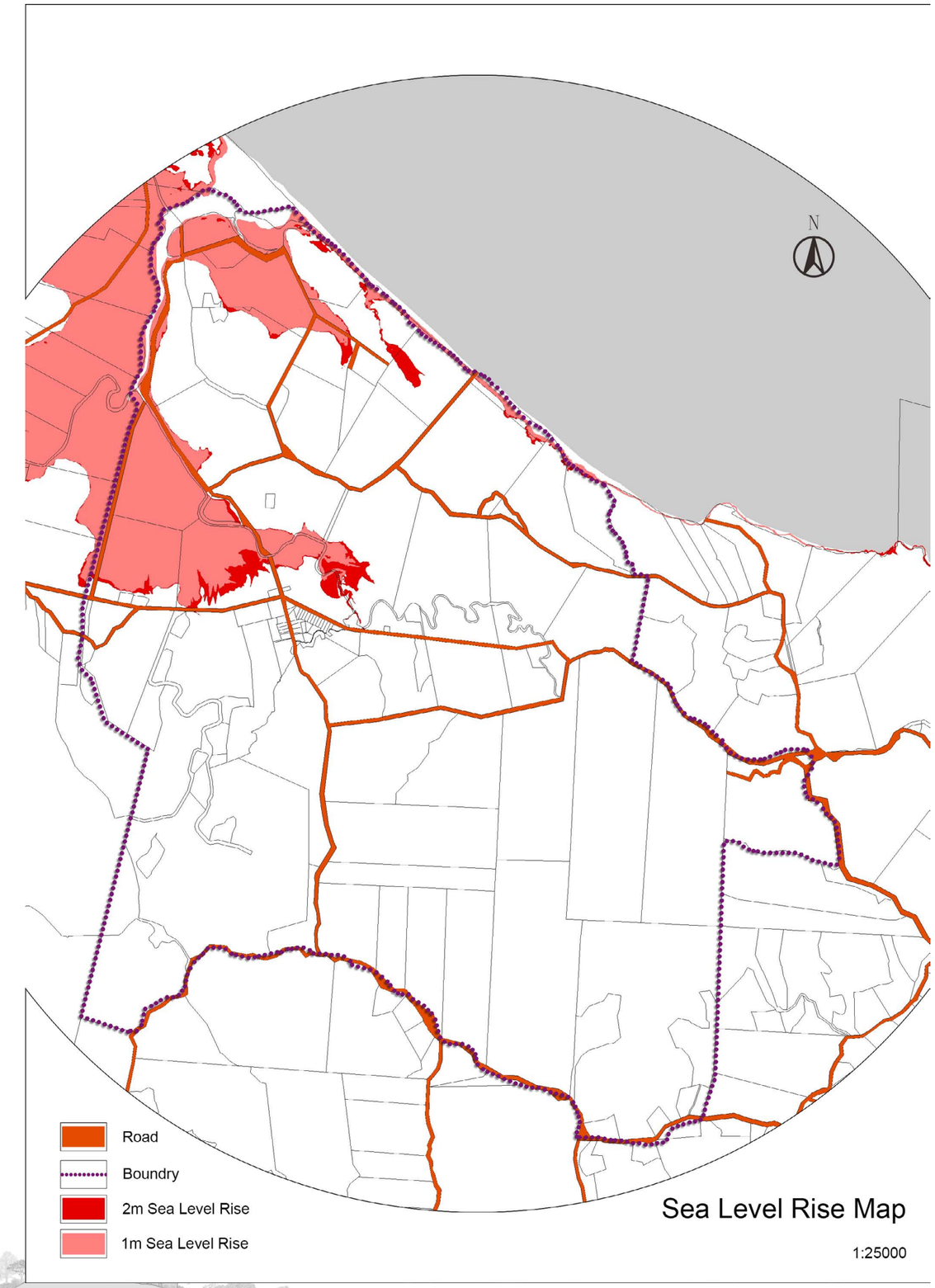


Vegetation Map

1:25000

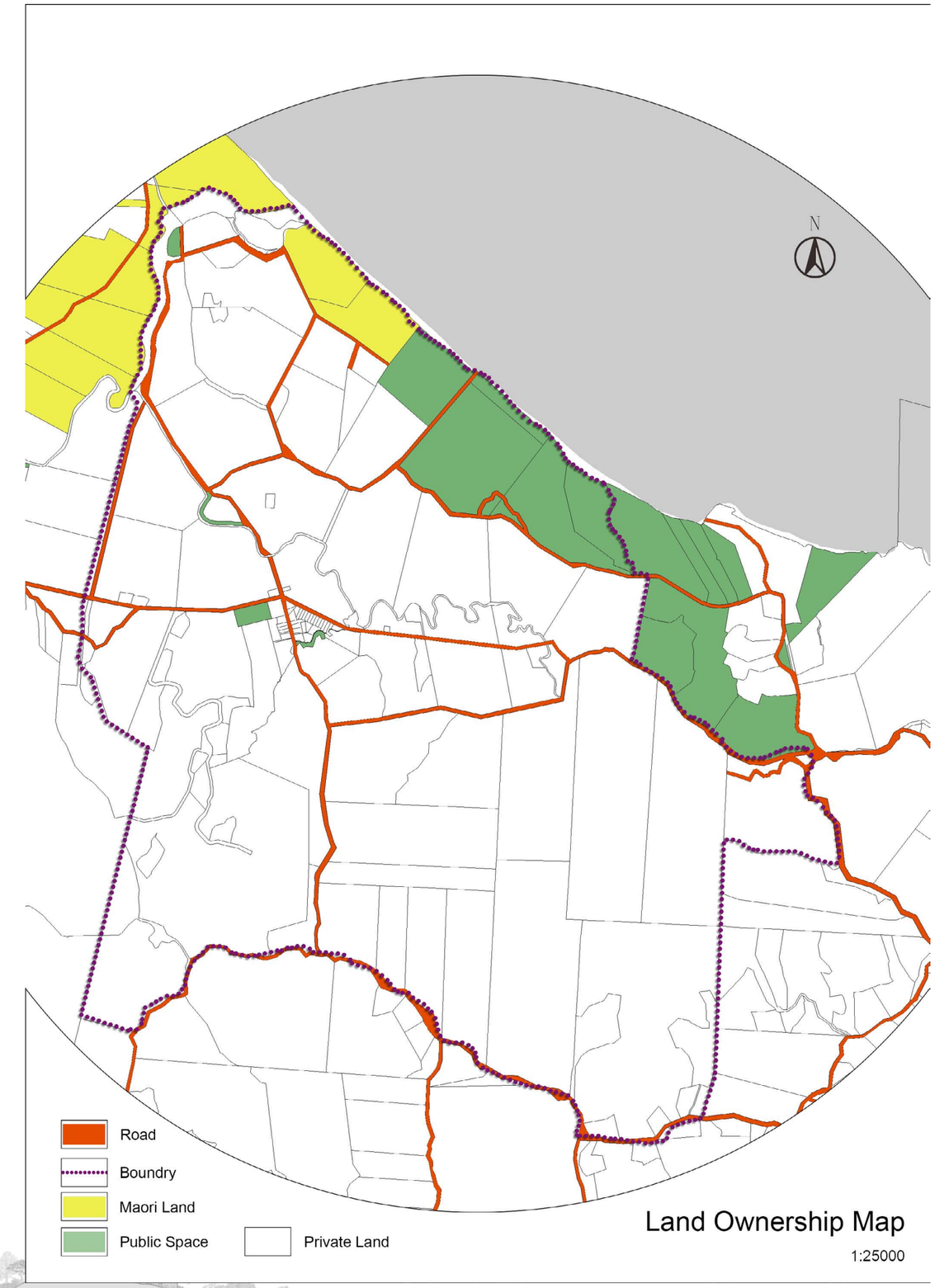
5.2.2 Natural disaster area

This is a special analysis map. As a coastal town, Pakiri mainly faces rising sea levels and flood disaster. The map shows 1 to 2m of sea-level rise impact areas.



5.2.3 Land use condition

The Pakiri land use analysis map is based on land ownership, because as a small coastal village, Pakiri doesn't have any industrial or commercial land. Most land is privately owned, and other types of properties include conservation areas and Maori land.

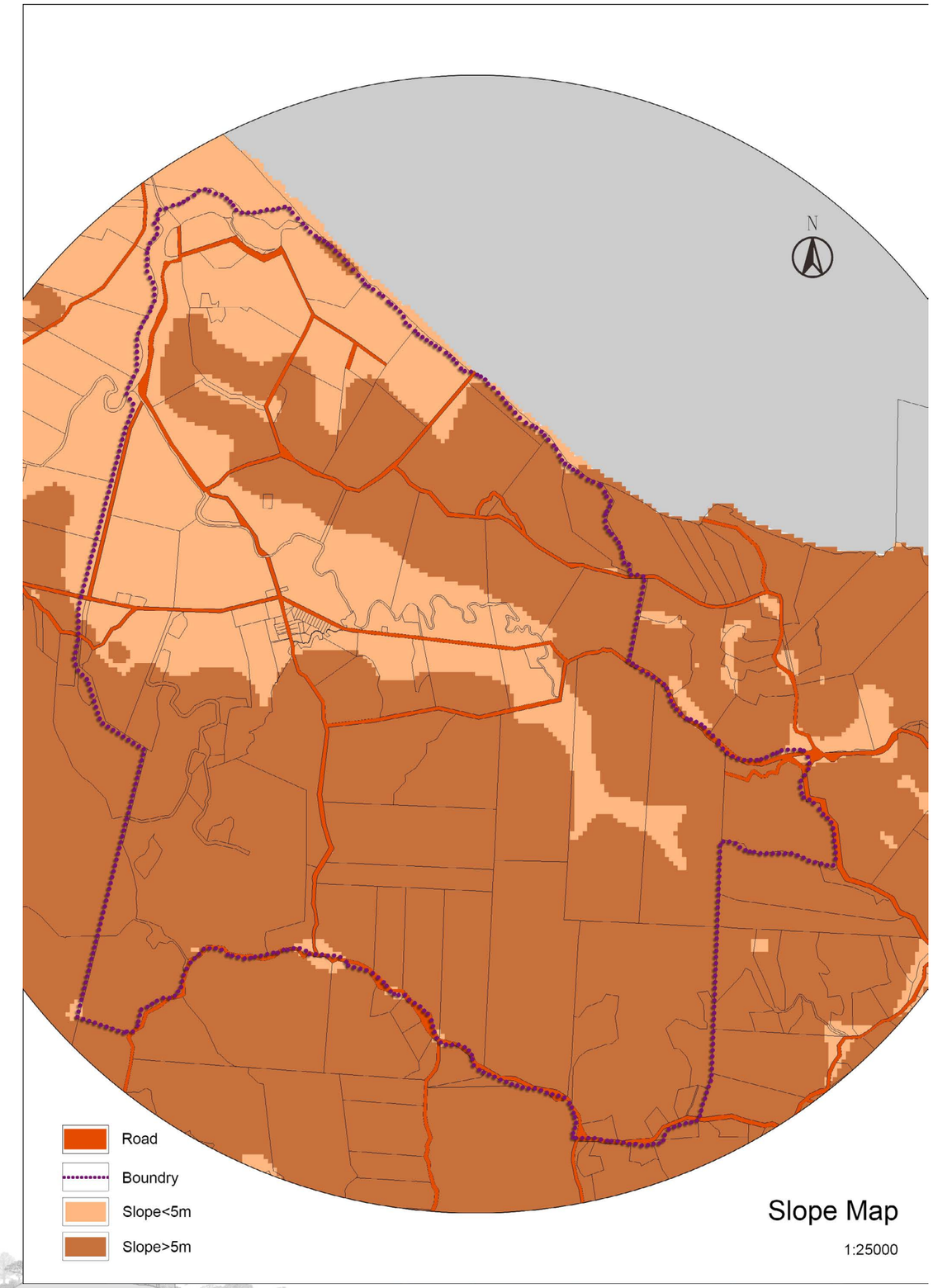


Land Ownership Map

1:25000

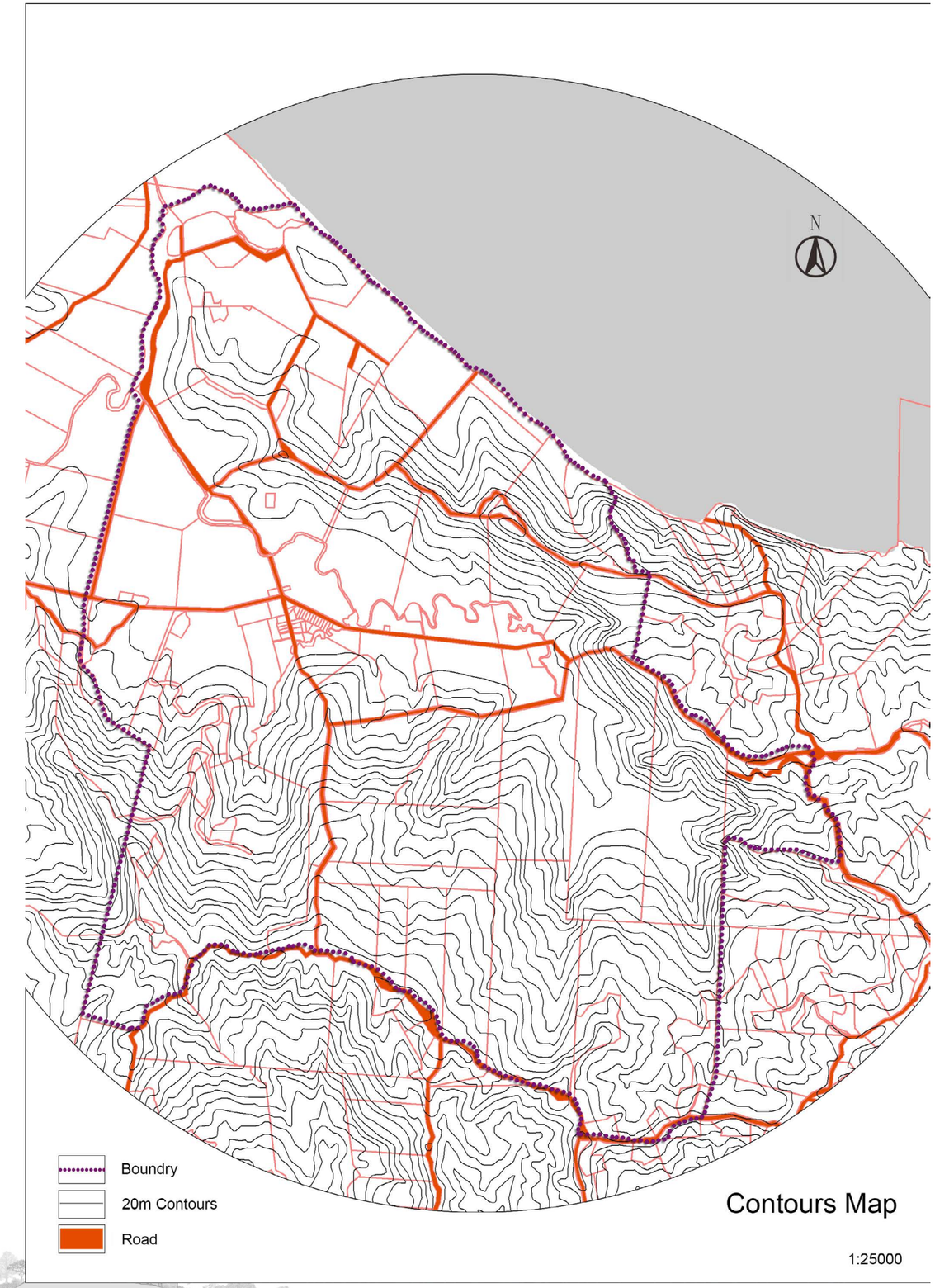
5.2.4 Slope analysis

This map shows that Pakiri has a lot of land over 5 degrees, while the main residential area and the Pakiri River buffer are flatter.



5.2.5 Contours

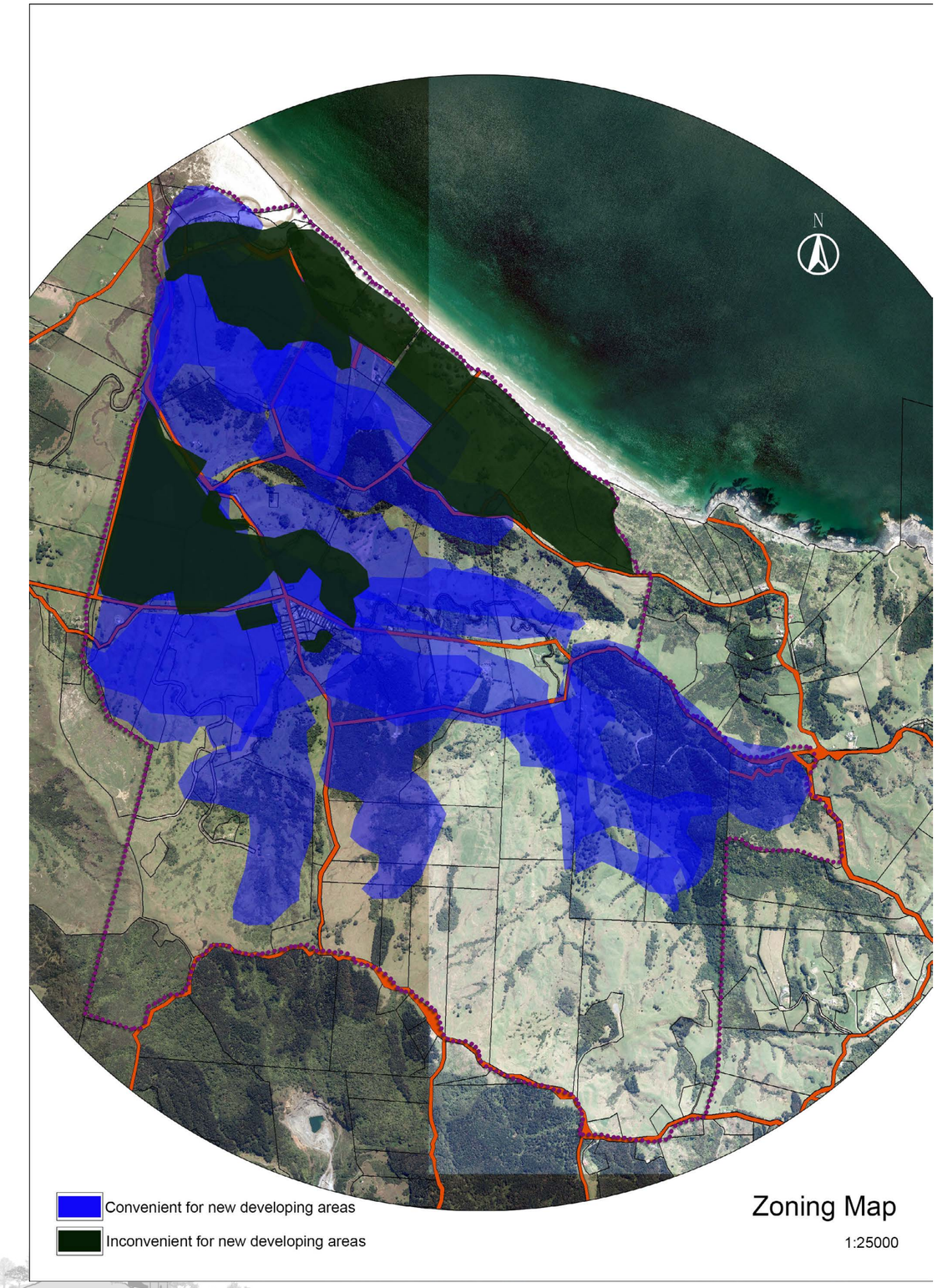
As one can see, the contour map shows that the western area of Pakiri is higher than middle region, rendered as a small basin topography. It is relatively smooth in the mouth of the river terrain, and between the beach and the residential areas are two small hills, with a height of 100m.

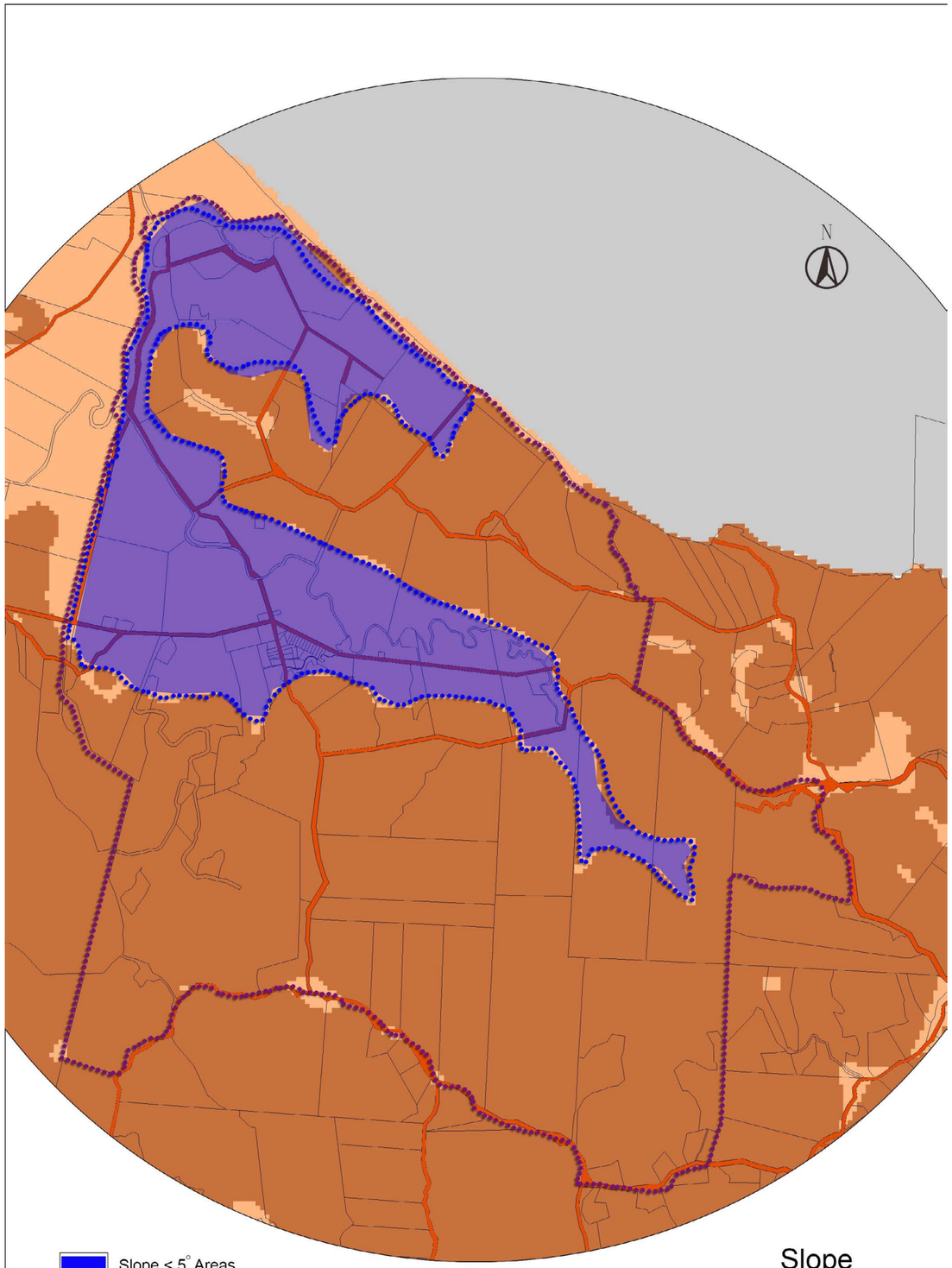


5.2.6 Combining map (Sustainable development zone)

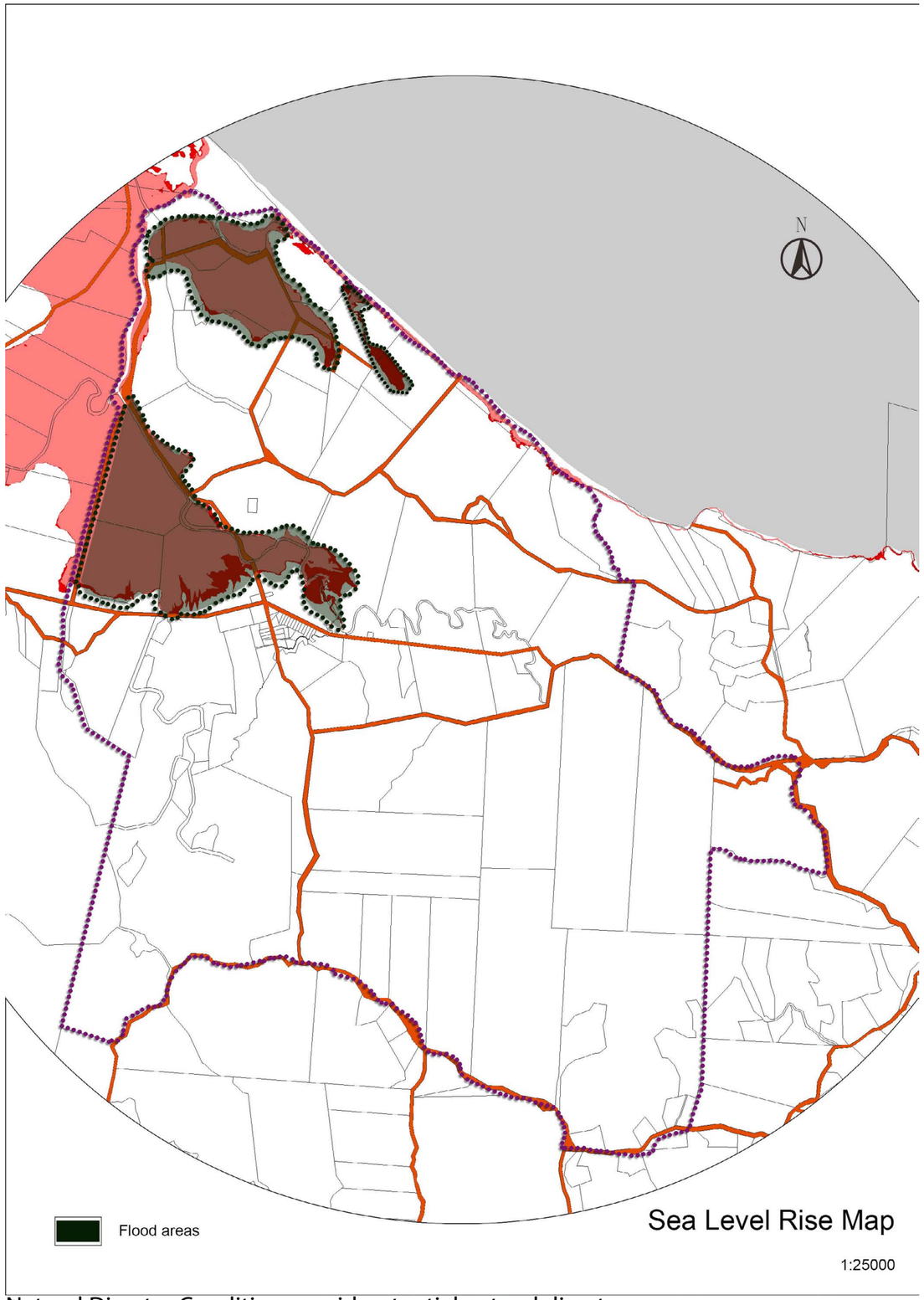
Based on the environmentally sustainable development criteria, these maps identified a new sustainable development zone for Pakiri. As one can see, the blue areas show the most sustainable development zone, and the dark green areas the unsatisfactory development zone

The criteria for a sustainable development from the research methodology will use a sustainability analysis for Pakiri. For example, some of the conditions that are choose are ; the most diverse vegetation coverage areas, avoiding potential natural disaster areas, protecting conservation and historical value regions, and selecting the specific geographical condition with a slope of less than 5 degrees for future urban construction

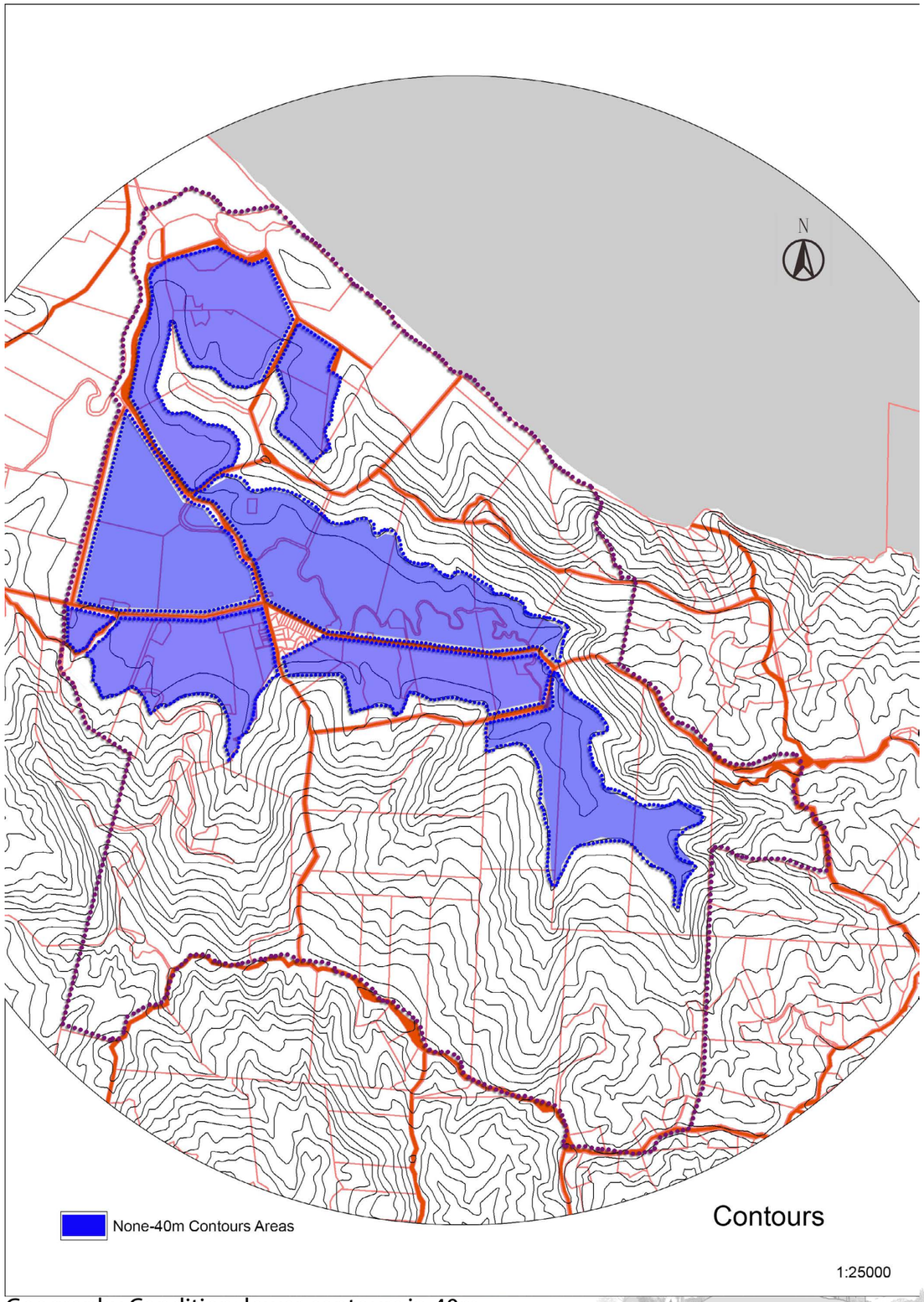


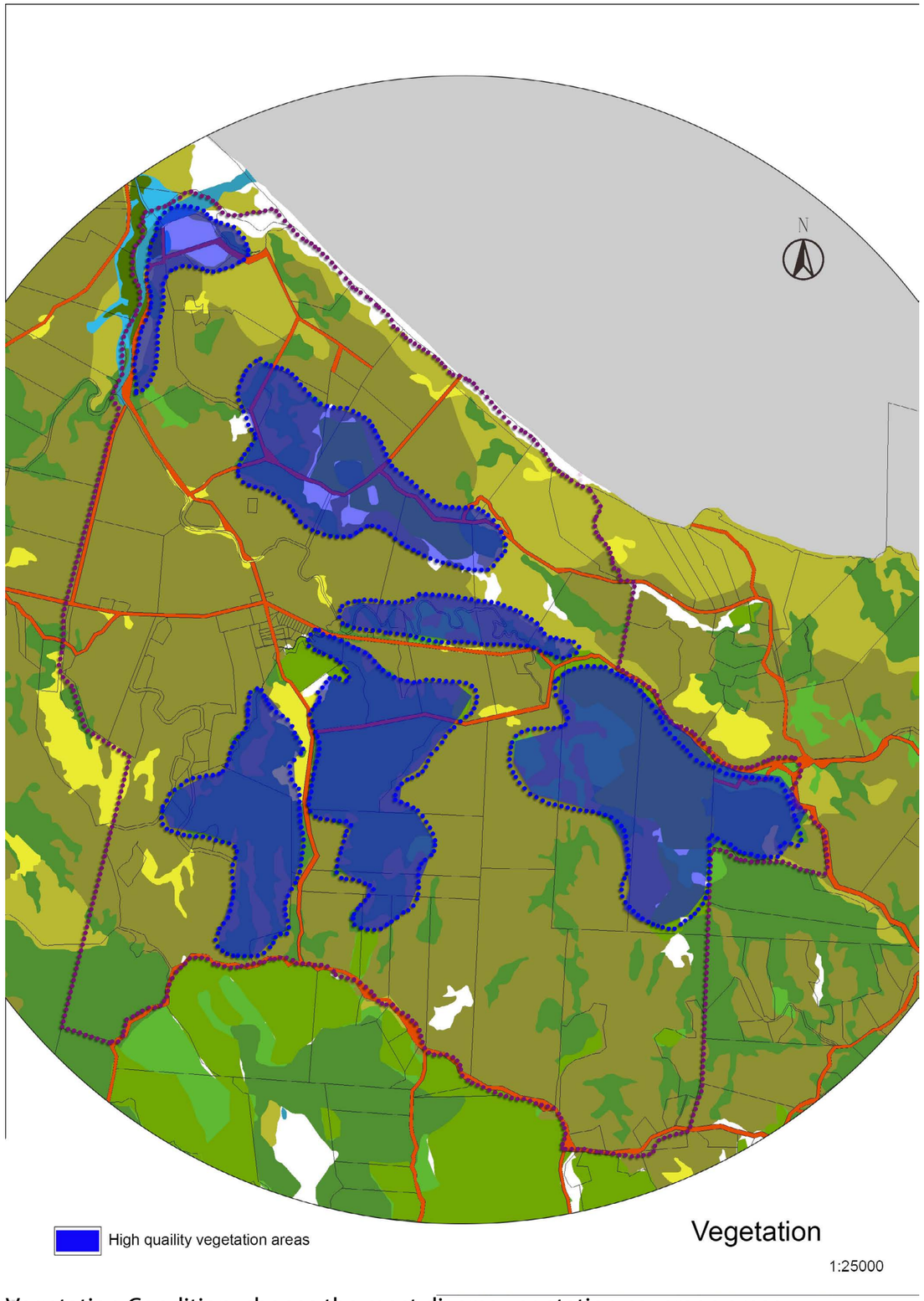


Slope Condition : less than 5 degrees



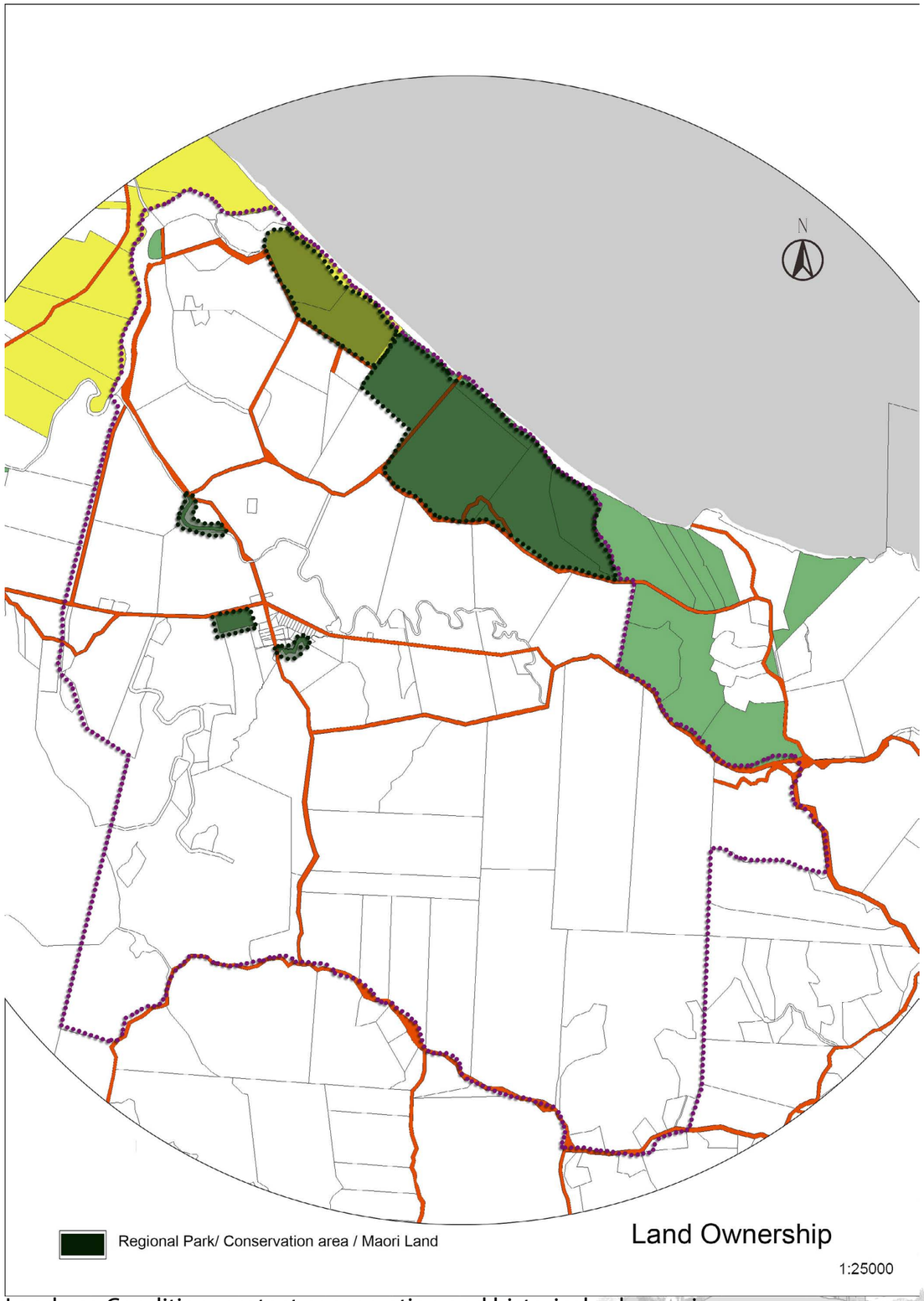
Natural Disaster Condition : avoid potential natural disaster areas





Geography Condition: lower contours in 40m

Vegetation Condition: choose the most diverse vegetation coverage areas



Each map basic on the environment sustainaibility criteria analysis.

Environmental Sustainability Criteria:

- Avoid ecologically sensitive areas aimed at protecting local ecological characteristics, such as wetlands, forests, rivers, wildlife, wild plants.
- Healthy and environmentally friendly, considering environmental pollution and population growth. The new site will be required to be green, so will include a description of a healthy natural environment, such as the distribution of vegetation, climatic conditions and population.
- Analysis of potential natural disasters will serve as an important criterion for selecting a site. Analysis should identify potential natural disasters (flood, sea level rise), and potentially affected areas.
- Geographical features, mainly urban planning requirements, include slope and elevation analysis, and each standard will follow the urban planning criteria (slope < 5/ Contours < 20m).

Land use Condition: protect conservation and historical value regions

5.3 Environmentally sustainable development plan

This plan shows an environmentally sustainable development plan for this area by explaining the thinking behind the diagram of the coastal zone's environmentally sustainable, and then choosing a site for establishing an environmentally sustainable tourism operation.

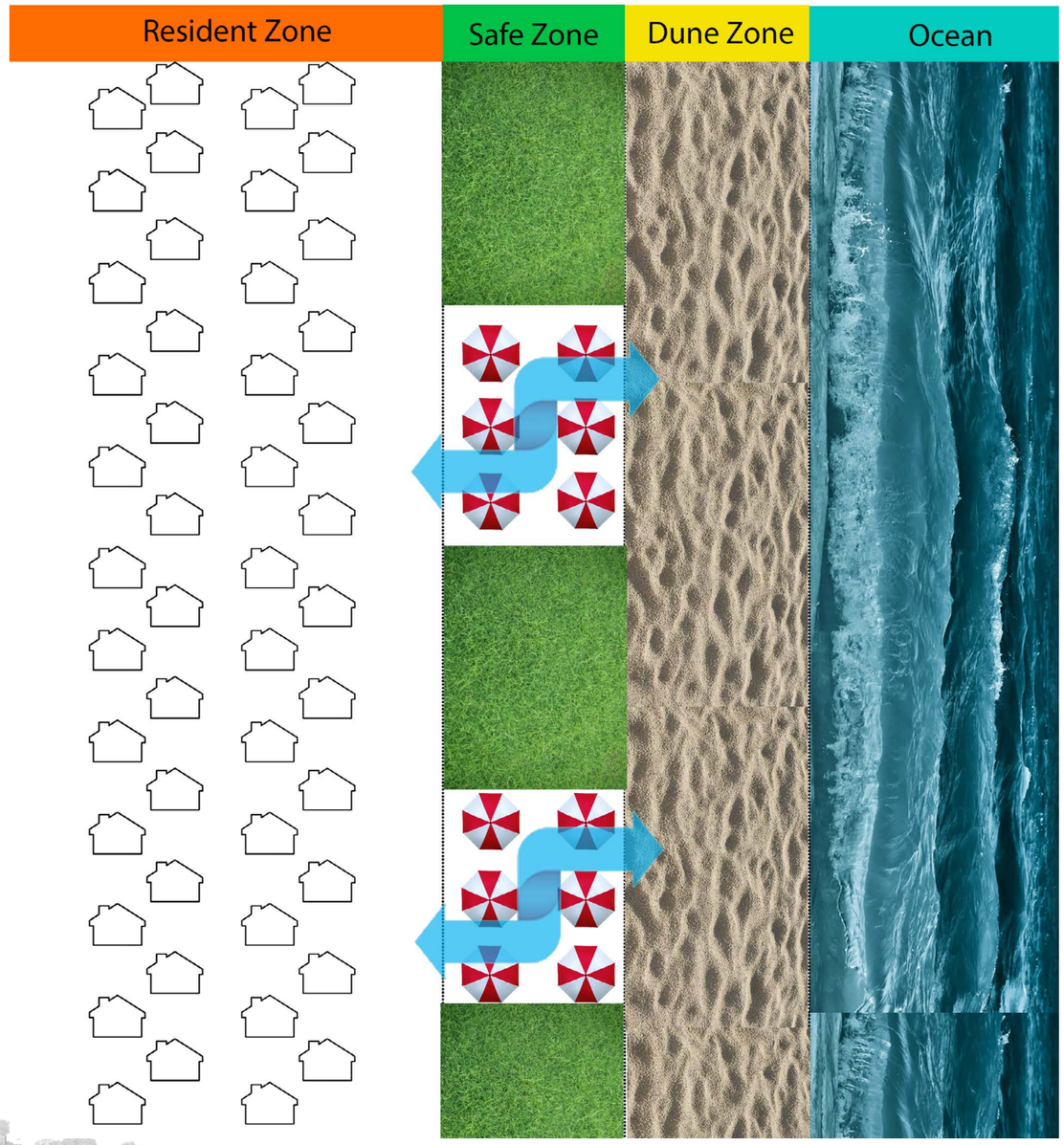
5.3.1 Sustainable coastal zone

The development of a sustainable urban coastal zone is the main driver of this project, and this diagram shows how an environmentally sustainable development in a coastal zone can developed. Coastal zones will always be developed near the coastal edge, and close to the beach zone, which causes problems such as erosion, ecological system damage and loss of planting.

Sustainable coastal development requires an understanding of each coastal zone, and the making of an environmentally sustainable plan before the urban development stage. This diagram clearly shows that an environmentally sustainable coastal zone plan should have these criteria:

- Public acceptable
- Respect for the natural environment
- Setting a safe distance between residential areas and the natural coastal areas
- Protecting the natural coastal areas

From this diagram we can see how an environmentally sustainable coastal plan can protects the natural environment, by using environmentally sustainable tourism to make the coastal zone more valuable.

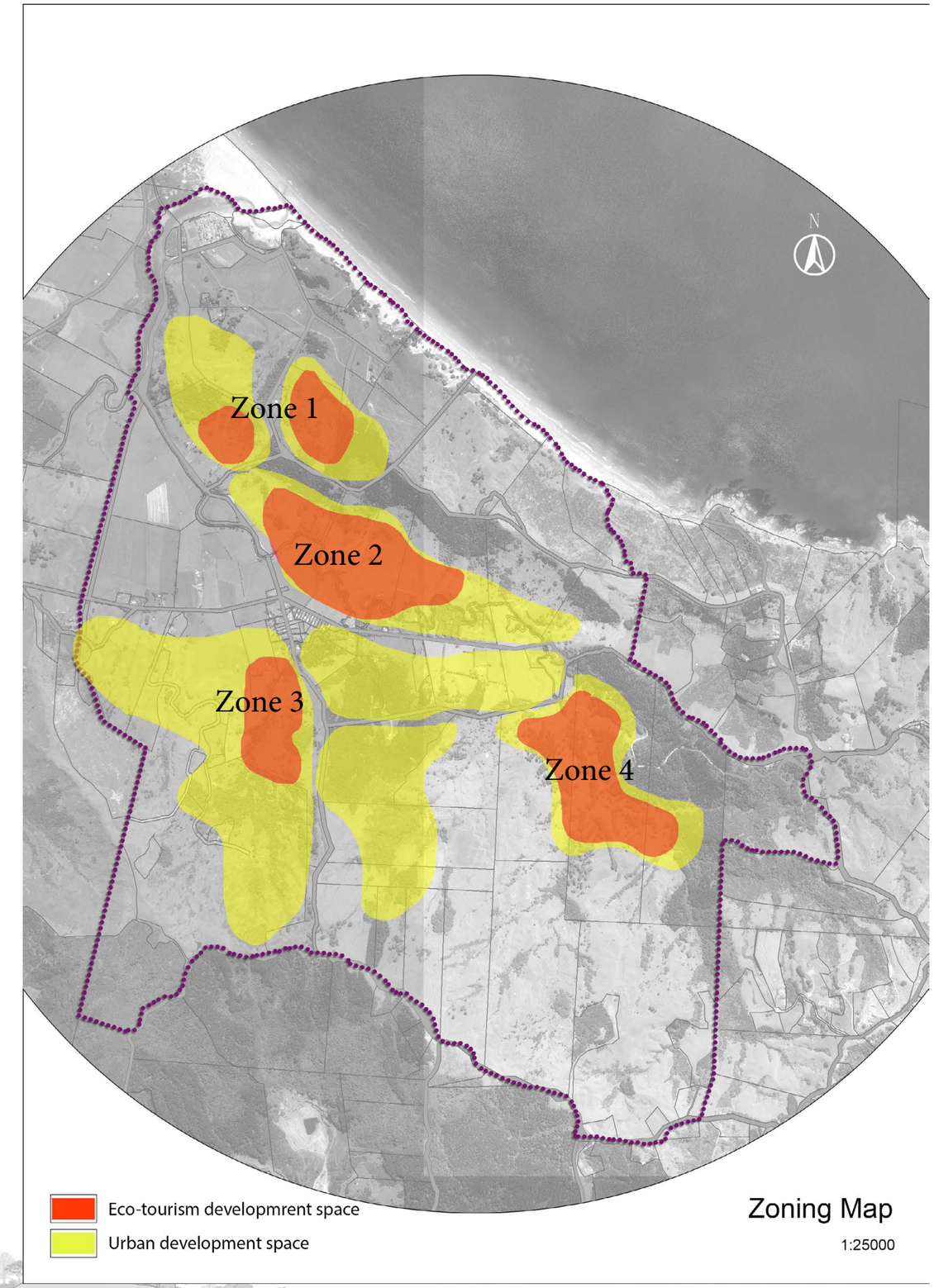


5.3.2 Environmentally sustainable development plan

This map shows the result of an environmentally sustainable development plan for the Pakiri site. These are the potential environmentally sustainable development zones in Pakiri, each zone is designed as a new destination for visitors. Each zone can improve sustainable development at the Pakiri site, and can protect the original coastal environment

5.3.3 Environmentally sustainable tourism design site

I chose zone one as my design site for testing the idea of an environmentally sustainable development and increasing coastal preservation. There are several reasons for choosing zone one as my site. Firstly, location: zone one's setting on a coastal hill, close to the beach and also close to the Pakiri River will offer different landscape experiences for visitors. Secondly, transport: zone one is opposite the village, therefore is it convenient for visitors arriving. Thirdly, environment: zone one has been developed as a farming zone, therefore it provides a good opportunity for showing the traditional rural lifestyle to overseas visitors.



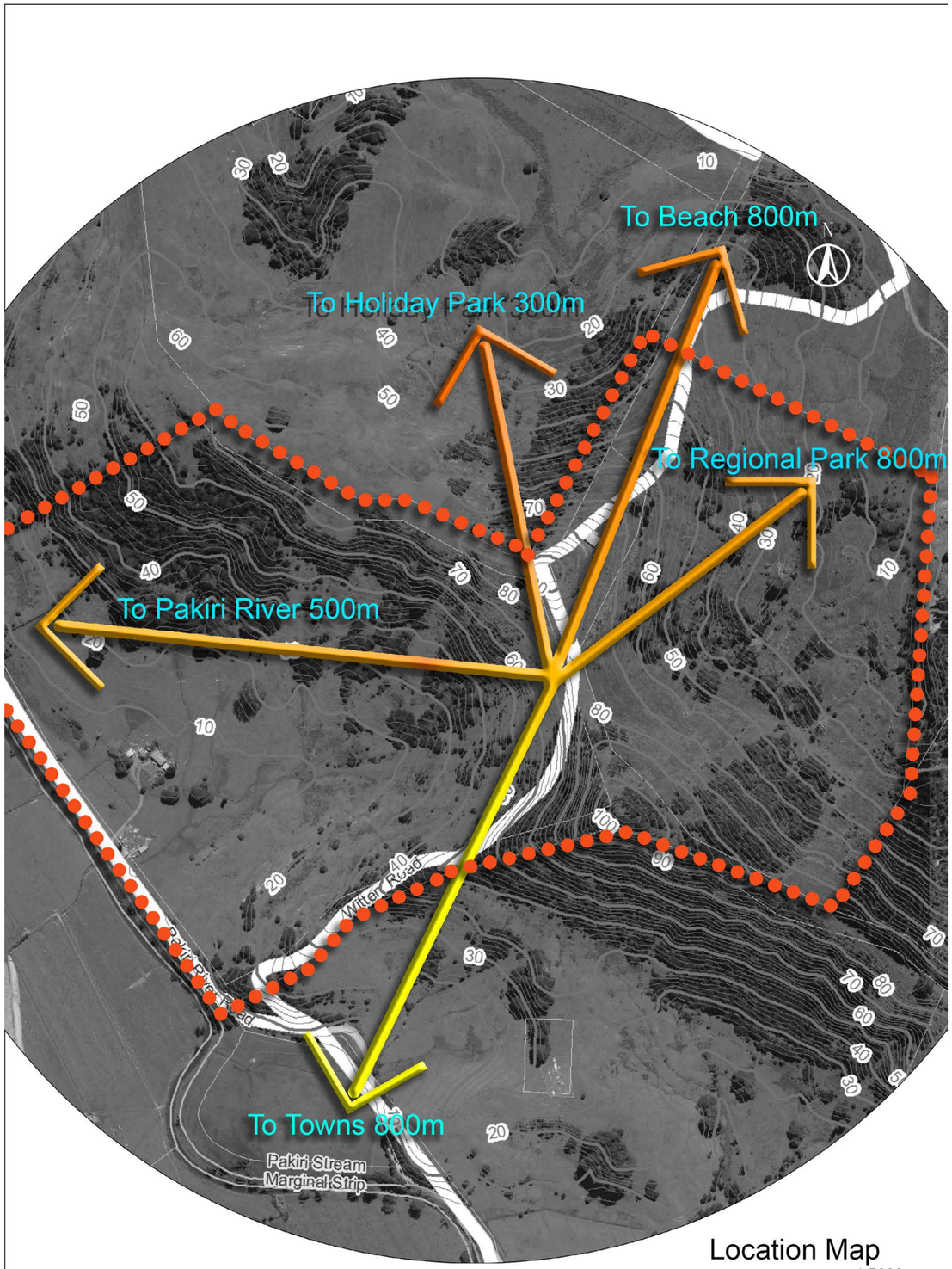
5.4 Holiday park plan

This section will approach the idea of environmentally sustainable tourism as a device to ensure coastal preservation through the design of a holiday park. The investigation will continue to uphold the strategy of environmentally sustainable development. This stage is divided into several parts, which including site analysis, preliminary plan, overall concept, detail design, transect analysis and perspective.

Zone 1: Analysis maps

5.4.1 Location map

The location map shows that as a new destination, the site has location advantage; for people living in this new coastal site. It is not far away from the surrounding landscape. This site also connects with two roads (Pakiri River Road and Witter Road), so it is convenient for arriving visitors.



Location Map
1:5000

5.4.2 Topographical map

This map shows the sites topographic conditions; hills (centre) and flat areas (east and west sides). The existing building and surrounding land use shows that the chosen site has a good coverage of native plants. The east side is also close to Pakiri River

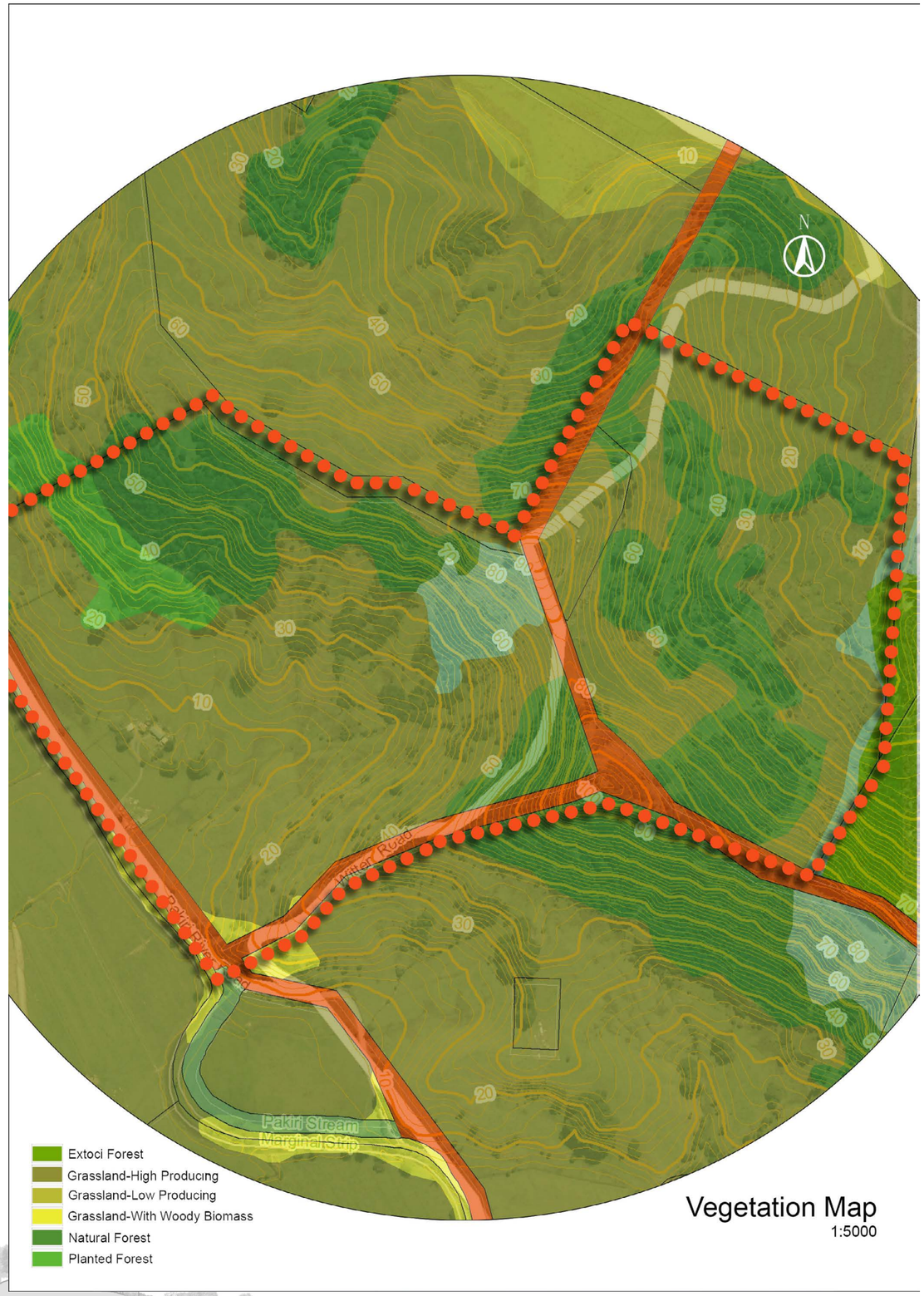
5.4.3 Slope map

This map analyses the site terrain in particular the slope condition. From the map, the central area is over 5 degrees and not suitable for construction. The east and west sides are relatively flat, both under 5 degrees, and suitable for new construction activities.

Slope Map
1:5000

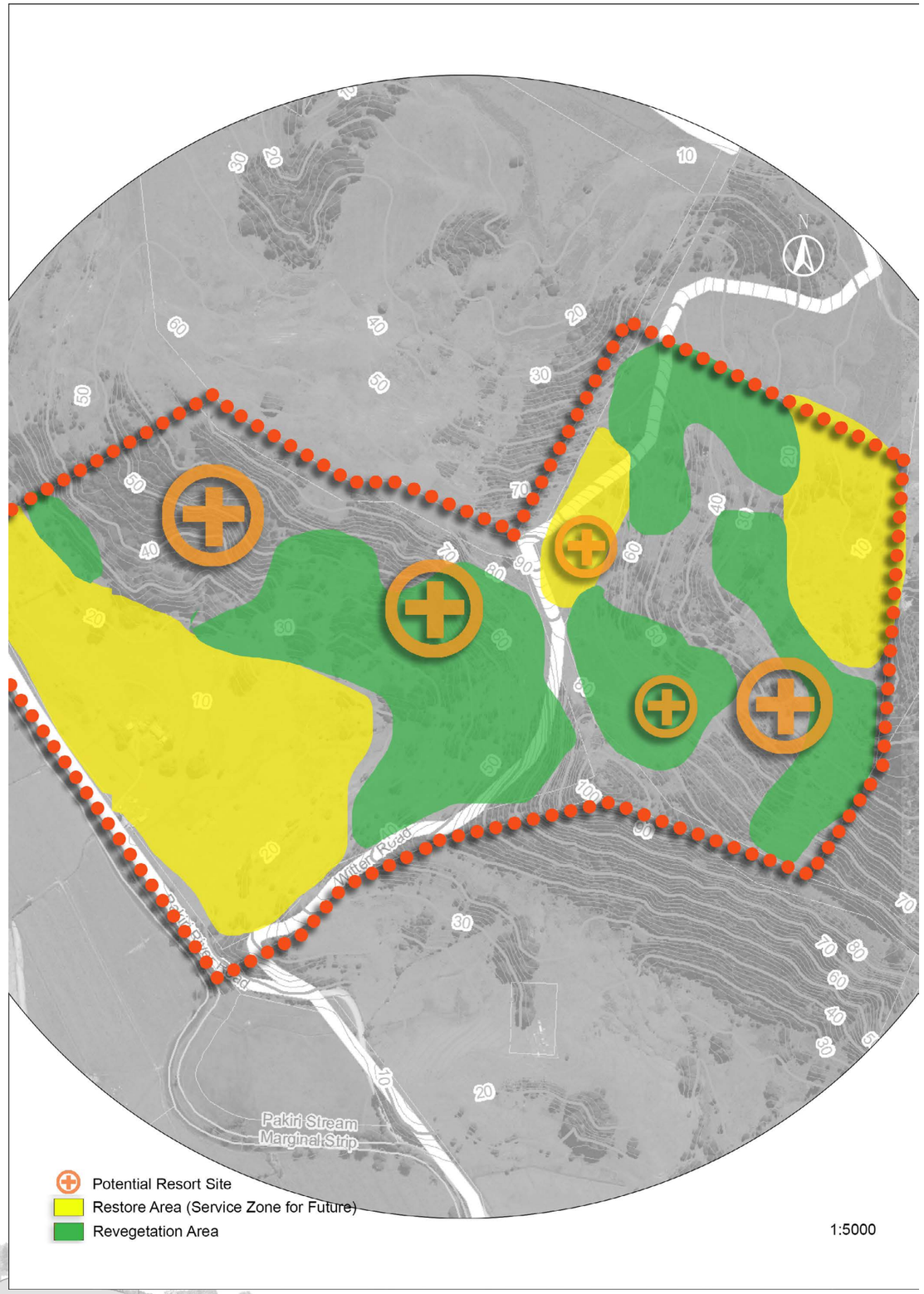
5.4.4 Vegetation map

This map shows plant condition at the site. Most of the area is covered with grass, while the northwest and southeast areas are mostly native and exotic forest. It can be seen, in the distribution of vegetation, that a vegetation program would improve the natural environment.



Preliminary plan

Based on the development and protection analysis, the site has been planned as a new, environmentally sustainable tourism holiday park. Based on the site analysis, the site has been divided into four areas, an service and recreation zone, revegetation zone, accommodation site and existing plants protection zone. By dividing the site into these four areas the goals of protection and development for the coastal zone can be better met, To retain the idea of environmentally sustainable tourism in the site design stage, will require the setting of design goals, based on the environmentally sustainable tourism criteria.

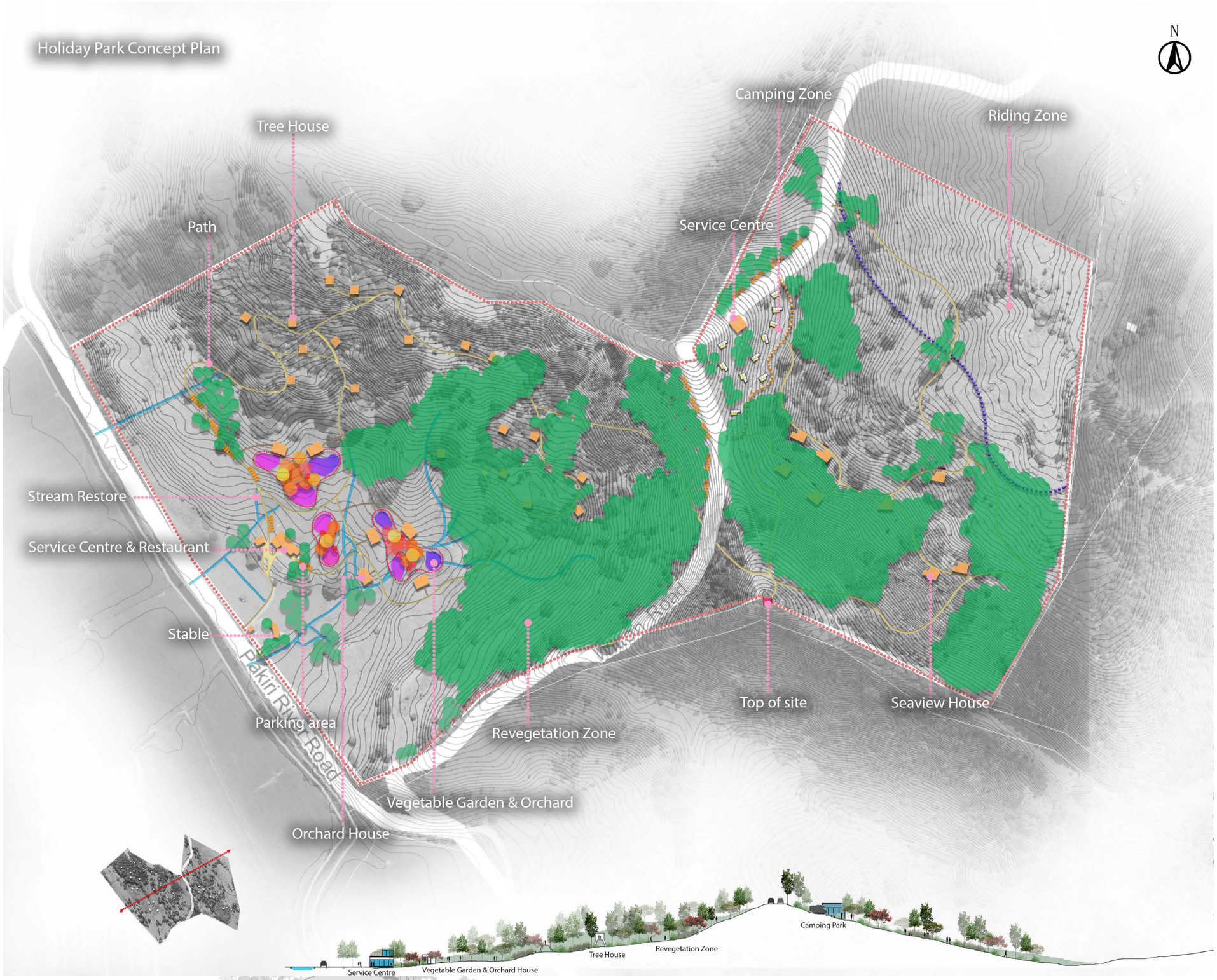


5.4.5 Design goals:

- Respect the local environment
  - Located in natural environment (Beach/Lake/River/Hill/Wetland/Grassland/Forest)
  - Minimum damage to natural environment (Low construction/ low terraforming/ construction with local materials/ maintain the original natural form)
  - Protect existing ecosystem (Identify the original plant and animal distribution/ vegetation restoration/ establish educational demonstration area)
  - Rebuild the natural storm water system
  - Improve natural environment by revegetation
  - Use sustainable designs for new building (Environmentally friendly buildings)
- Take advantage of existing activity
- Keep the original rural lifestyle (Farming activity)
- Take local popular activities into the site design (Horse riding)
- Improve the holiday park recreation aspect (Camping zone)
- Interaction with local community
- Rebuild existing buildings
- Respect local culture (Rural lifestyle)

5.4.6 Overall concept

Six design approaches are used to shape the final plan for the holiday park. All design methods can be applied to other site design work. These designs have met the design goals. They not only enhance the environmental sustainability of the site, but also protect the original environment, and better preserve local lifestyle.



- Revegetation Planting

In order to enhance and protect the original ecology, analysis and planning of native vegetation restoration is designed to improve the links between each vegetation area, and to enrich the site landscape performance. The use of the analysis of site vegetation conditions found in the native forest-covered area can be used to achieve environmentally sustainable tourism requirements. Restoring the native vegetation will create a richer natural environment while meeting development and protection standards.

- Recreation Zone

The recreation area is the most important area in the holiday park design, and in this site it occupies an important location. Environmentally sustainable tourism must also respect the local culture and lifestyle and interact with the local community. Therefore, in this site, the recreation zone has been designed both to meet a landscape function and conform to the environmentally sustainable tourism criteria.

- Restore streams

As a requirement of environmental sustainability criteria, streams are an important part of the overall ecosystem restoration.

- Path network

A good path network will provide an m convenient services for visitors to access the whole site. A good pedestrian network will also achieve the environmentally sustainable tourism criteria.

- Housing

Good housing is not only about the quantity, but also being able to meet the environmental sustainability standard and offer different living experiences to the visitors. This suggested housing site meets environmentally sustainable living conditions.

- Camping zone and riding zone
- The last part of the design work considers local lifestyle and cultural background and how they may influence the site design. The location of the Camping zone and riding zone are based on an analysis of the environment surrounding the site,

5.4.7 Detailed Design

This section shows the details of each design section according to the analysis and design goals,

- Design 1: Revegetation Planting Revegetation Zone)

The design protects the original vegetation and strengthens the links between native planting. Firstly, by analyzing the distribution of the original plant environment, then planning the recovery vegetation regions, then, select plants according to the conditions and methods for plant recovery. This design concept respects the local environment, by protecting and improves the local ecosystems. A unique natural experience will be created for visitors, and create a new, natural link for the existing coastal zone.

Revegetation:

* Slope >5 Degree
* Over 10m Contours
* Choosing Local plants
* Protect soil
* Close to existing bush
* Restore stream planting
* Flood risk reduction

Revegetation List:
*Manatu (Leptospermum scoparium)
*Kanuka (Kunzea ericoides)
*Ti kouka (Cordyline australis)
*Karamu (Coprosma robusta)
*Akiraho (Olearia paniculata)
*Ngaio (Myoporum laetum)
*Lowland ribbonwood (Plagianthus regius)
*Kohuhu (Pittosporum tenuifolium)
*Tarata (Pittosporum eugenioides)

*Makomako (Aristotelia serrata)
*Koromiko (Hebe stricata var. stricata)
*Mapou (Myrsine australis)
*Totara (Podocarpus totara)
*Puahou (Pseudopanax arboreus)

- Design 2: Recreation Zone (Vegetable garden and orchard)

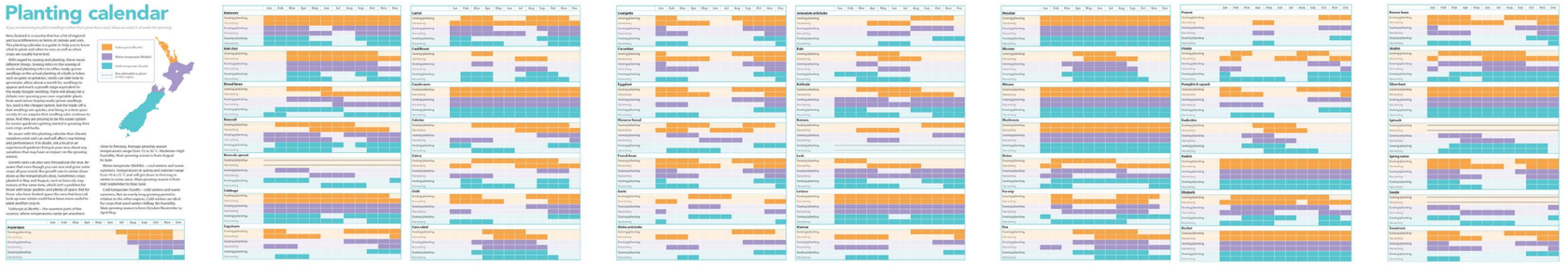
According to the design goals of interacting with local community and taking advantage of existing activities, this design will create a main area for the site. Firstly, it is necessary to understand the local lifestyle and cultural background, then specifically apply that information to the site design. Secondly, this design approach also considers sharing the rural lifestyle with visitors as well as creating a public area to improve the site landscape.

The vegetable garden and orchard are the main form of this design section. As a valuable landscape manifestation, it is a good example of the local rural lifestyle, and also provides a special recreation feature. In addition to providing organic food, visitors have a public area for walking and enjoying a rural experience, participating in the fun of planting and picking activities.

Additionally, when the garden is also located in a flat and easily viewed area, it can visually enrich the landscape of the site.

Vegetable Garden:

* Slope < 5 Degree
* Close to water
* Usable Landscape
* 62 Kinds vegetable avaiable
* Education Function
* Food support



- Design 3: Restoring streams

Respecting the local environment, by restoring the natural stream system.

Firstly, GIS data analysis identifies each potential stream and reconstructs these areas in order to restore the drainage functions.

Secondly, the stream areas will connect with the new vegetable gardens and orchard areas and provide irrigation. Finally, new planting will enrich the landscape of stream areas.

Stream Water

Pakiri River

Pakiri River

Stream Water

Potential flooding area

- Design 4: Path network

The path network plays an important linking role by meeting the needs of visitors. The network does this in two vital ways.

Firstly, in addition to linking each part of the site, the network is also divided into three different types: single roads, public roads and management roads.

Secondly, the path network design transforms a small amount of space, and by planning based on terrain conditions.

Private Path (1m)

Public Path (2m)

Public Path (3m)- car acceptable

Private Path (1m)

Public Path (2m)

Public Path (3m)- car acceptable

- Design 5: Housing

The design will be for an environmentally friendly housing system. In addition to meeting the needs of visitors, the house design also offers environmental protection and sustainable design features.

Firstly, a sufficient number of houses will be designed to meet site visitor limits, and will be spread around different areas in accordance with the different kinds of landscape ie rural, bush, and coastal. Secondly, in order to meet the environmentally sustainable development requirements, housing design criteria will incorporate the need to build with sustainable materials and to use new energy technology, such as renewable energy, water recycling, waste separation and recovery, and so on. Finally, based on the different landscapes, the housing are classified into different types, including tree houses, orchard houses, sea view houses, and an area for recreational vehicles (RVs), enriching the living experience of visitors.

Tree House

Seaview House

Orchard House

RV

- Design 6: Camping zone and riding zone

Based on the design goals of taking advantage of existing activities, this design focuses on providing local lifestyle and entertainment options for visitors, . The design includes camping and riding areas, mainly in the eastern region of the site. This area was chosen partly because of original topographic factors, but also because it is close to the beach and can give visitors better sightseeing and other experiences.

Camping and Riding Zone:

* Sea View Landscape
* Beach Zone
* Existing Horse Riding Activity
* Natural Bush Path

*Take advantage with existing activities

5.4.8 Transect

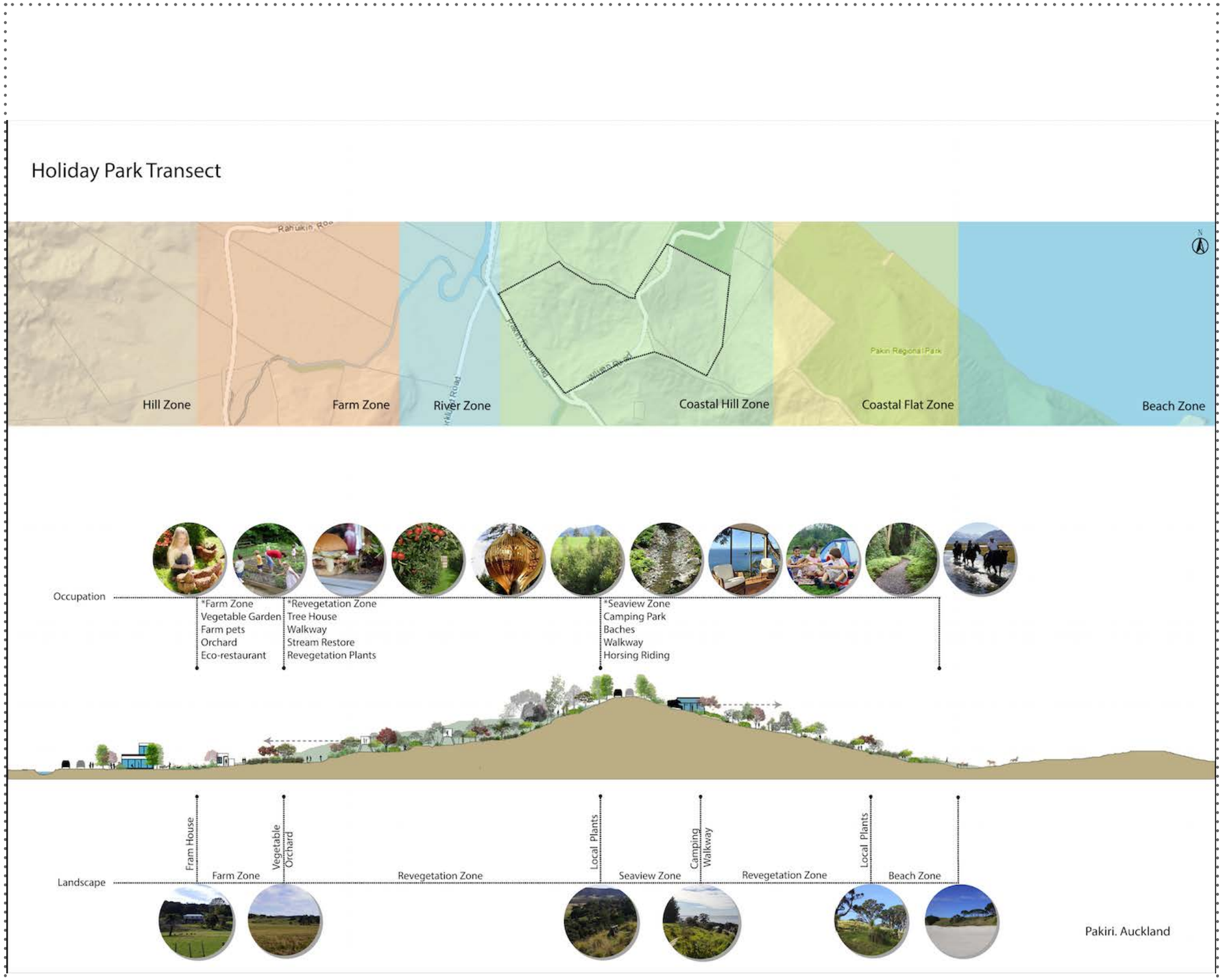
The transect view and the whole site section (east-west) clearly demonstrate the changes in landscape

The transect shows the design work in a relationship to the site, but also shows the site's relationship with the surrounding environment and location. It explains the environmentally sustainable development in coastal areas. Planning protects the edge of the coastal environment, setting a safe distance between village and coastal edge regions.

The transect diagram can also show each design element in the site applications. For instance, each element has been divided among different functional areas, but is more refined in the transect map.

- Farm zone (entry, vegetable garden, orchard, service center)
- Revegetation zone (tree house, walkway, stream water restores, revegetation plants)
- Sea view zone (camping park, beaches, walkway, horsing riding)
- Beach zone (revegetation)

There is a strong link between each of the functional areas, whether from the perspective of the completion of the design goals or better combinations with the site's original natural environment.



5.4.9 Perspectives

These perspectives demonstrate how the four major areas, the entry zone, vegetable garden and orchard zone, camping zone, and revegetation zone work.

Entry zone (Farm zone)

Key Words: Farm pets/Farming Activities/ Rural Landscape

As the entrance of the holiday park is located the farming zone, which includes farm pets and a tourists' interactive area. The area provides a glimpse at the kiwi rural lifestyle for visitors, and enriches the holiday park's landscape.

Vegetable garden and orchard zone (Farm zone)

Key Words: Organic Food/ Rural lifestyle/ Participant/Healthy/Education/Family time

This area has been designed as an organic vegetable garden and orchard. It will provide a public area for visitor's residents and people wanting to share family time. Visitors can enjoy picking their own food, and learning about organic food production. This area is designed to preserve the local kiwi lifestyle, as well as offering a valuable insight for visitors.

Vegetable Garden & Orchard

Revegetation and bach zone (Revegetation zone)

Key Words: Revegetation/ Natural Experience/ Bush/ Baches

This area is designed to restore and enhance the local, native environment, and provide visitors with a natural, coastal environment experience. This area is also designed with environmentally friendly baches to meet the needs of the different visitors.

Camping park and sea view zone (Beach zone)

Key Words: Rural Lifestyle/ Holiday Activities/ Sea View/Beach

To provide visitors with a place to enjoy the unique freedom of the coastal environment with little expense, this area was designed as a public campground. The area includes sea views, the chance to experience camping life and a native bush path experience.

5.5 Surrounding network

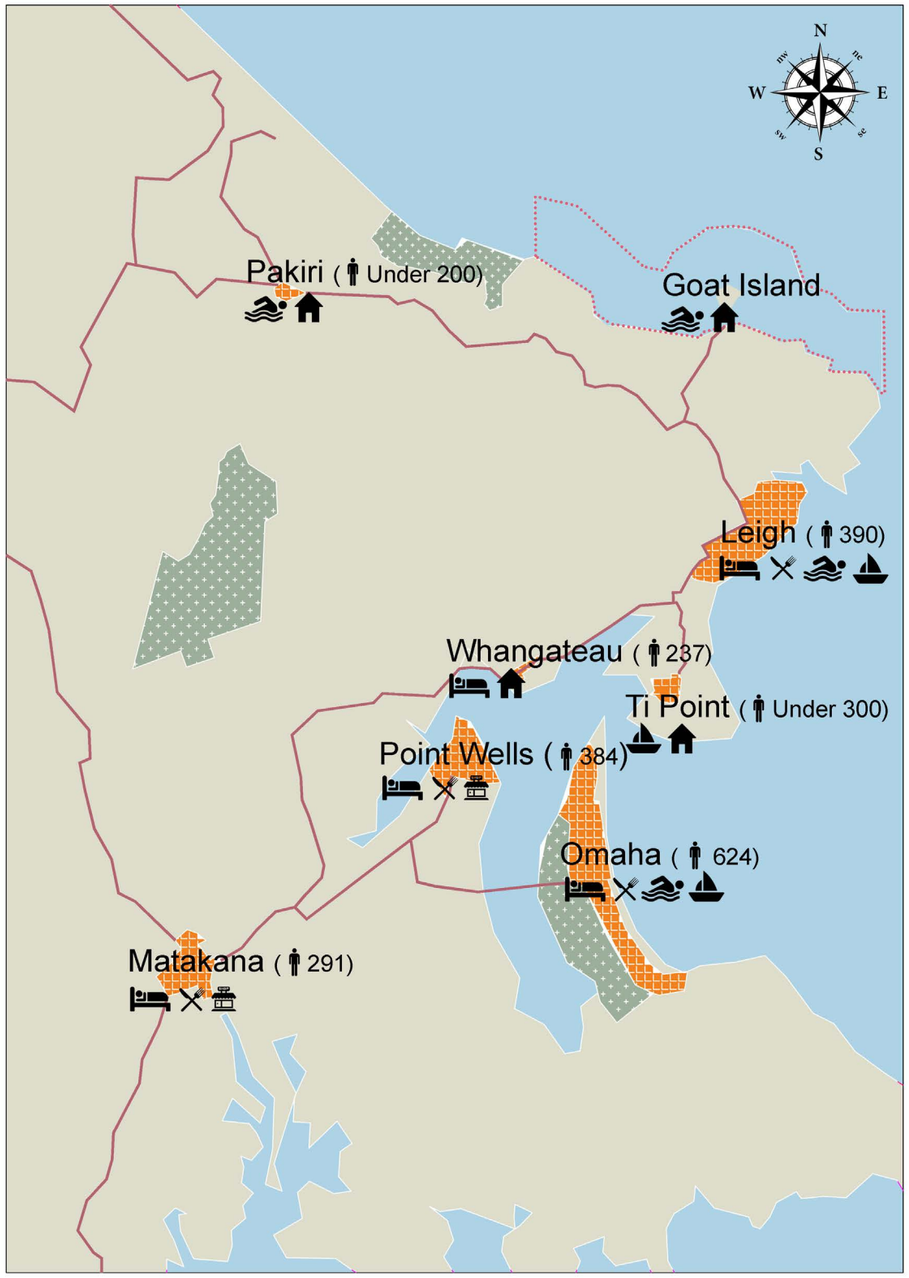
In designing a new sustainable coastal zone development, it is not enough to plan a coastal settlement. In other words, to build an environmentally sustainable coastal zone development, it is critical to connect to the level of regional development planning. This chapter shows how Pakiri town's sustainable development programme can lead to integration of Pakiri's development cycle, and improving the regional development interaction.

This section will include three aspects, which are Surrounding network analysis, Surrounding network plan and Regional development interaction.

5.5.1 Surrounding network analysis

Firstly, understanding the circumstances of the towns surrounding Pakiri better shows the current regional development trends through this analysis we can find the connection between Pakiri and surrounding towns, making a surrounding network plan and improving regional development interaction.

Secondly, the surrounding network analysis method will be based on the Pakiri site construction. The result of completing an environmentally sustainable designs for Pakiri site will be to build it up as a new coastal development area and attract visitors. The surrounding network analysis will be based on the surrounding towns' ability to attract visitors, and include data on population, reception capacity, transportation and recreation activities (NZ Statistics, 2015).



Surrounding Network Analysis

Surrounding towns	Population	Reception Capacity	Transportation	Recreation Activities
Goat Island	Under 50	Hotel 2	9.2km	Marine Visitor Center
Leigh	390	Hotel 4	9.4km	Fishing Charters
Whangateau	287	Hotel 1	13.8km	Holiday Park
Ti Point	Under 300	-	13.3km	-
Point Wells	384	Hotel 2	24.2km	Boating and Fishing Club
Omaha	624	Hotel 2	26.7km	Golf Club
Matakana	291	Hotel 7	19.0km	Saturday Market and Vineyard

Table 6.0: The surrounding towns condtion

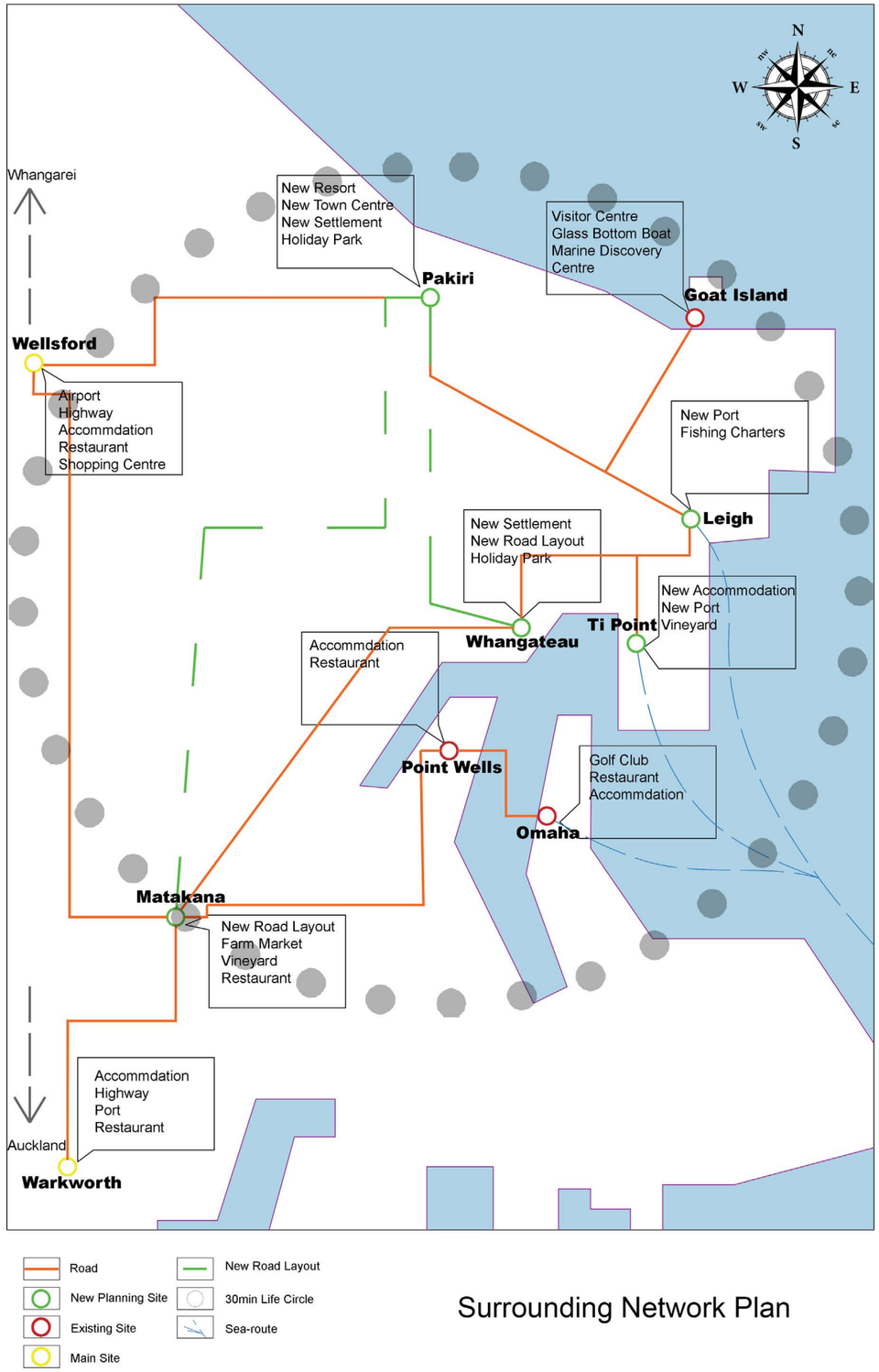
Conclusion

The surrounding network analysis shows that around Pakiri, there are seven regions that can be part of a new regional development cycle. In addition these towns, whether through a distance relationship or based on the development of capabilities, can form a complementary relationship with Pakiri. In particular, it can be seen from the analysis that Matakana town has a strong potential for development opportunities. It can also be seen that these towns need a new plan for transport links, and some need to accept further planning and regional development interaction.

5.5.2 Surrounding network plans

According to the surrounding network analysis, the Pakiri area has a good opportunity for regional development interaction. Developing this regional development interaction between Pakiri and the surrounding towns requires the following strategies:

- Take advantage of existing towns' development, improving each settlement's reception capability, and creating a new regional lifecycle.
- New road connection system for improving each town's links (specifically between Matakana and Pakiri, Whangateau and Pakiri).
- Connections with Auckland and Whangarei (develop Pakiri region with Auckland and Whangarei to build relationships, sharing the large potential tourism market).



Surrounding Network Plan

5.5.3 Regional development interaction

New regional development cycle

Building up a new Pakiri regional development life cycle will improve each surrounding town's connection, and bring benefits from the Pakiri site construction to the whole regional development interaction. The establishment of this regional development interaction cycle enables the Pakiri site to complete the project goal of sustainable development.

Summary:

Surrounding network planning is a part of Pakiri's sustainable development. The first step is the construction of the holiday park in Pakiri, attracting visitors to the village, then continuing with other new development zones, in the Pakiri valley making Pakiri into a new coastal development zone... Tourism is a driver for Pakiri's development and creating a new regional development cycle with surrounding towns. Finally, improve Pakiri region's relationships with Auckland and Whangarei, by connecting to the visitors' market wil bring more benefits and local sustainable development.

5.6 Summary

The surrounding urban and environmental network is an important part of Pakiri's environmentally sustainable development plan, not only sharing the benefit of Pakiri development with surrounding towns, but also ensuring Pakiri village obtains a greater market share from regional development interaction. Sharing the development pressure with surrounding towns better maintains the relationship between development and environmental protection.

6.0 Conclusion

6.0 Conclusion

"A new generation of New Zealanders will grow up with a very different seaside holiday experience, which is more comfortable, but more divorced from the natural elements of the coast." (Peart, 2009, p.10)

This research project aims to find a balance for the development of coastal areas that can effectively improve the development efficiency, and protect existing natural ecological factors.

The research question of this thesis was how can an environmentally sustainable model of coastal development be developed?

This research located around the issues of sustainable development, ecological preservation and environmentally sustainable tourism in coastal zone developments and, through this development, preserving the Kiwi lifestyle.

In order to address the research question, this project selected two case studies for analysis – a regional coastal zone case study and the Pakiri case study. The regional coastal zone case study used GIS data analysis around the coastal zone to understand the development potential and then set sustainable development criteria to find the most suitable site for an environmentally sustainable coastal development. The Pakiri case study identified a sustainable development site and through environmentally sustainable tourism criteria designed a holiday park to preserve the coastal zone environment and local lifestyle while encouraging development.

This research project offers a model of an environmentally sustainable coastal development by acknowledging the importance and value of the Greater Auckland coastal region. By using environmentally responsible tourism as a driver, both tourists and new residents will be attracted to the area and will be encouraged to live and enjoy both the local and sub-regional amenities.

6.1 Design reflection:

- Issue

A coastal zone has a unique environmental system, attracting many people to visit and live there. However, in many New Zealand coastal zones the coastal development model does not meet a sustainable development standard. For example, Omaha and Orewa are both based on the holiday homes development case, and do not form a sustainable development system. This research project discusses how an environmentally sustainable coastal development might be advanced and provides case studies to demonstrate a development methodology.

- Survey

GIS data analysis tools are used with site visits to understand the environmental reality of the regional coastal zone (from Whangarei to Tauranga) Studying regional coastal zones shows that the coastal zones north of Auckland have the most potential as sustainable development sites However, another finding through observation is that most coastal zone development is still stuck in a simple development model, either the establishment of a conservation park or holiday home development. One of the finding was that there is a lack of economic support for coastal development, such as could be provided by the tourism industry.

In order to understand the background of coastal region development, an investigation of was International case studies conducted, looking at; the Gold Coast, Dubai, and San Ya. These coastal region development cases studies demonstrated that tourism can generate coastal zone development. However There are also numerous problems with these developments, for example, coastal zone vegetation degradation, habitat destruction, soil erosion, climate change, and population explosion.

- Methodology

To develop an environmentally sustainable development approach to this project meant planning a coastal zone development behind the coastal edge areas. Specifically, this meant identifying a sustainable coastal development zone and planning a holiday park between the beach and village area, creating a middle zone to protect the coastline's ecosystem, and also sharing the coastal landscape with visitors. The holiday park design used the concept of an environmentally sustainable tourism by protecting the local natural environment and lifestyle. The holiday park design has been divided into several different zones, for example, a farming zone, a vegetable garden and orchard zone, a camping zone, a sea view zone and a revegetation zone, to meet the different needs of visitors. Developing an environmentally and socially sustainable holiday park can drive new coastal zone development.

- Regional thinking

Another important finding in this research project is that to further improve the environmental sustainability of the coastal zones, just the Local development plan itself is not enough; the regional development level must be considered. The way coastal development can connect with regional urban systems is important for promoting the environmental sustainability of the entire regional development. Analysis shows that existing coastal networks can be better maintained through a connection with regional development, for example, improved transport systems and tourist attractions. This research project, through a network case study of the areas around Pakiri , proposes a new regional development cycle, to further promote the regional development interaction.

Overall, this research project aims to develop a methodology of environmentally sustainable coastal development, and use the establishment of sustainable development criteria in order to further guide a sustainable development plan. The research outcomes can also be applied to other coastal regional development areas, for example, Tauranga and the Hawke's Bay.

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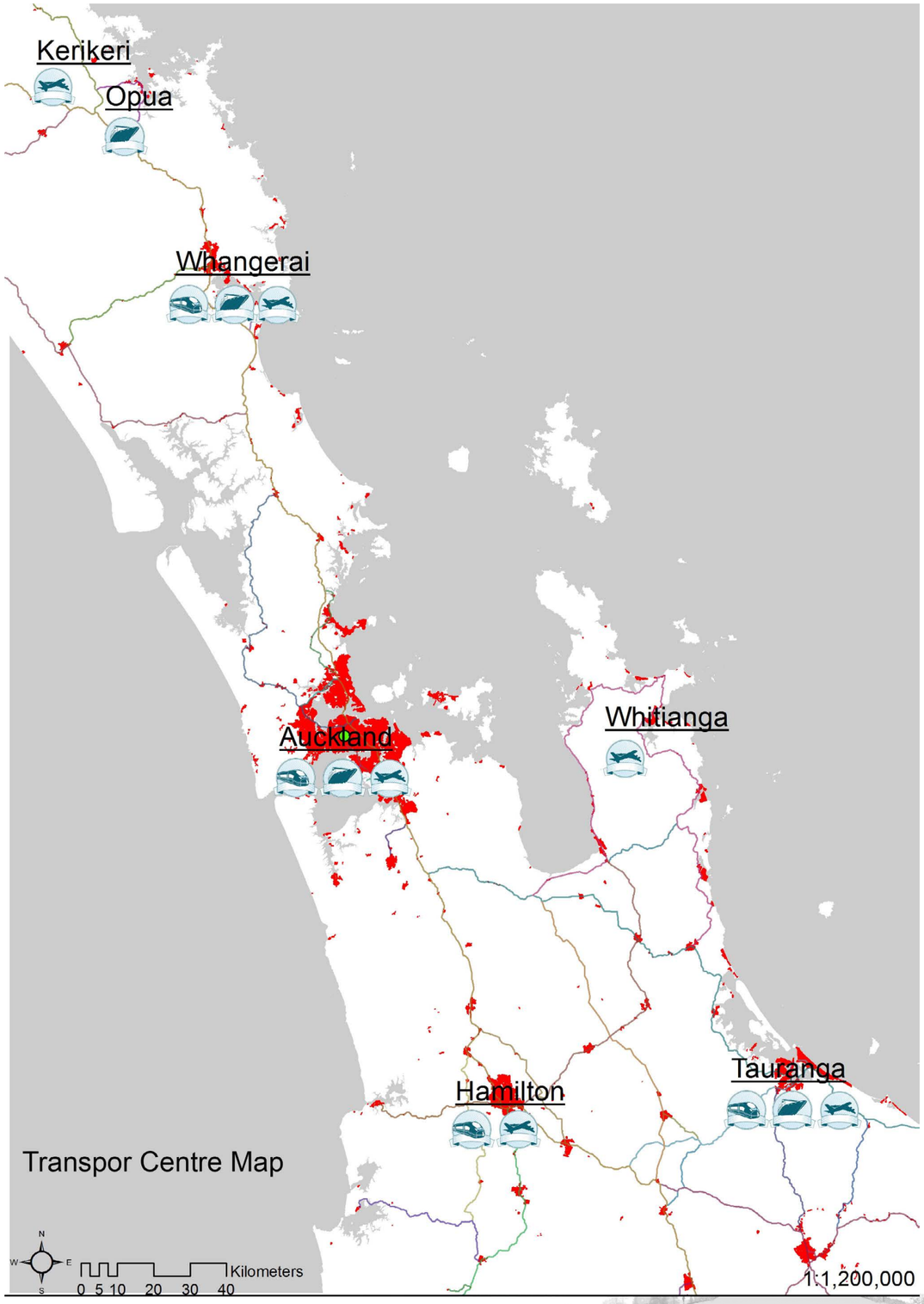
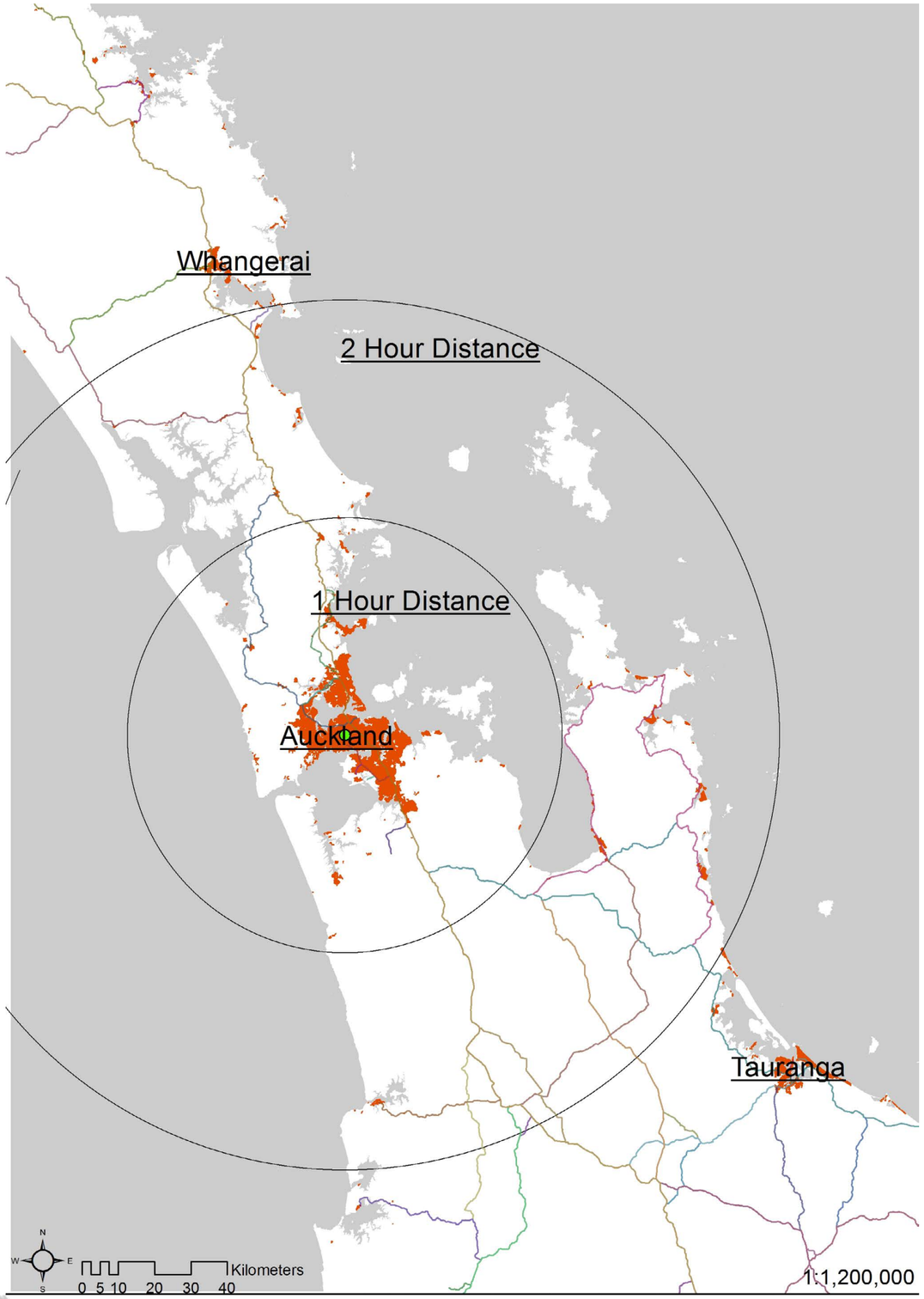
8.0 Appendix

Appendix (Regional Maps)





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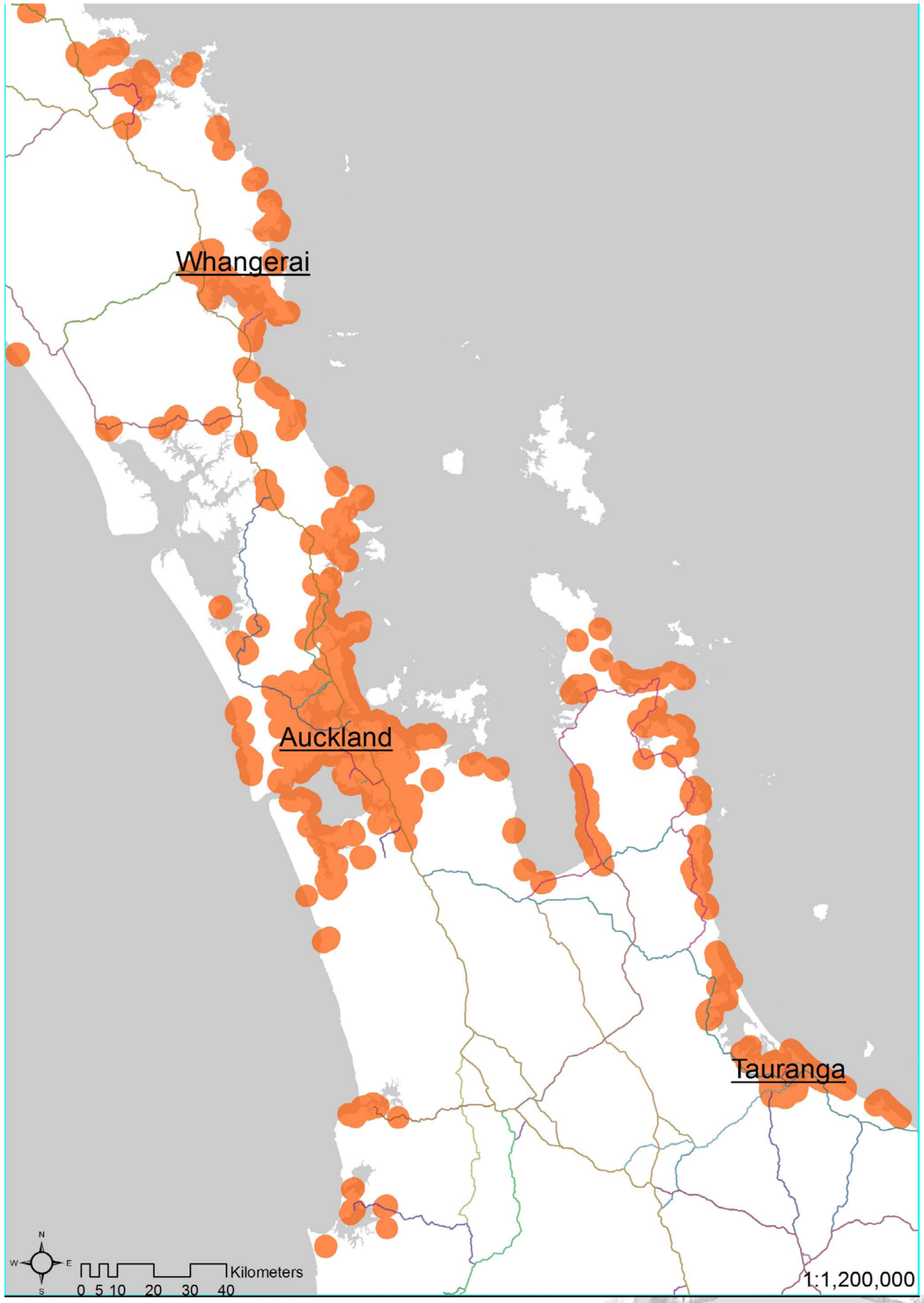

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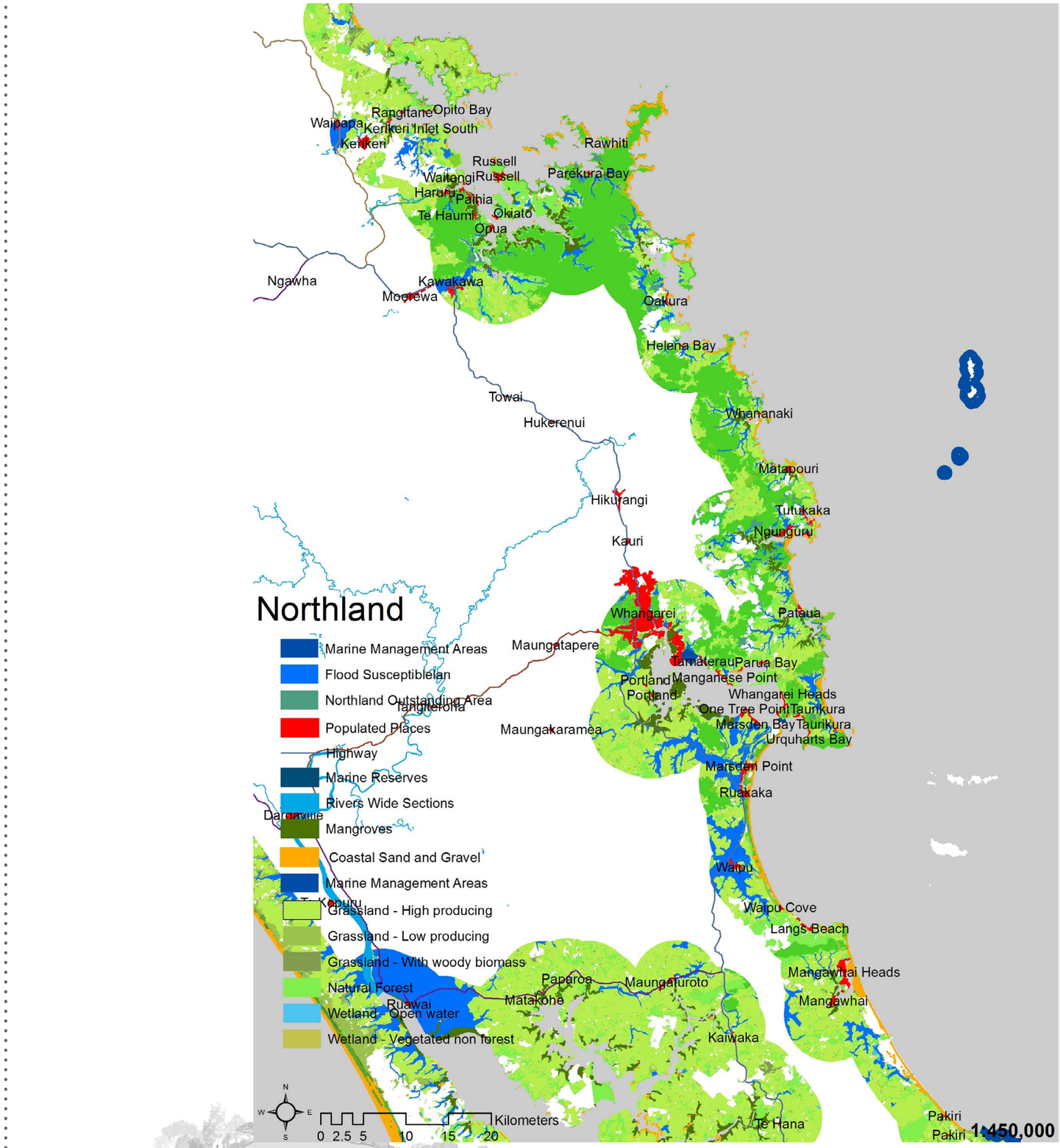

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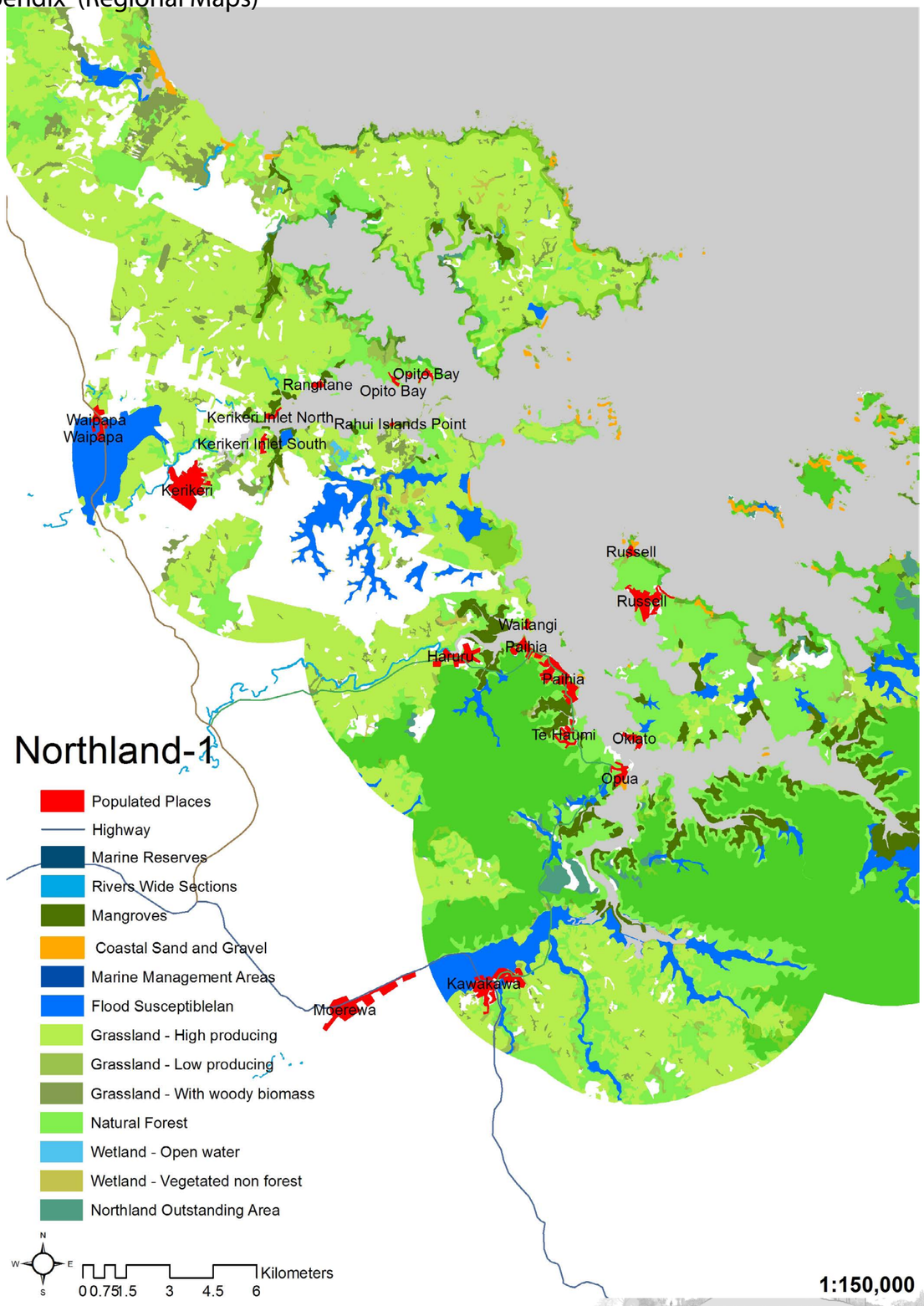

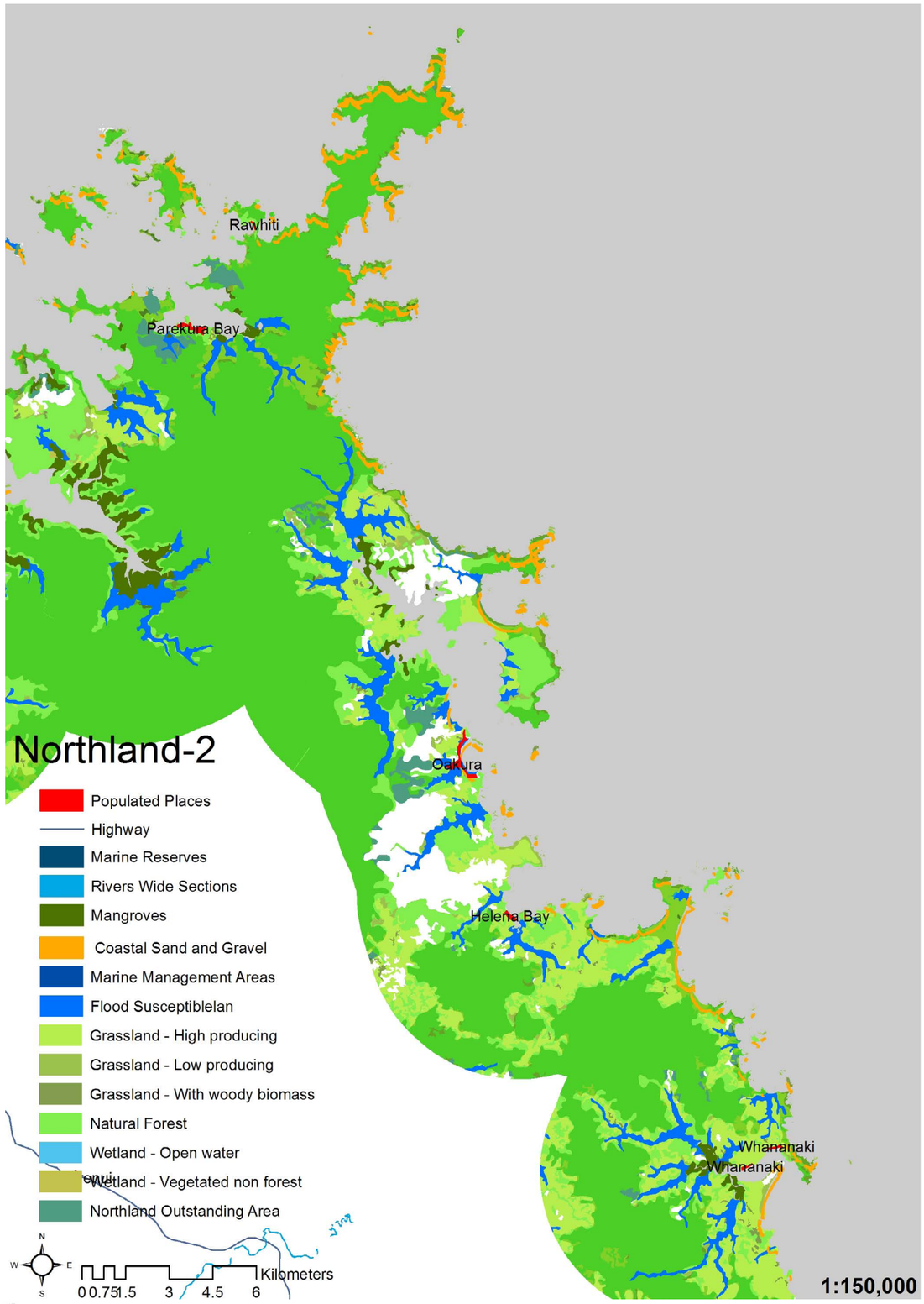

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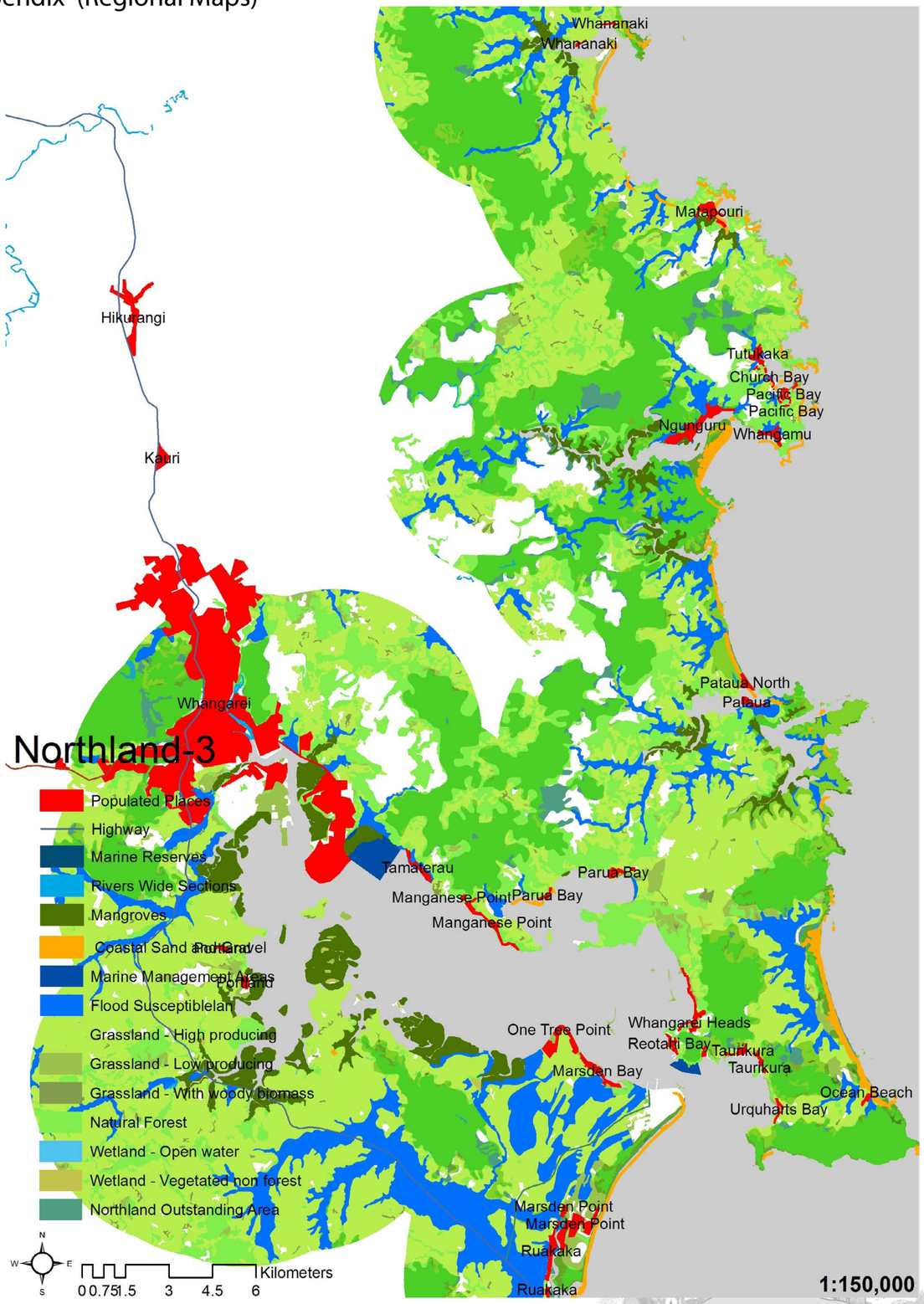

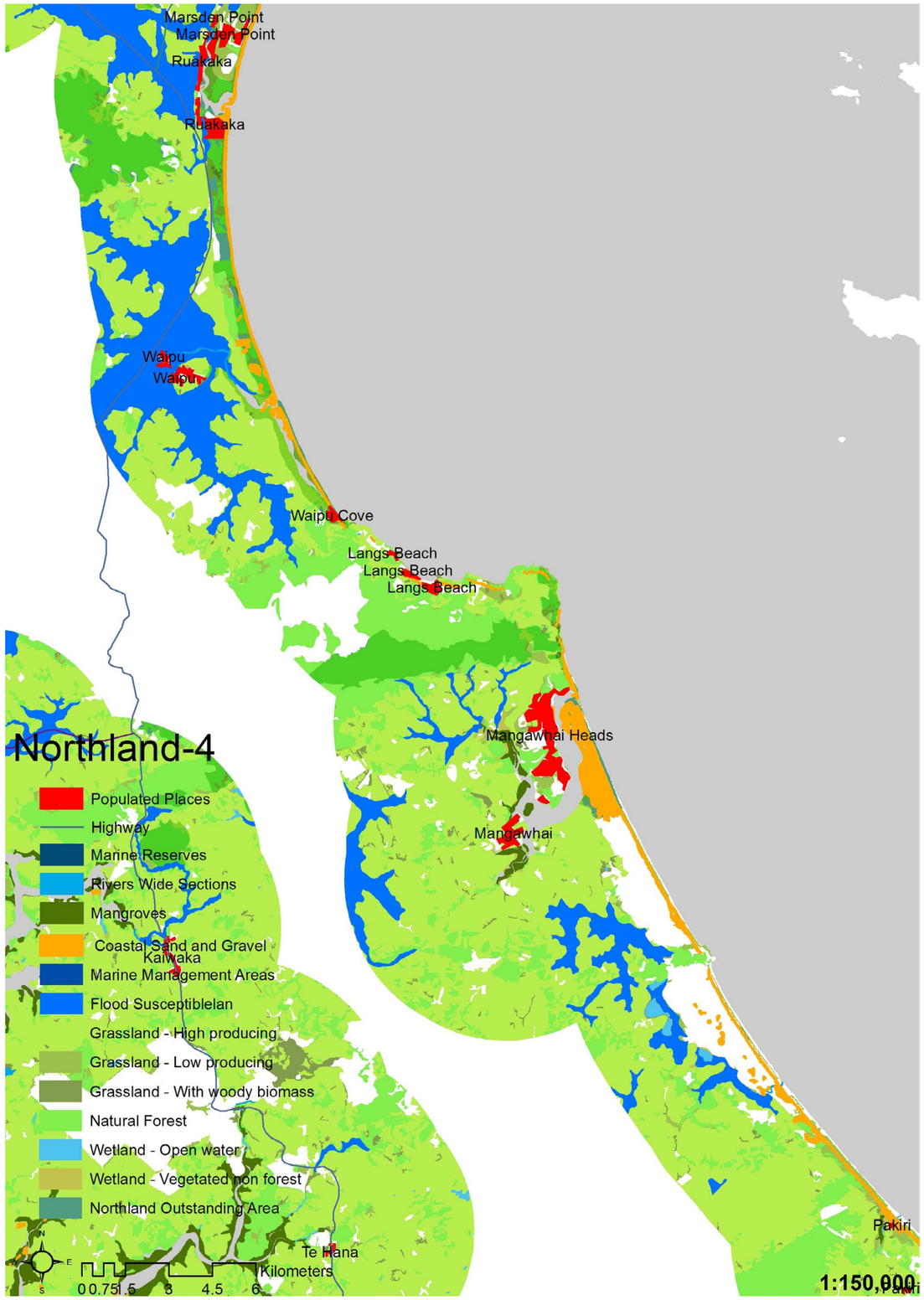

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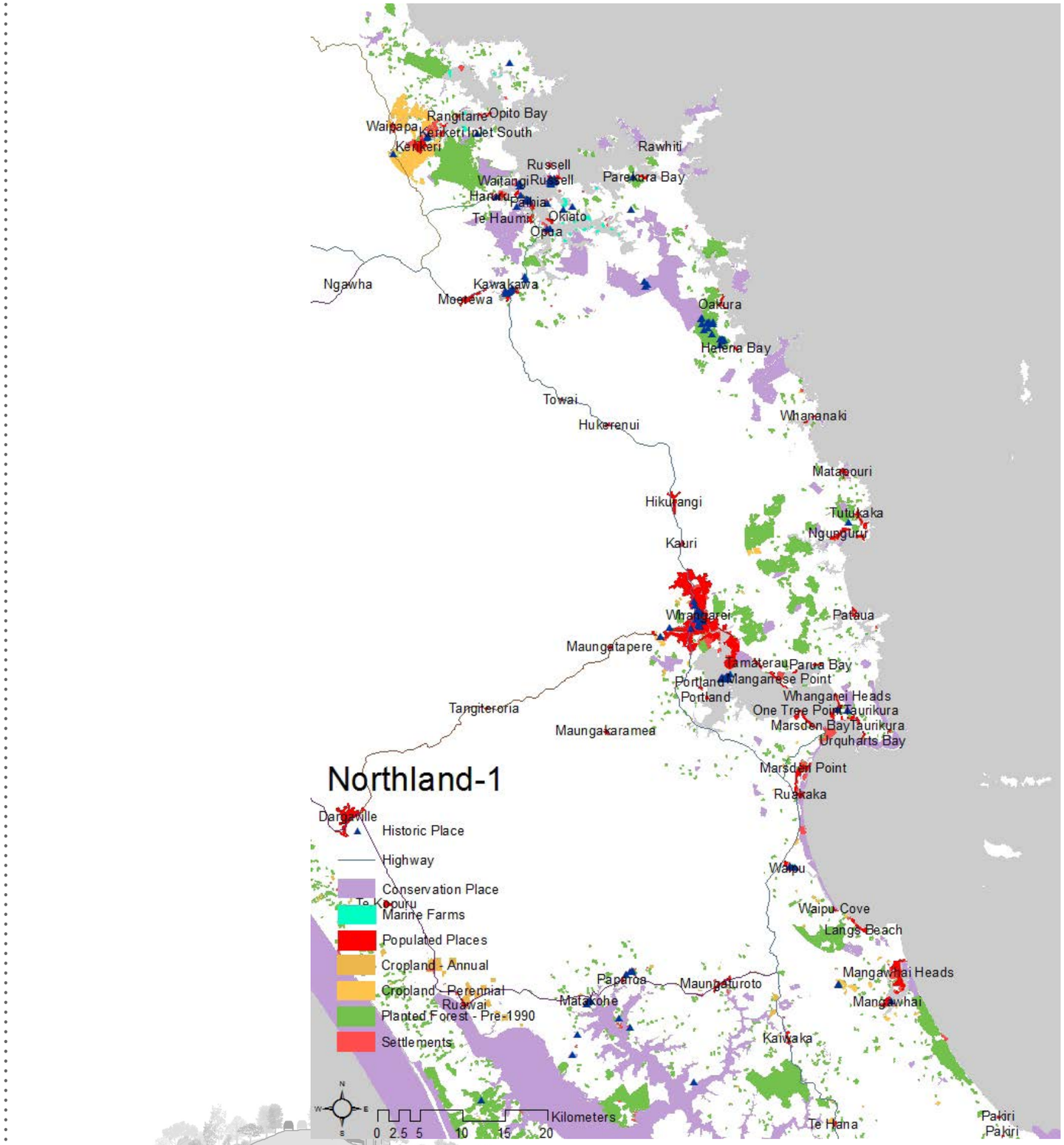

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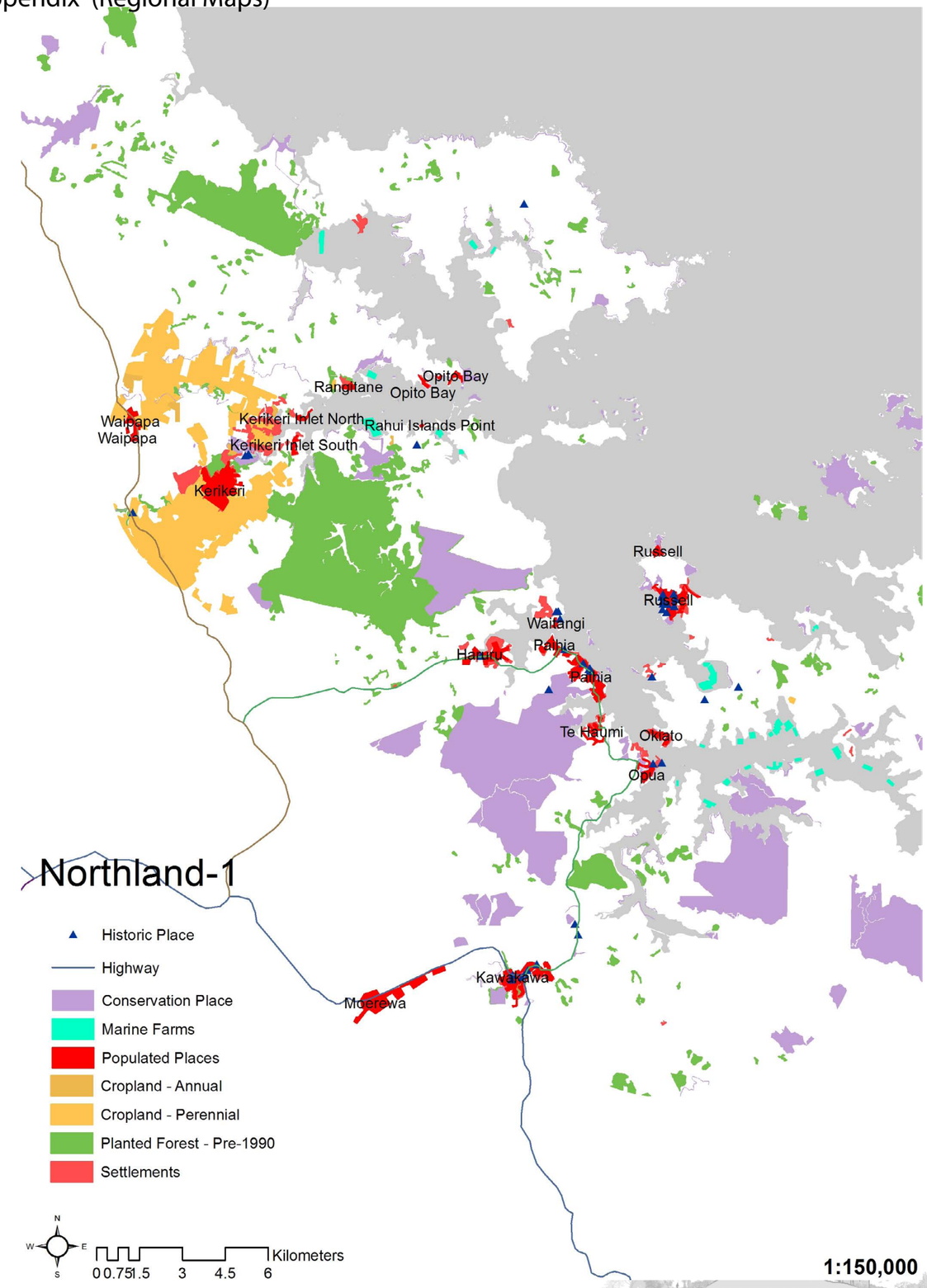

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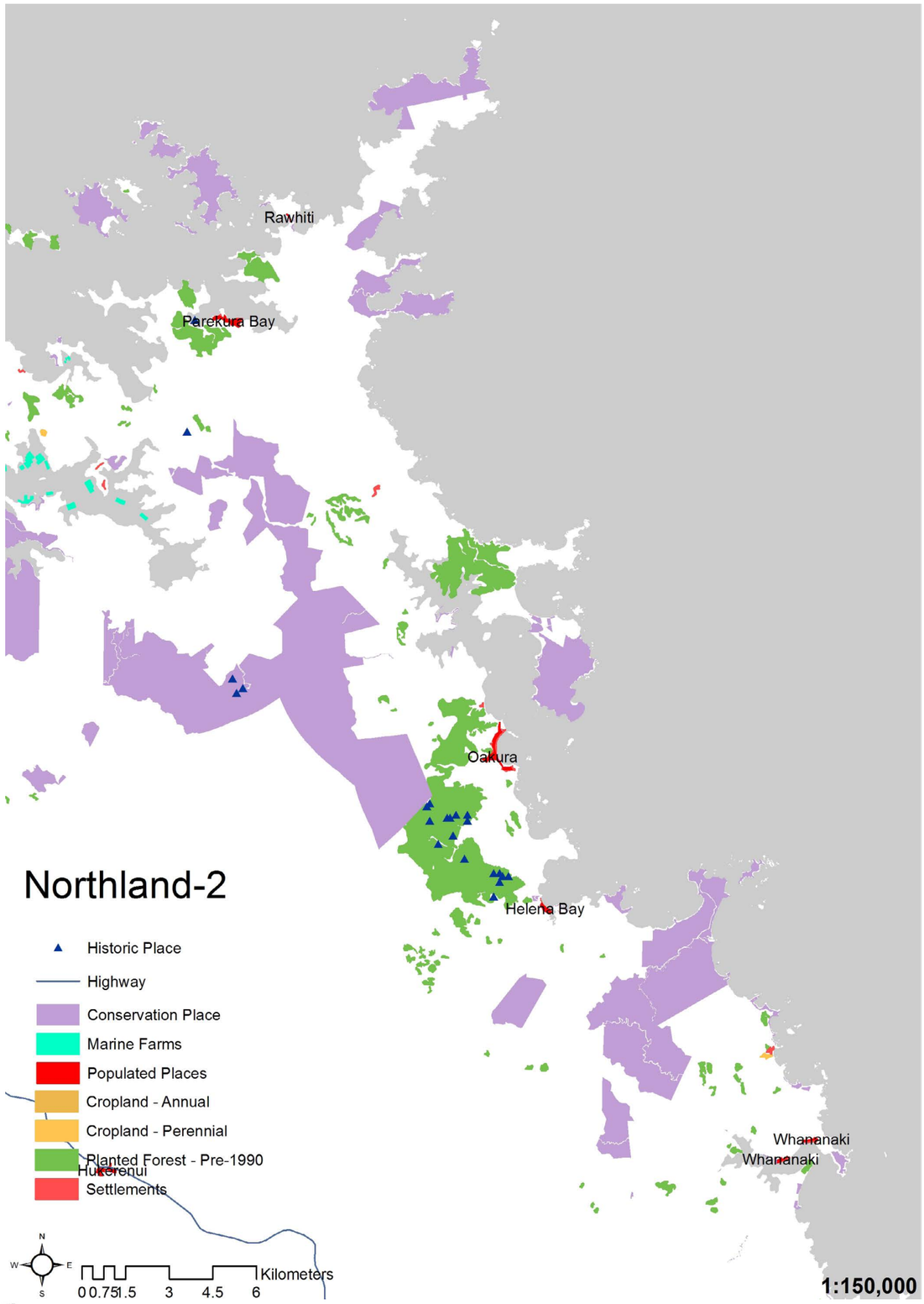

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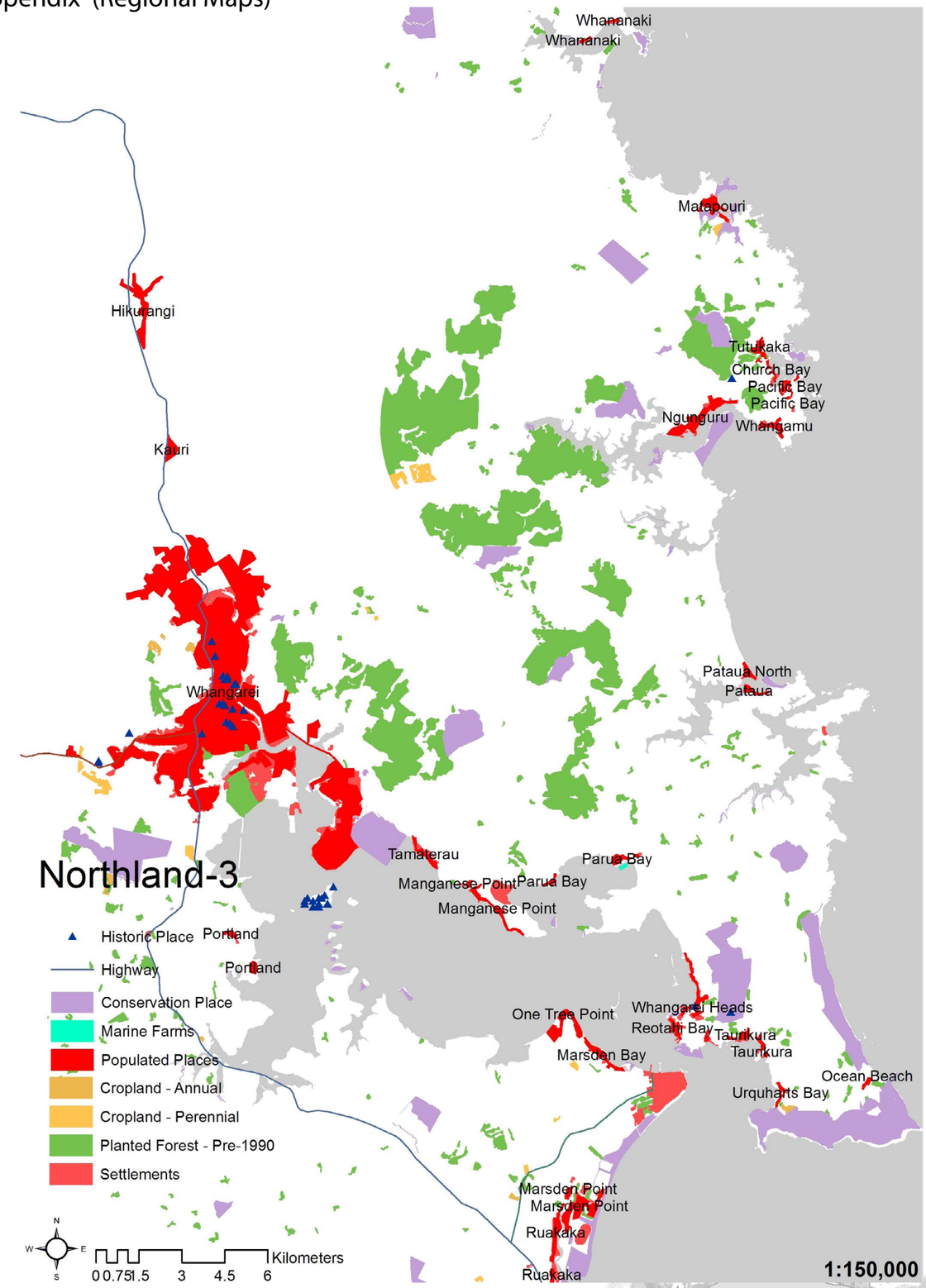

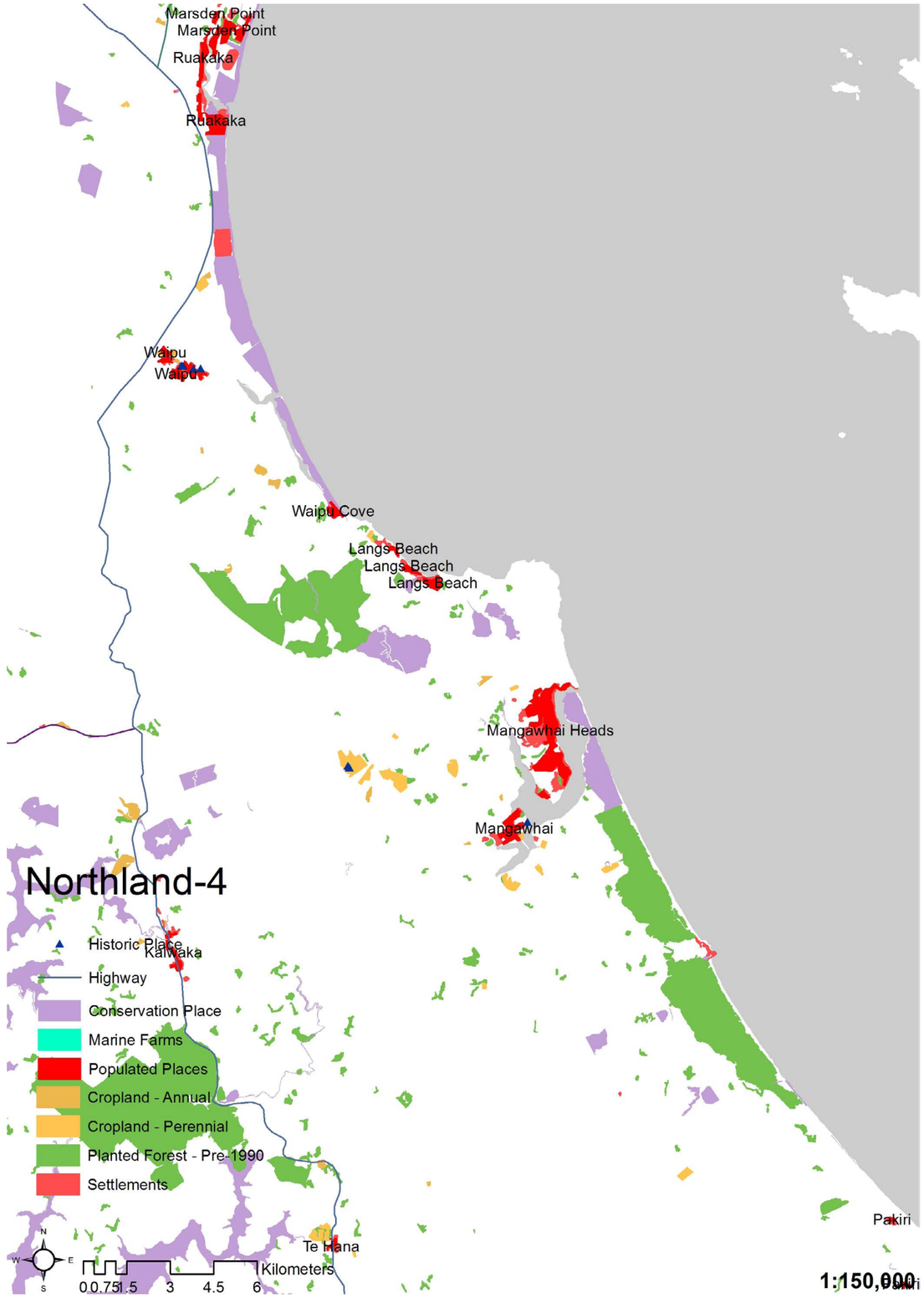

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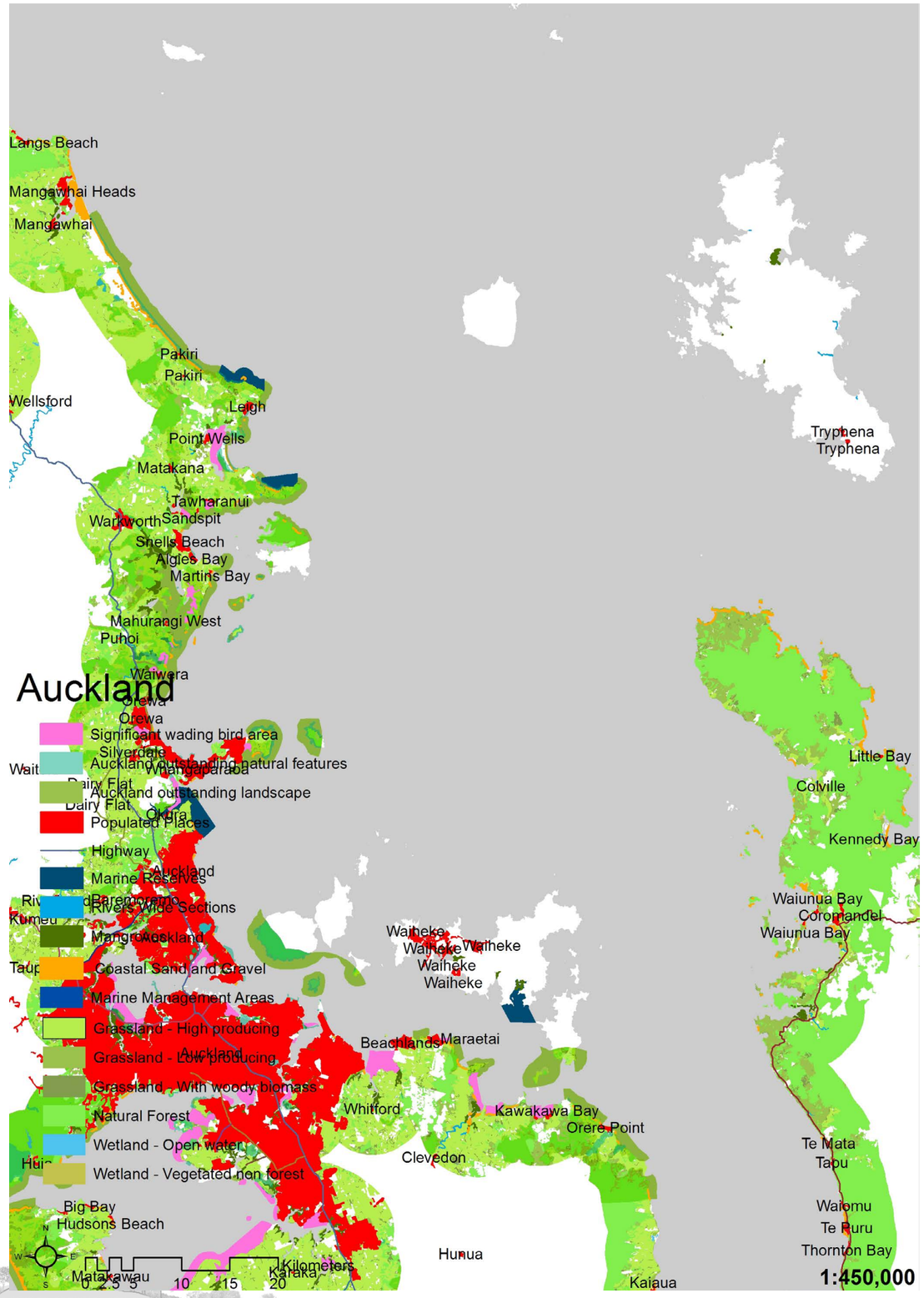

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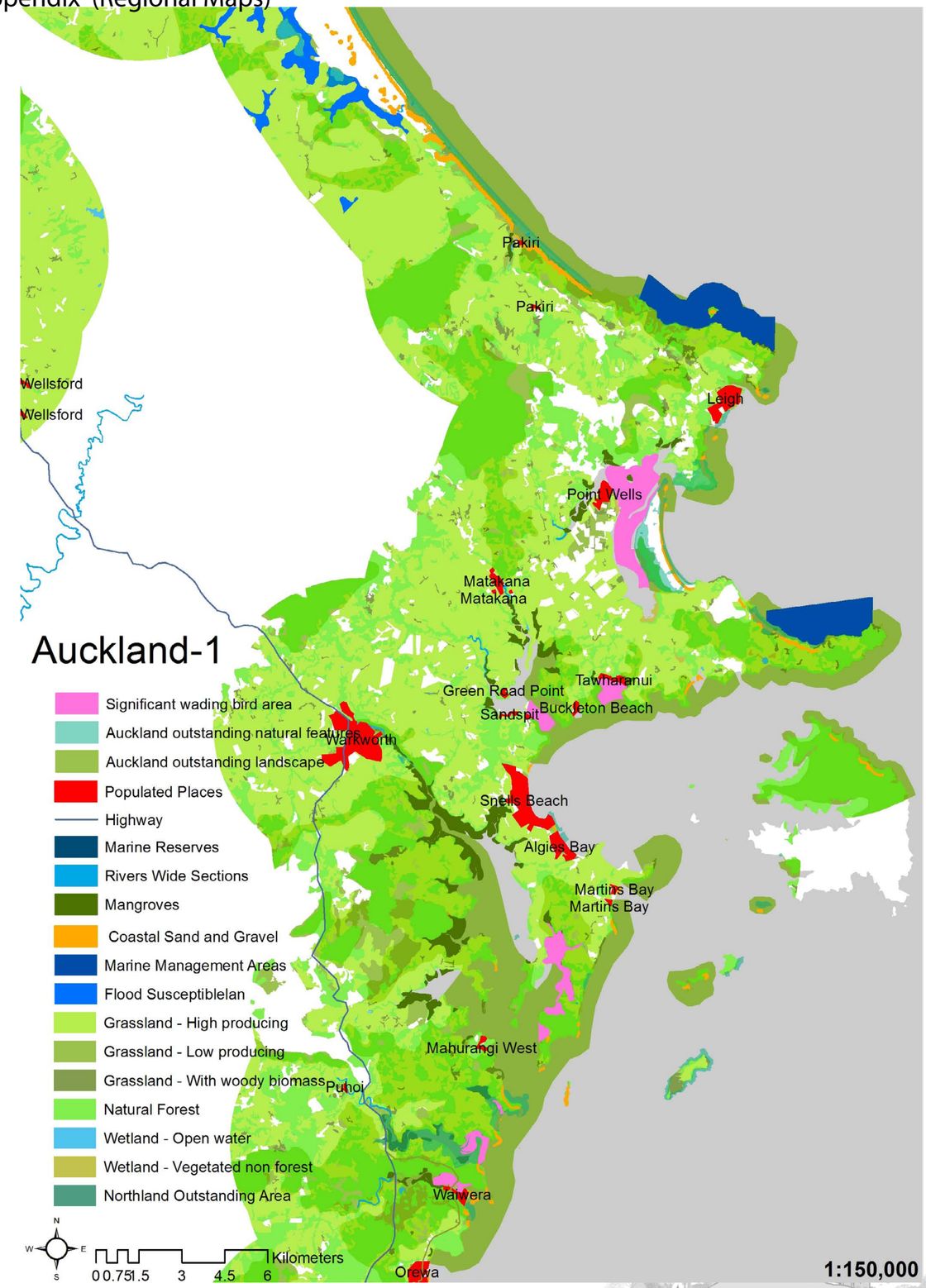

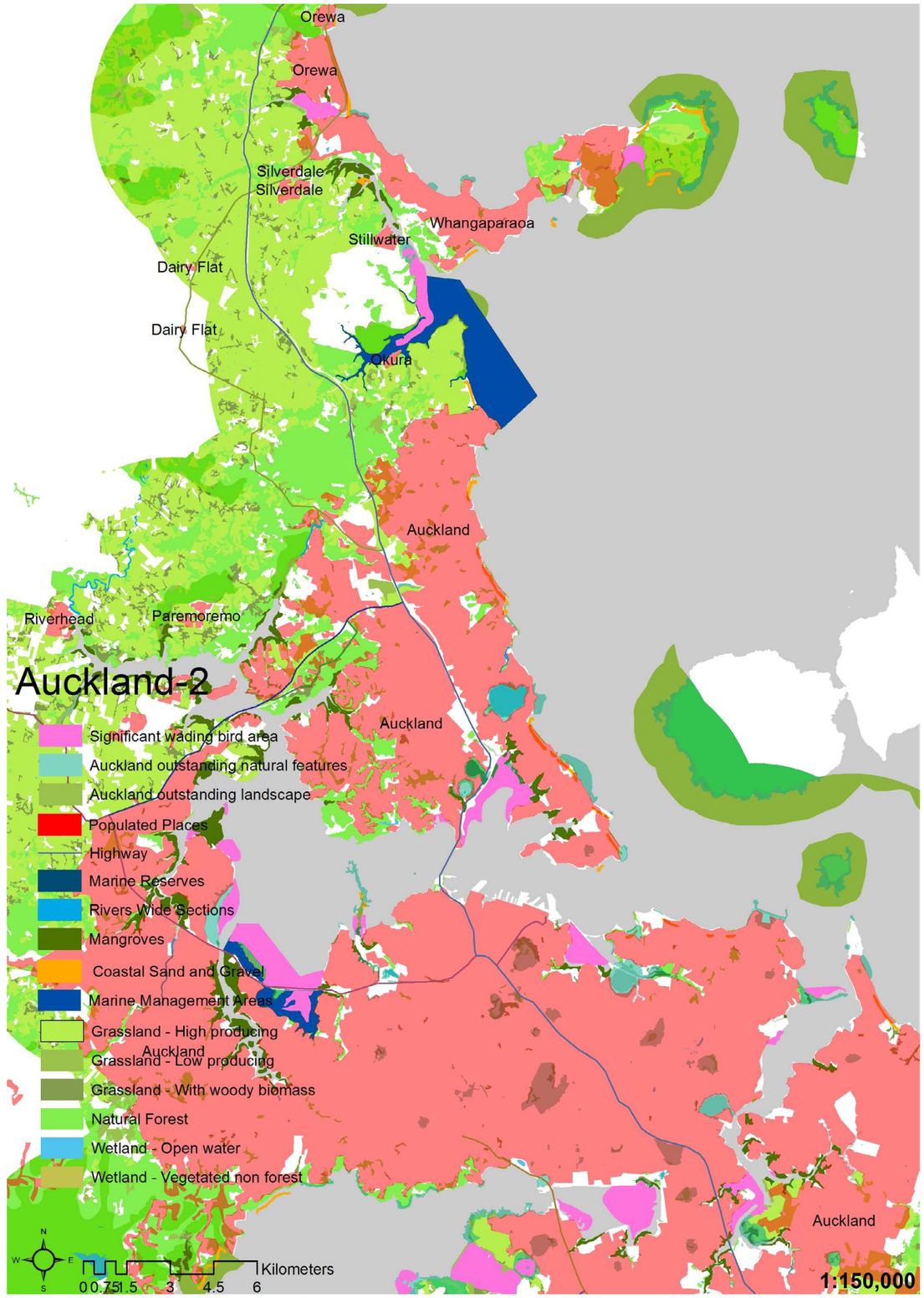

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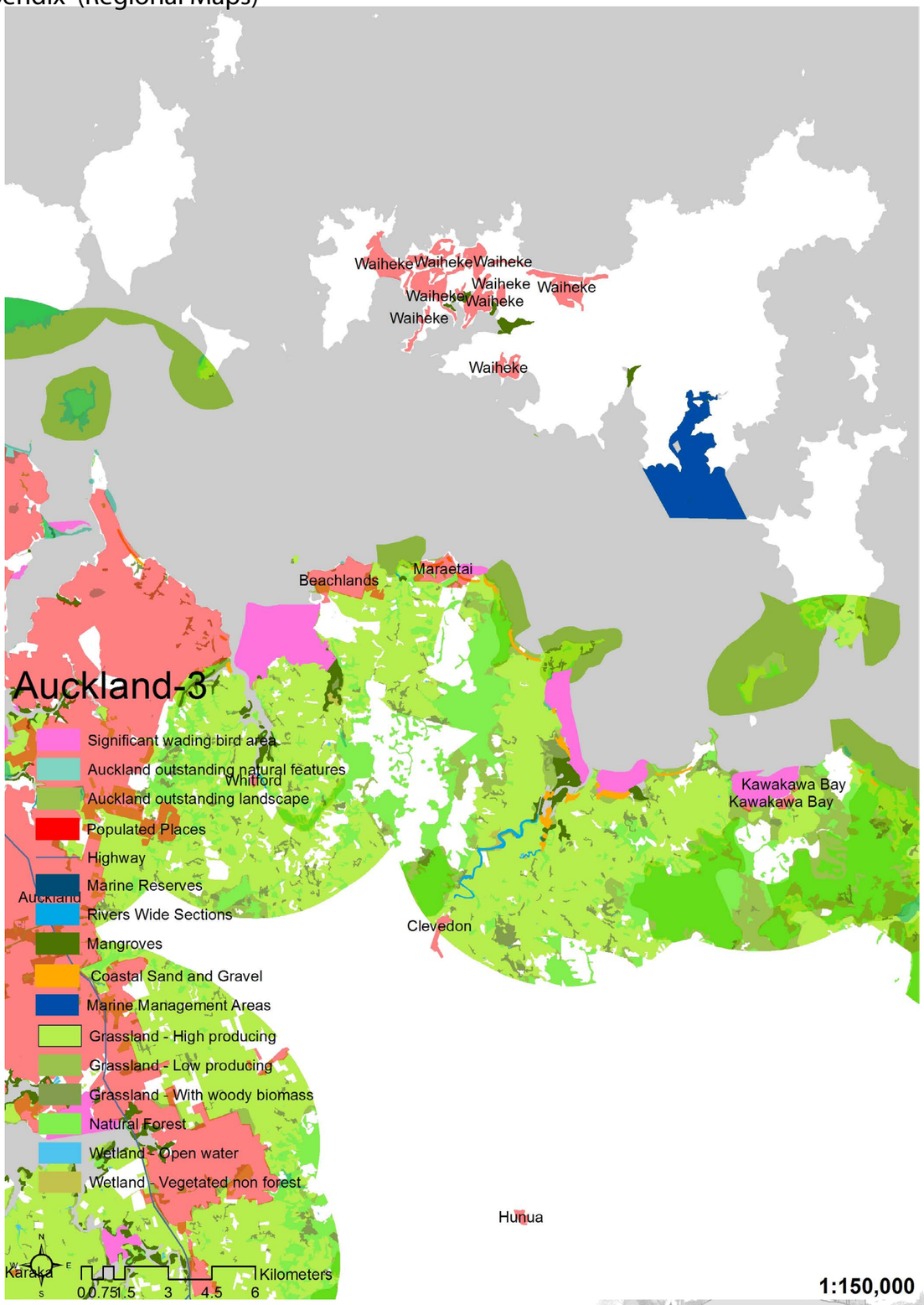

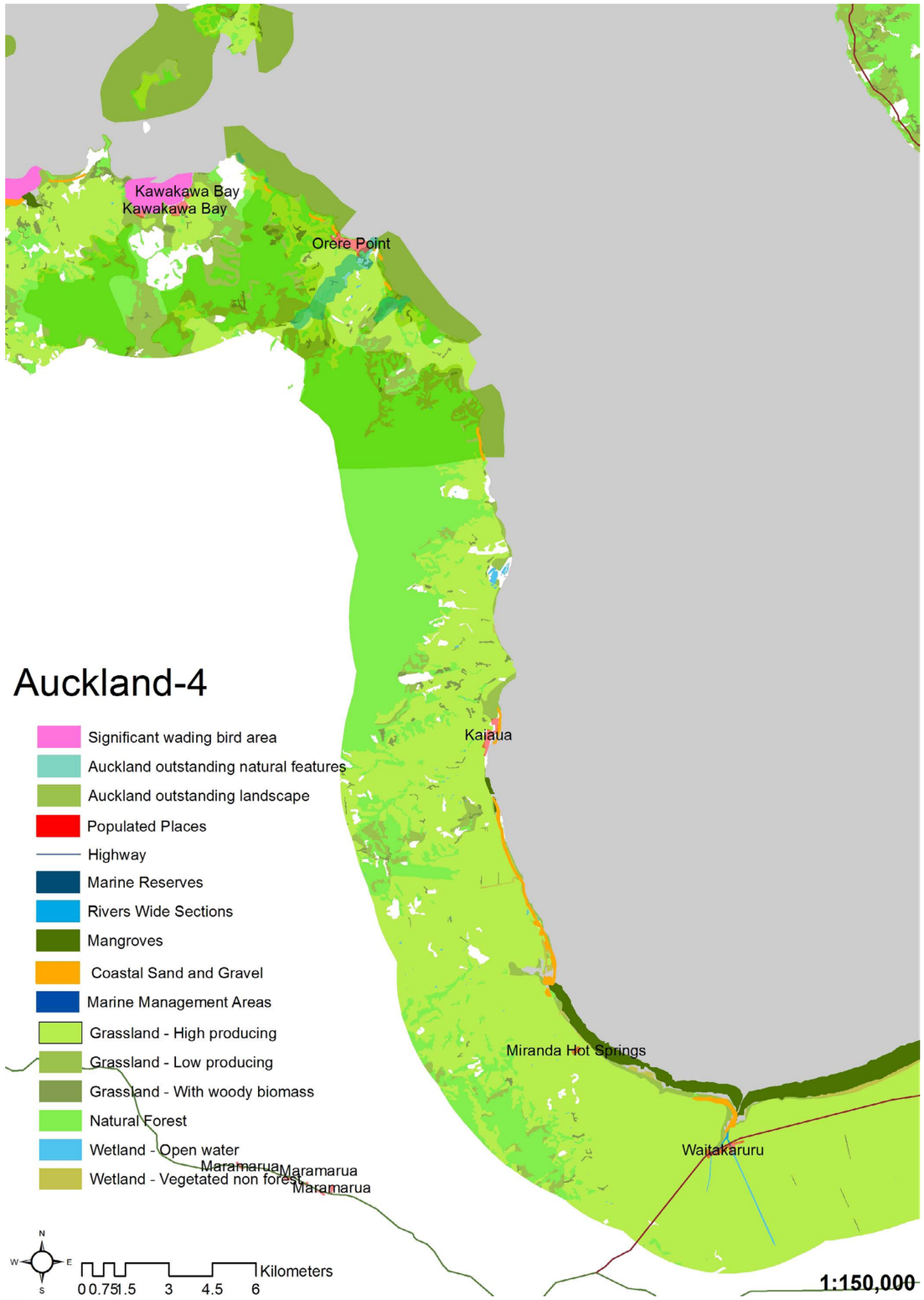

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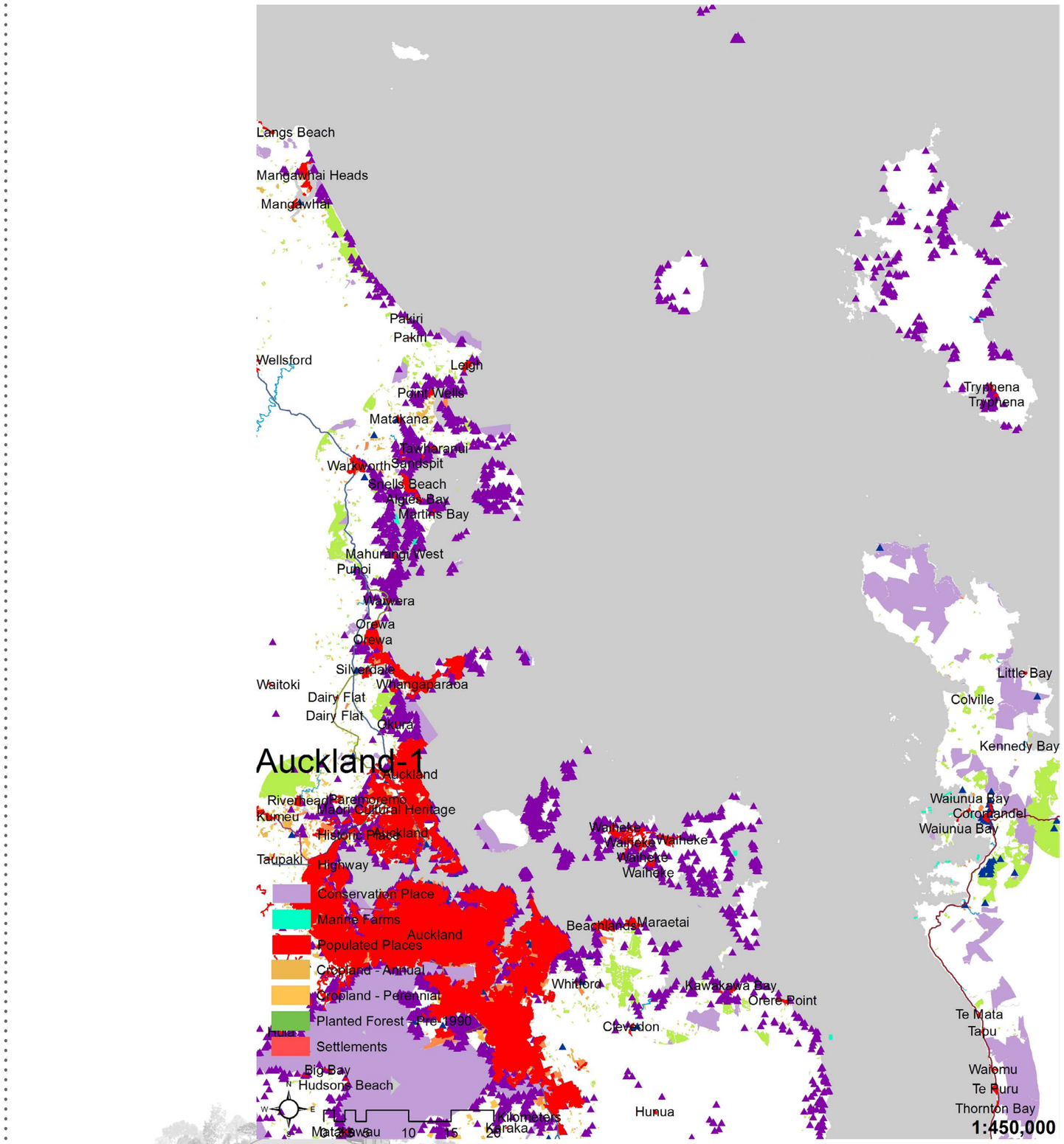

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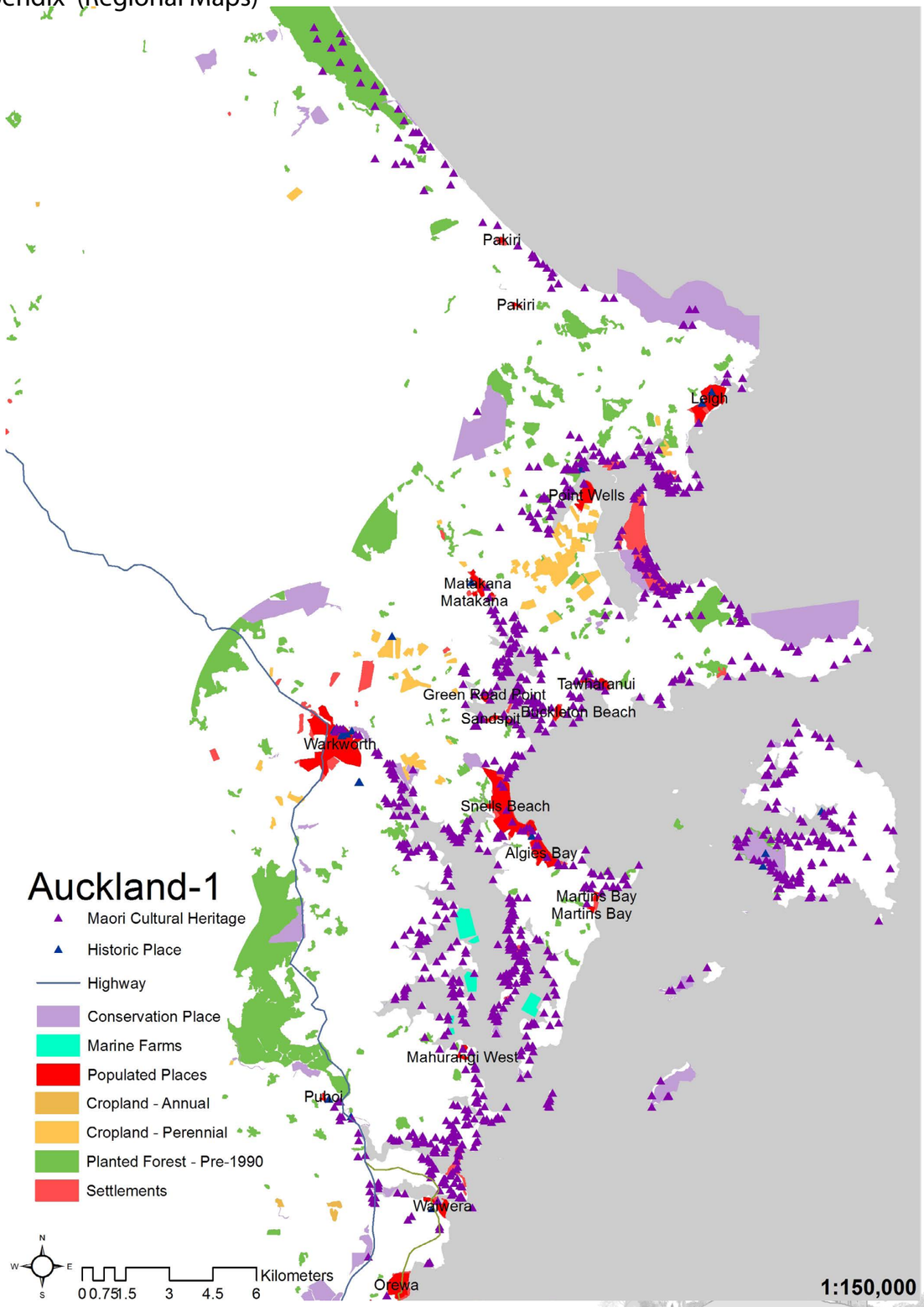

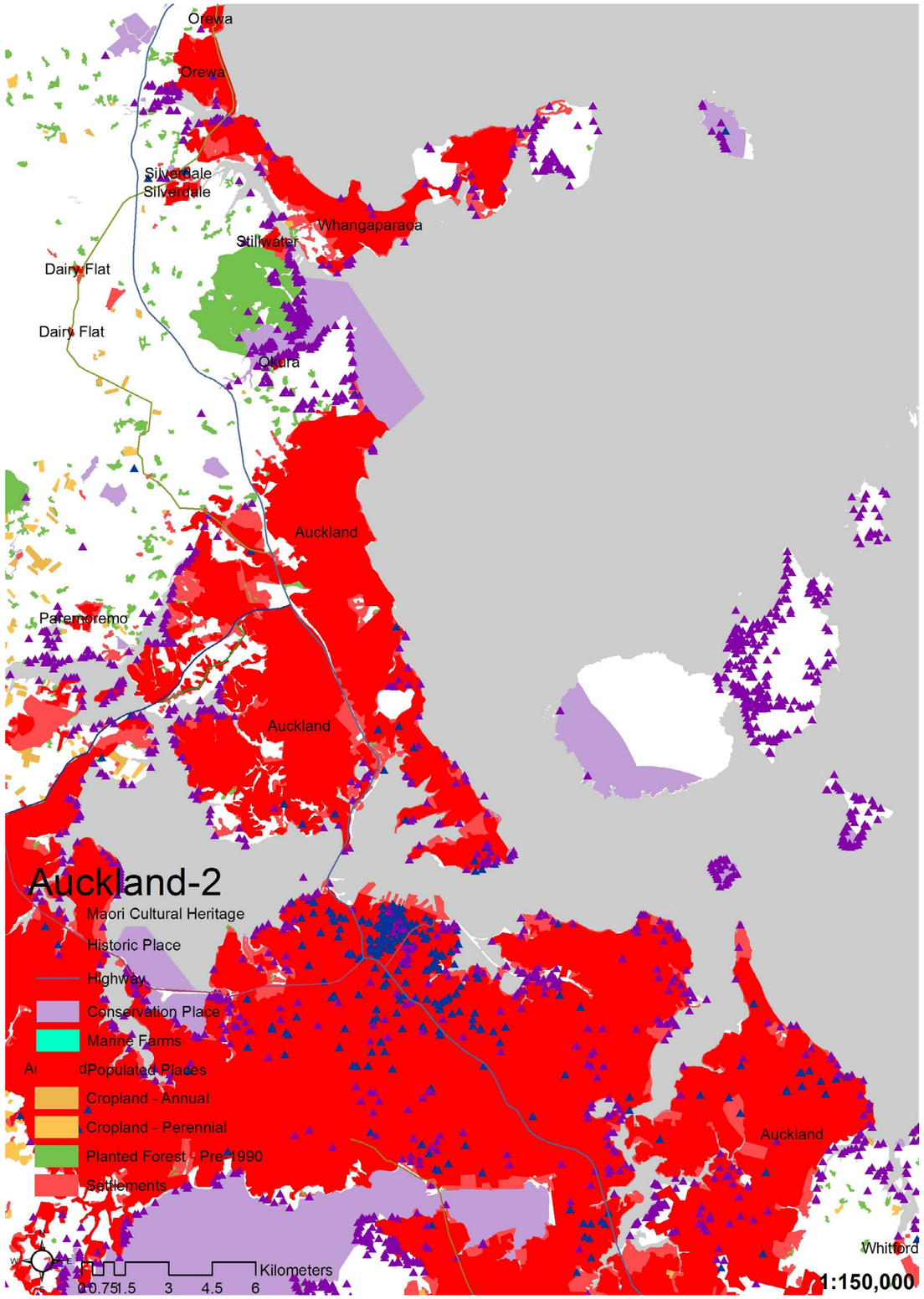

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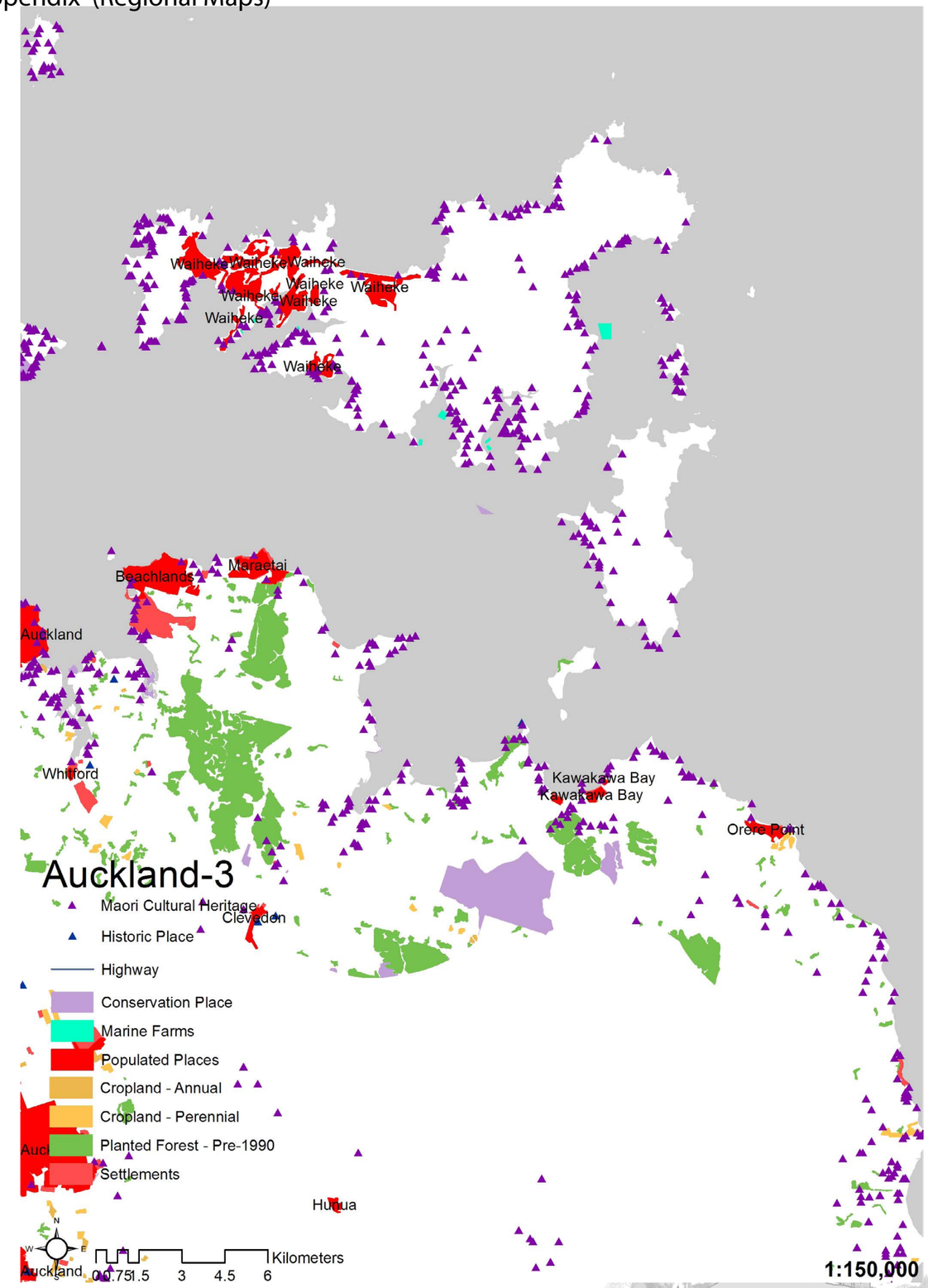

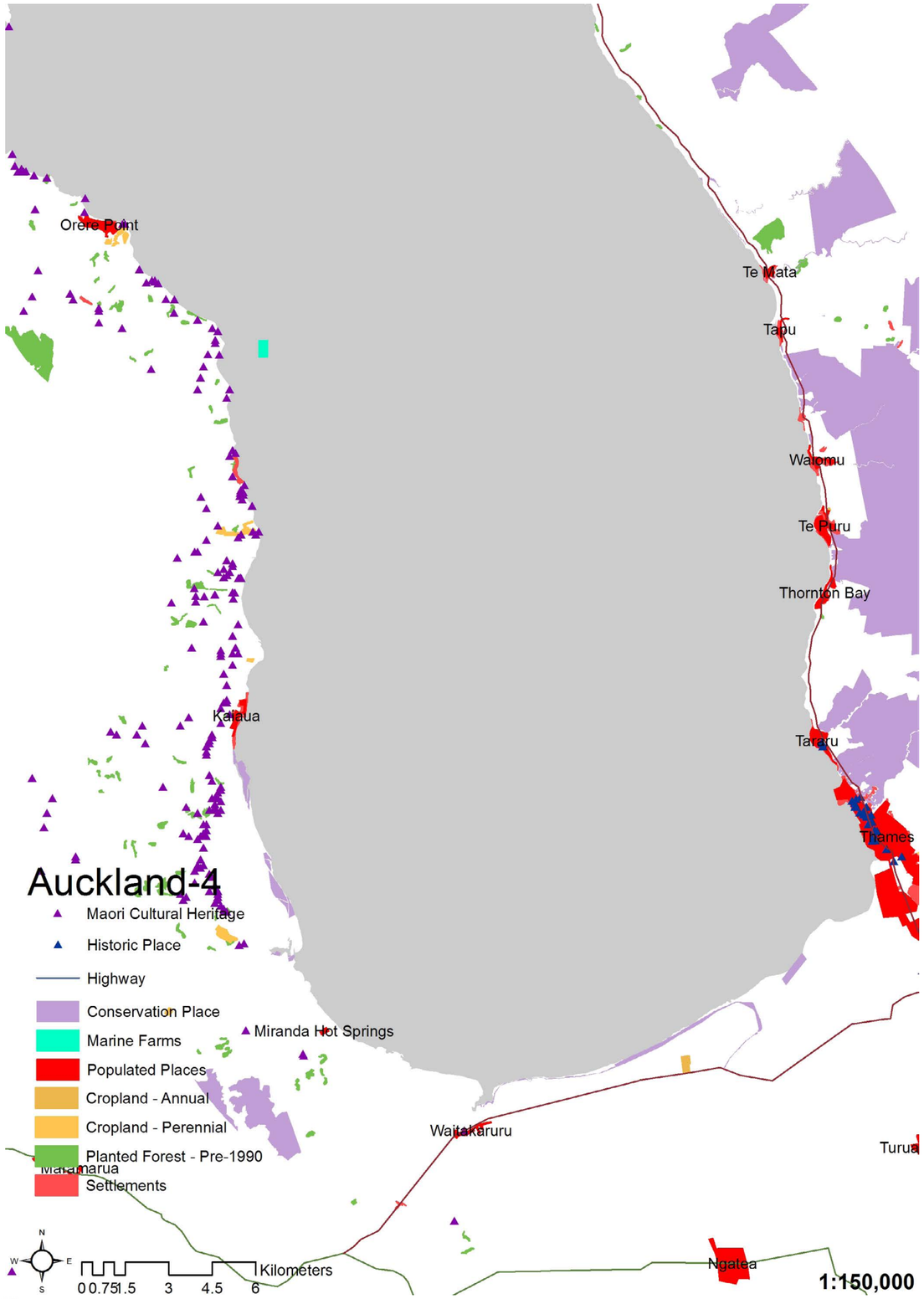

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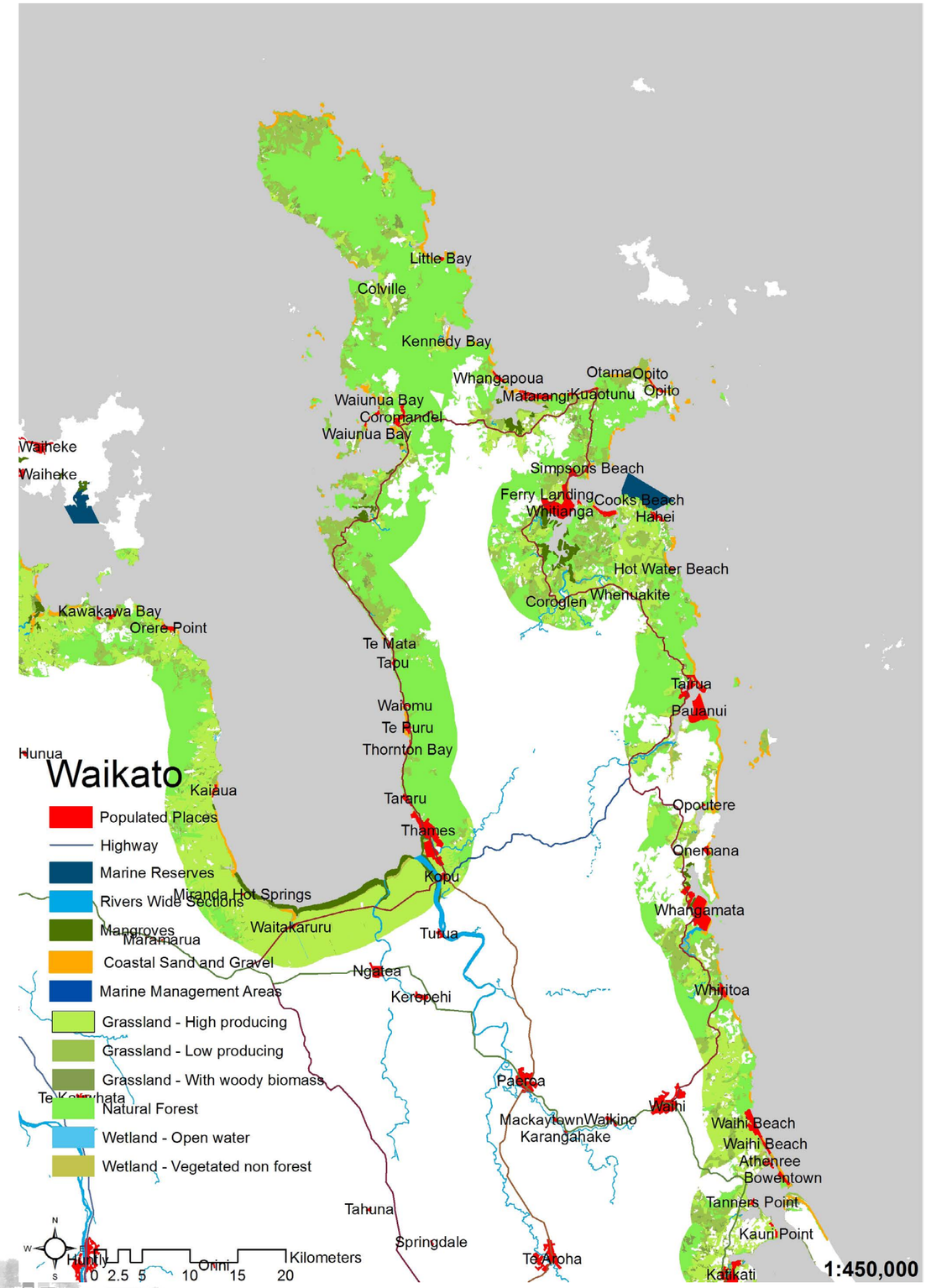

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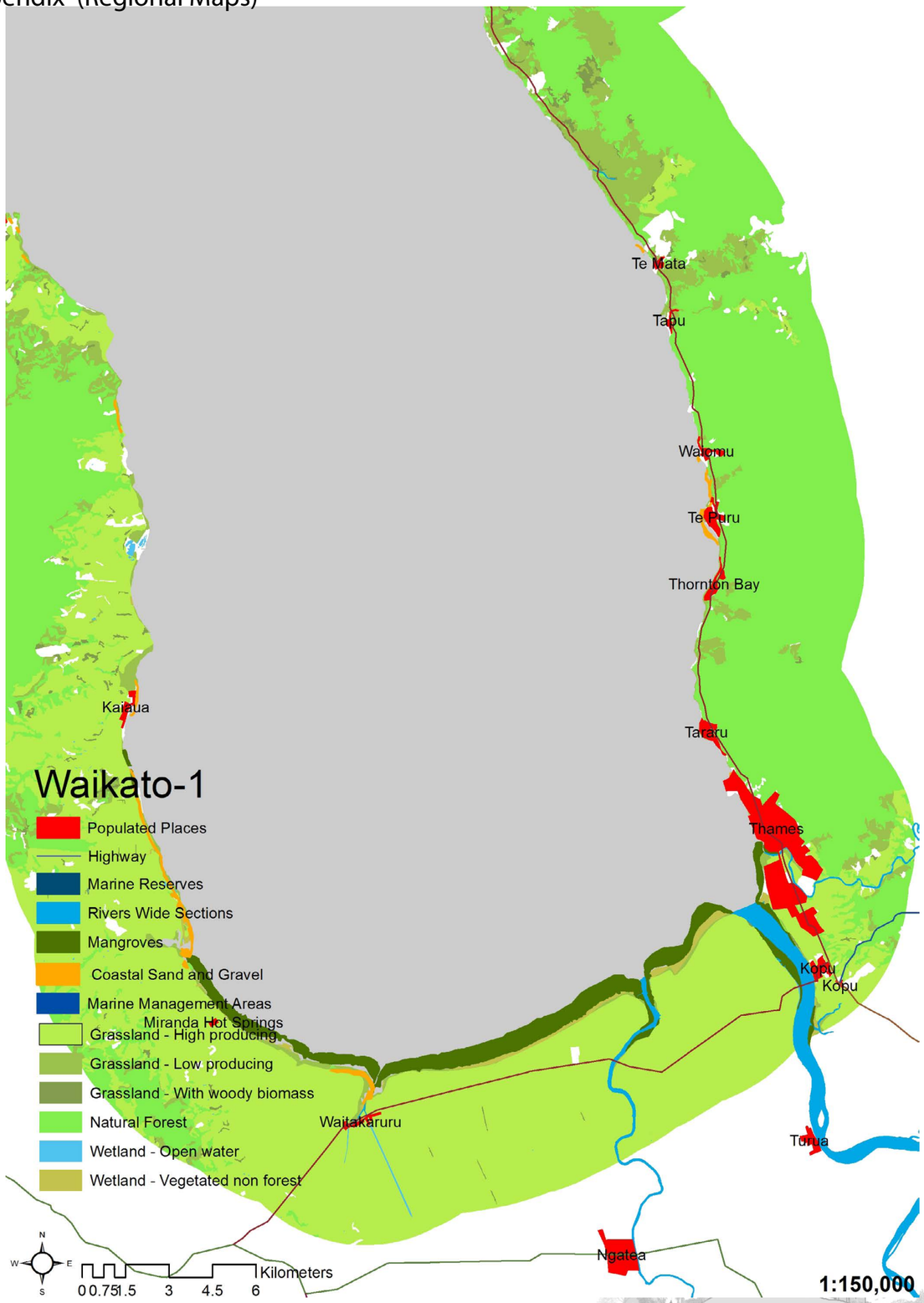

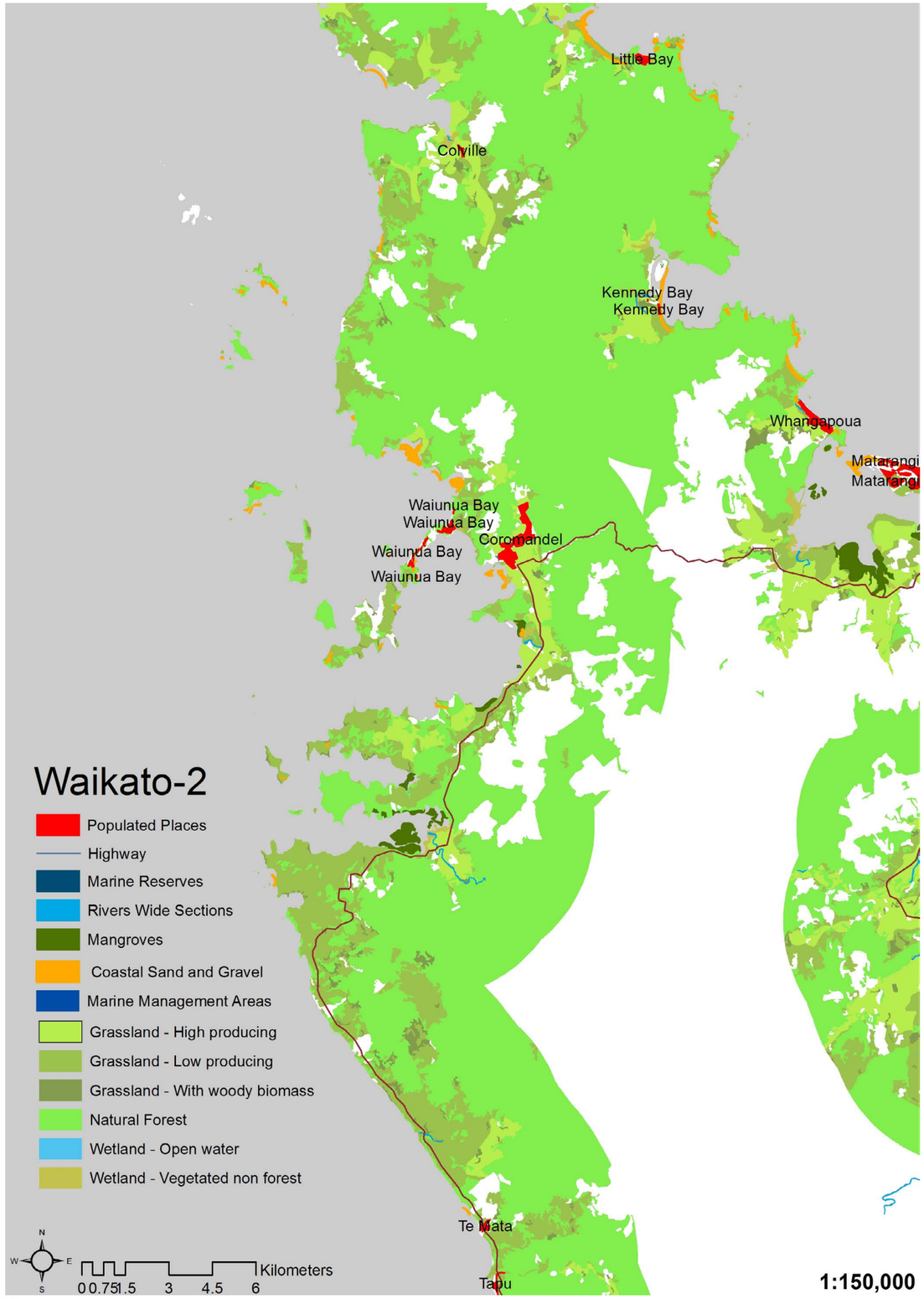

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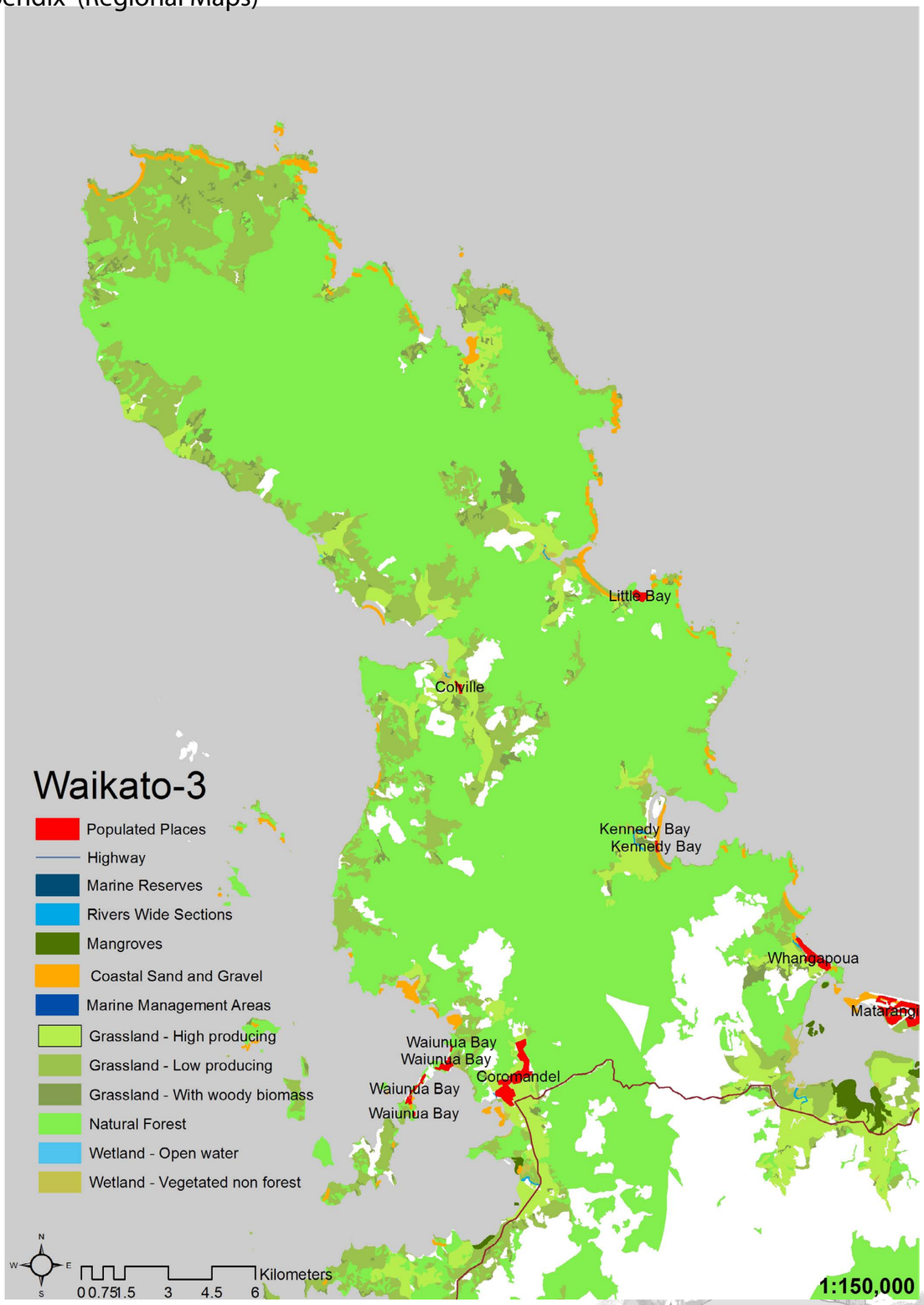

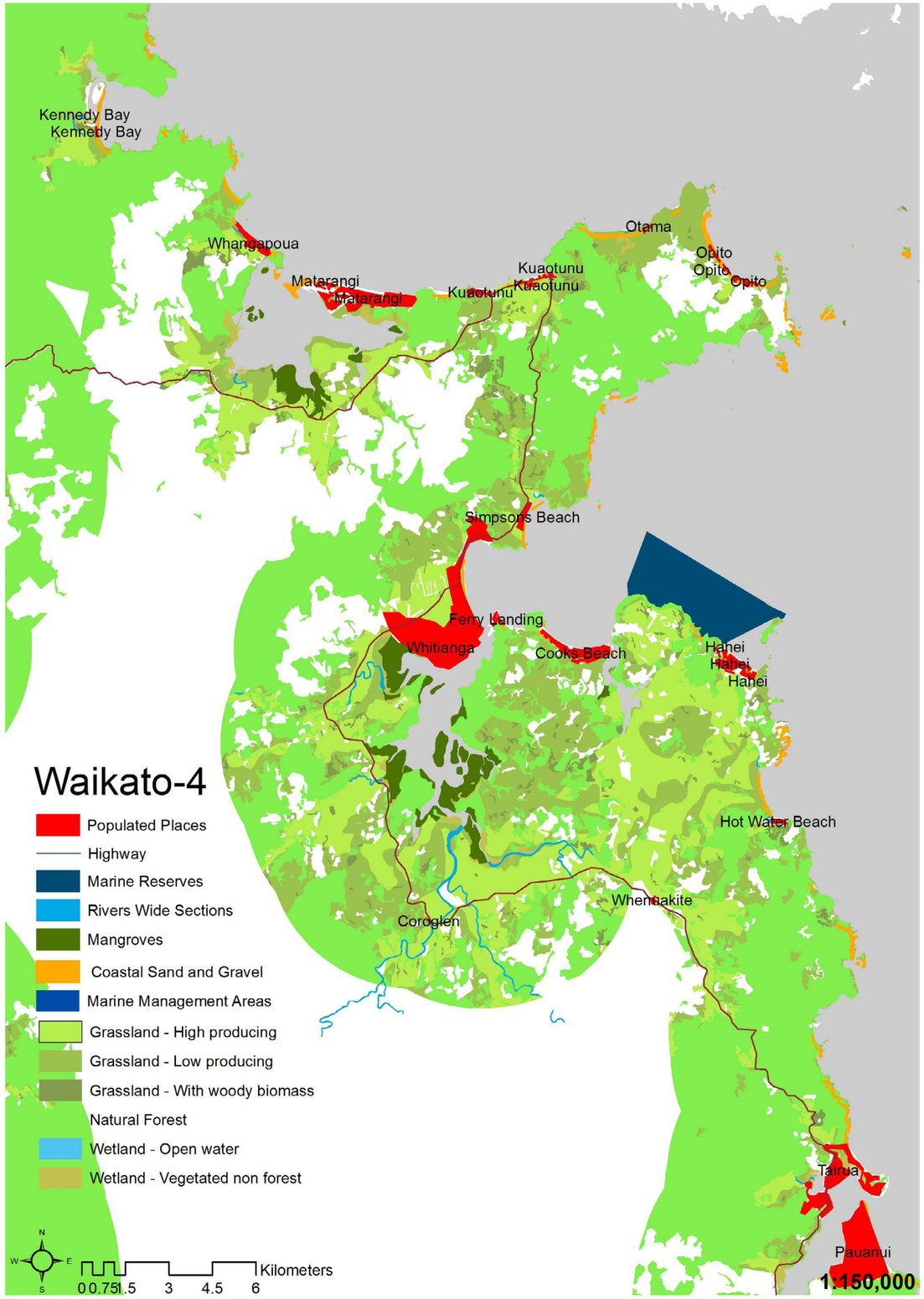

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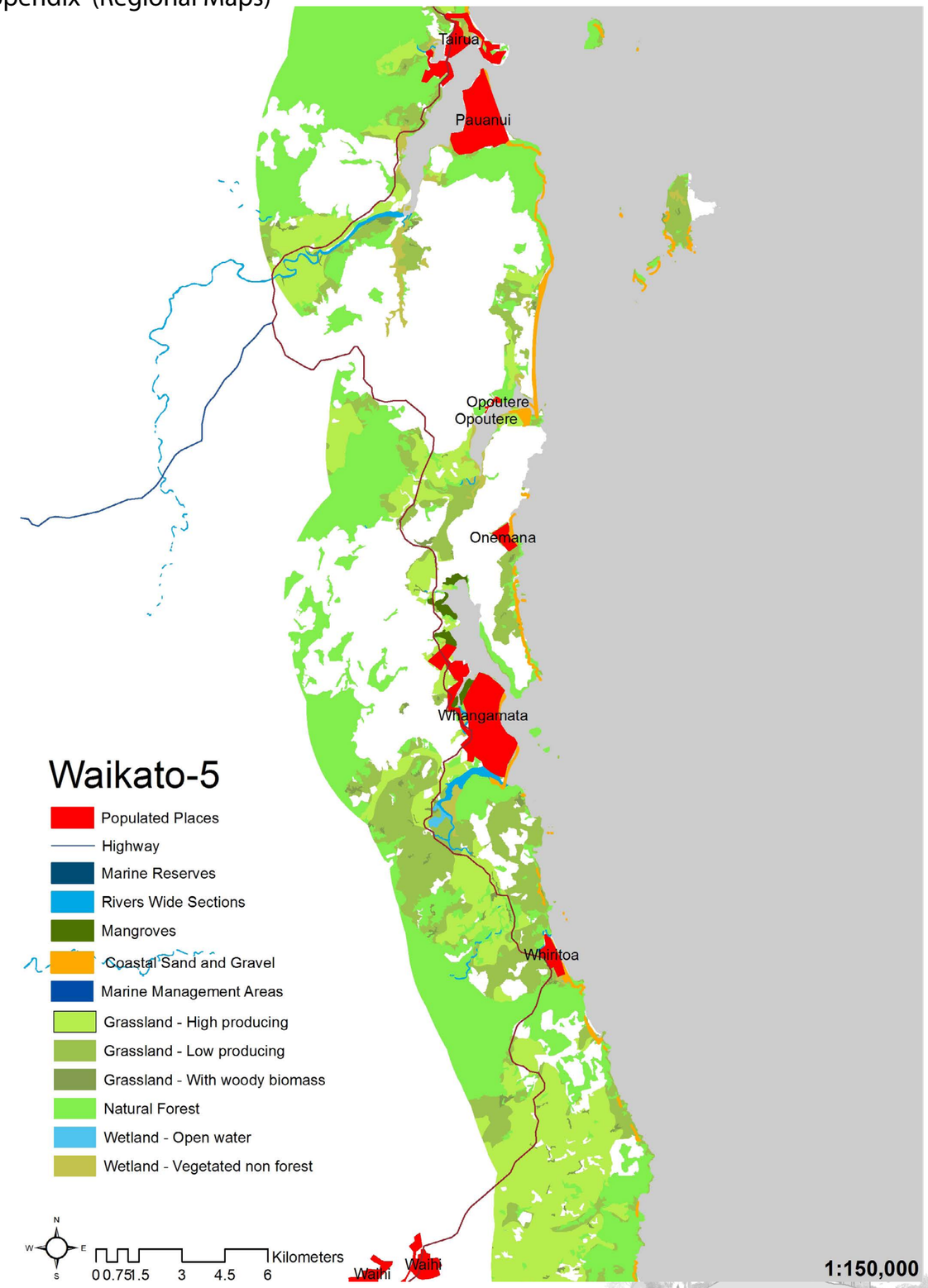

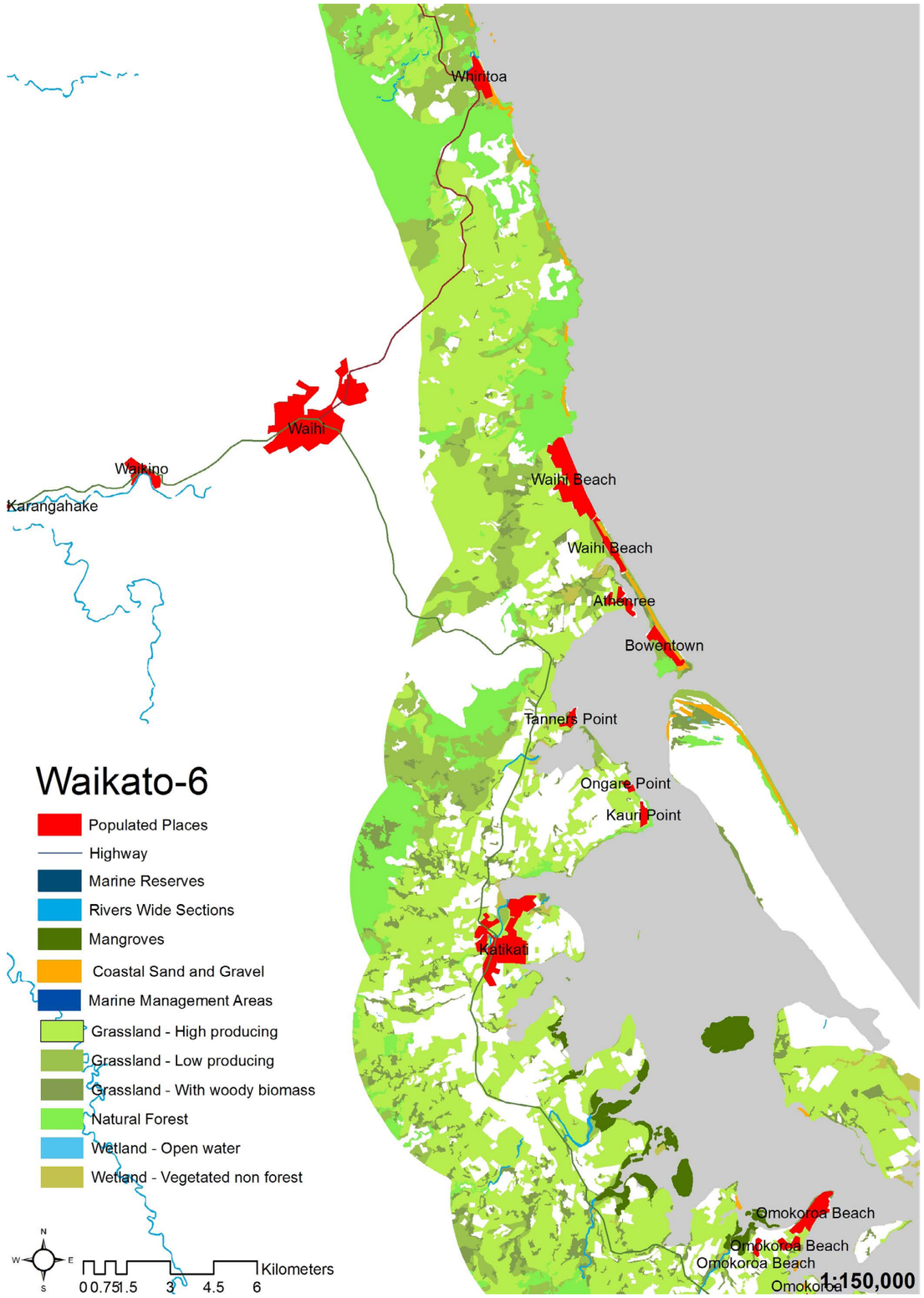

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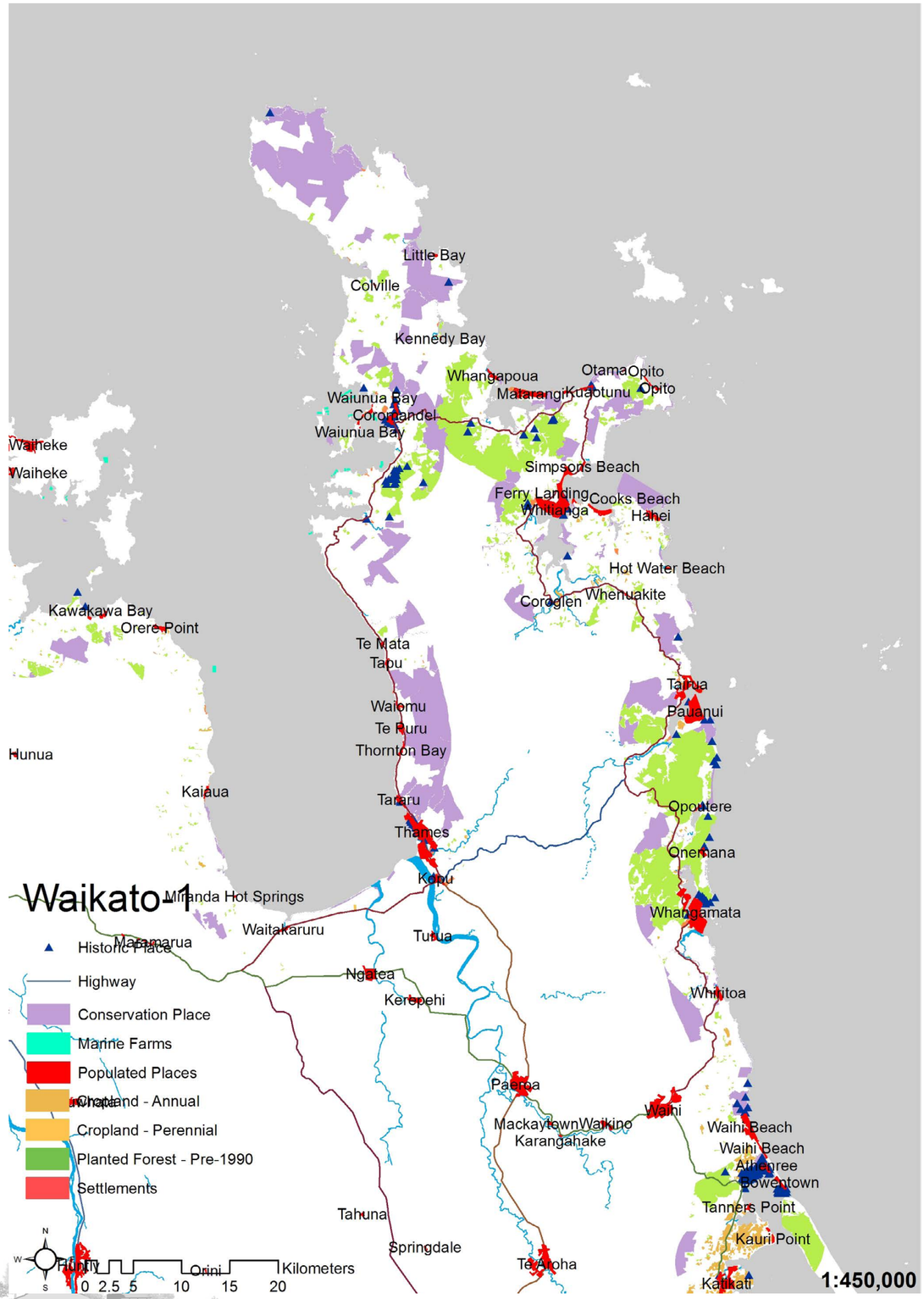

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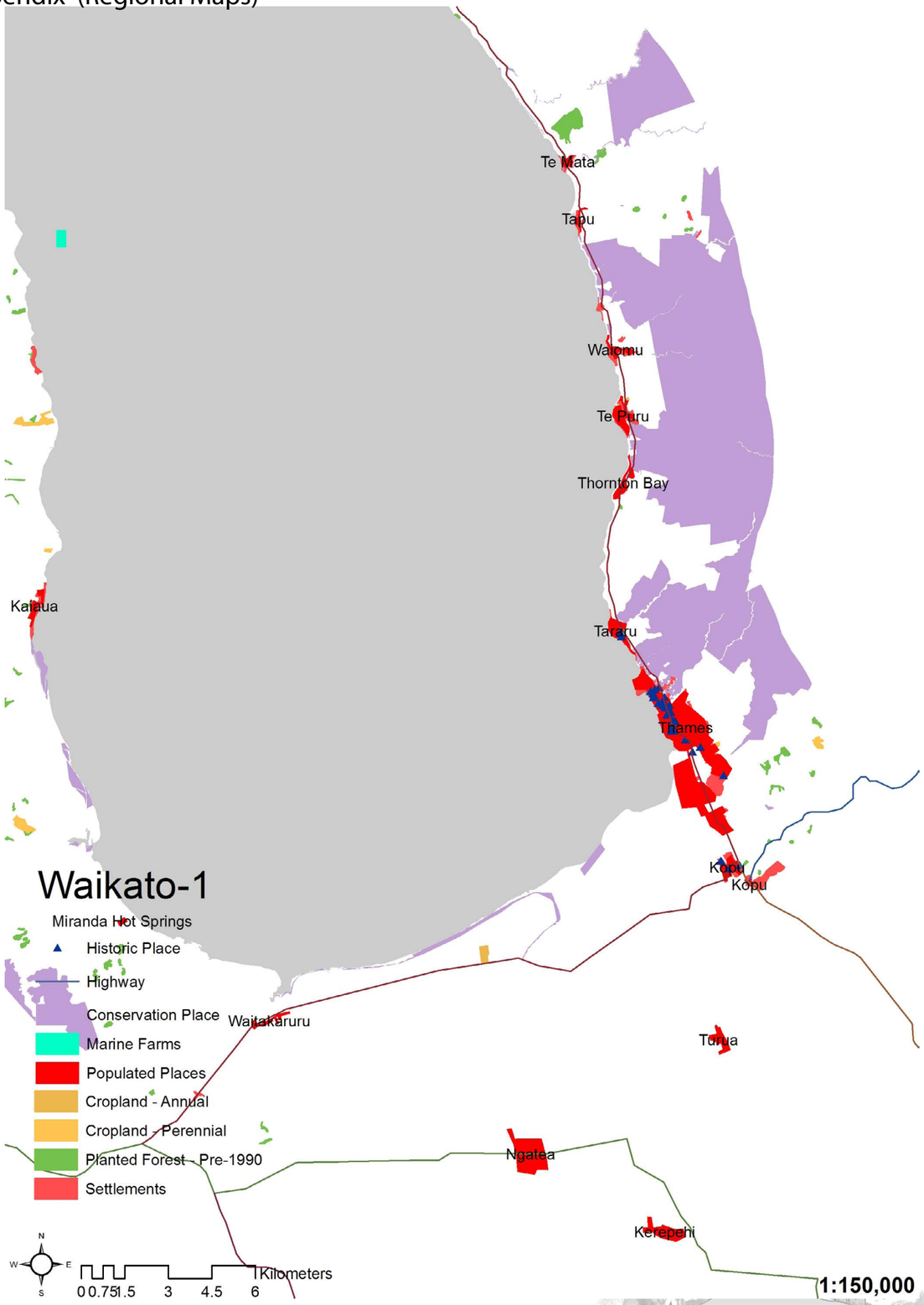

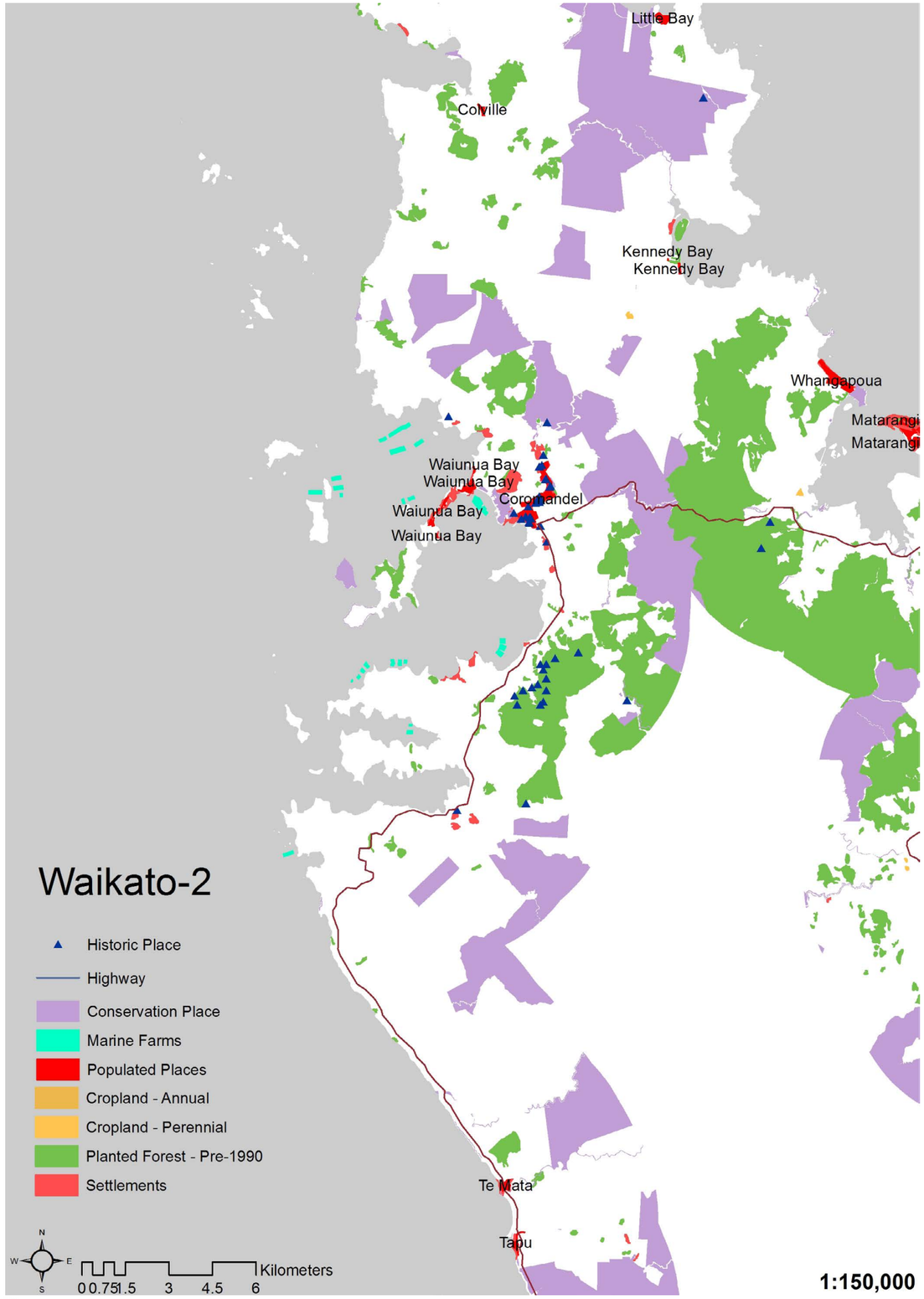

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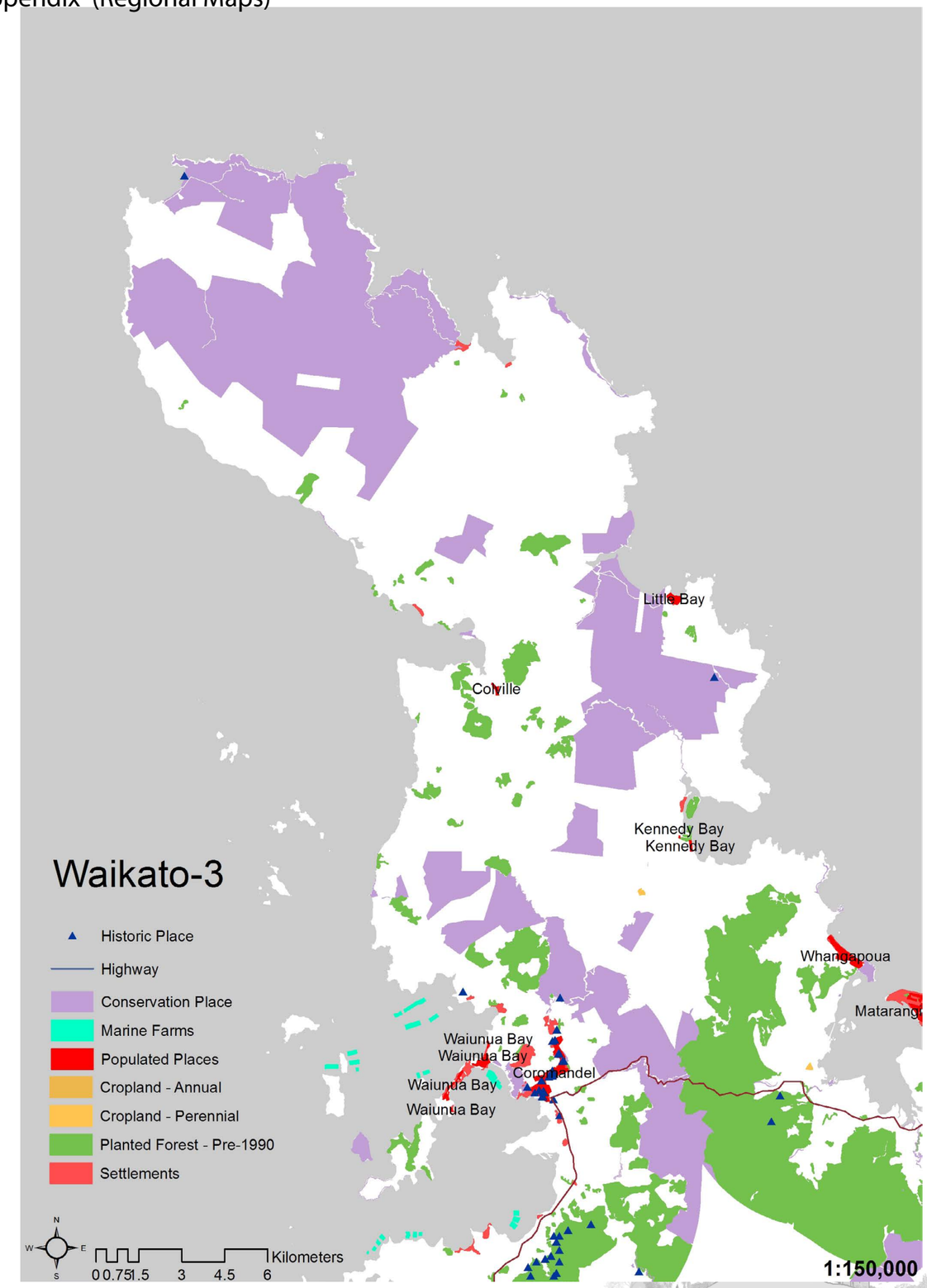

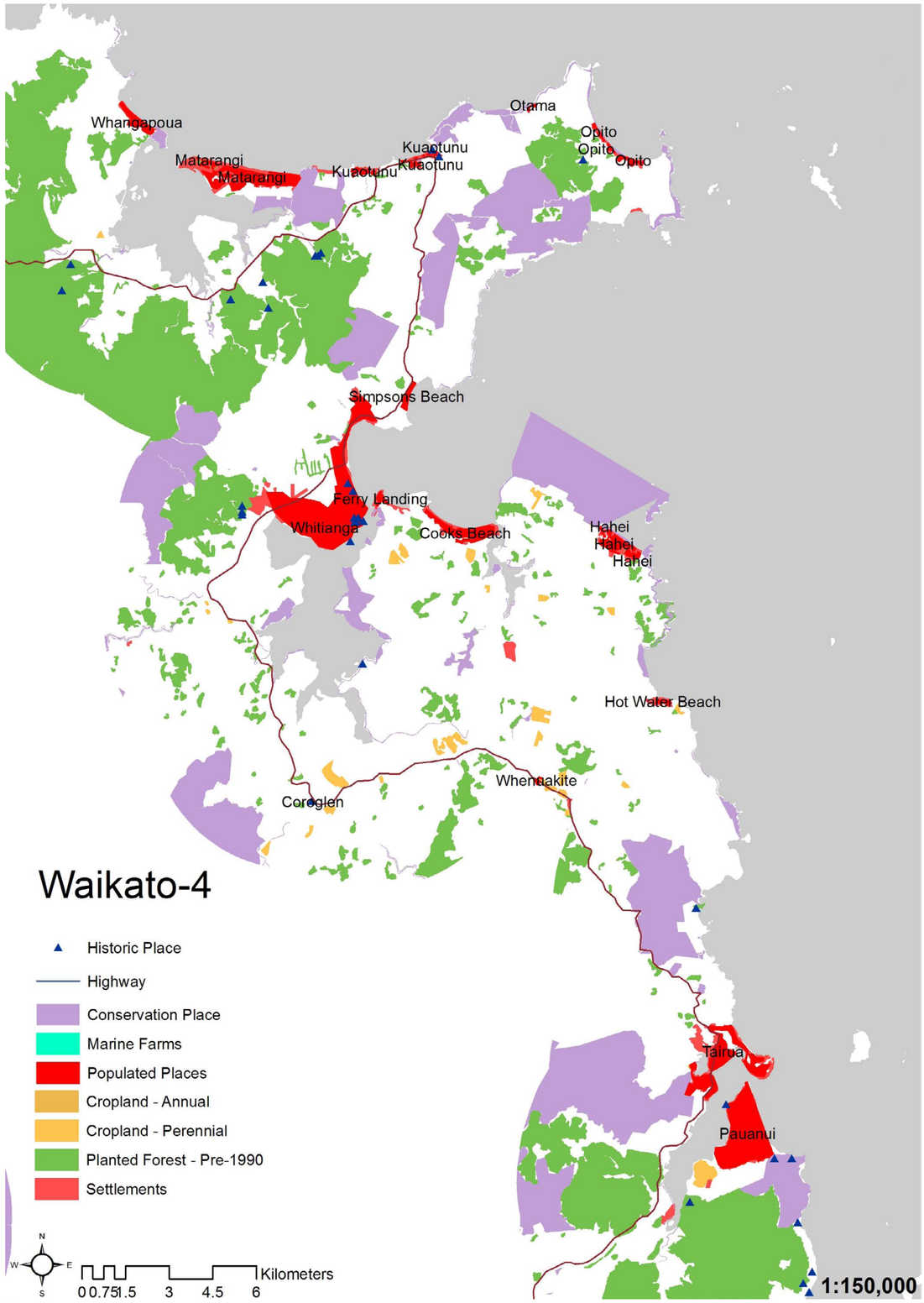

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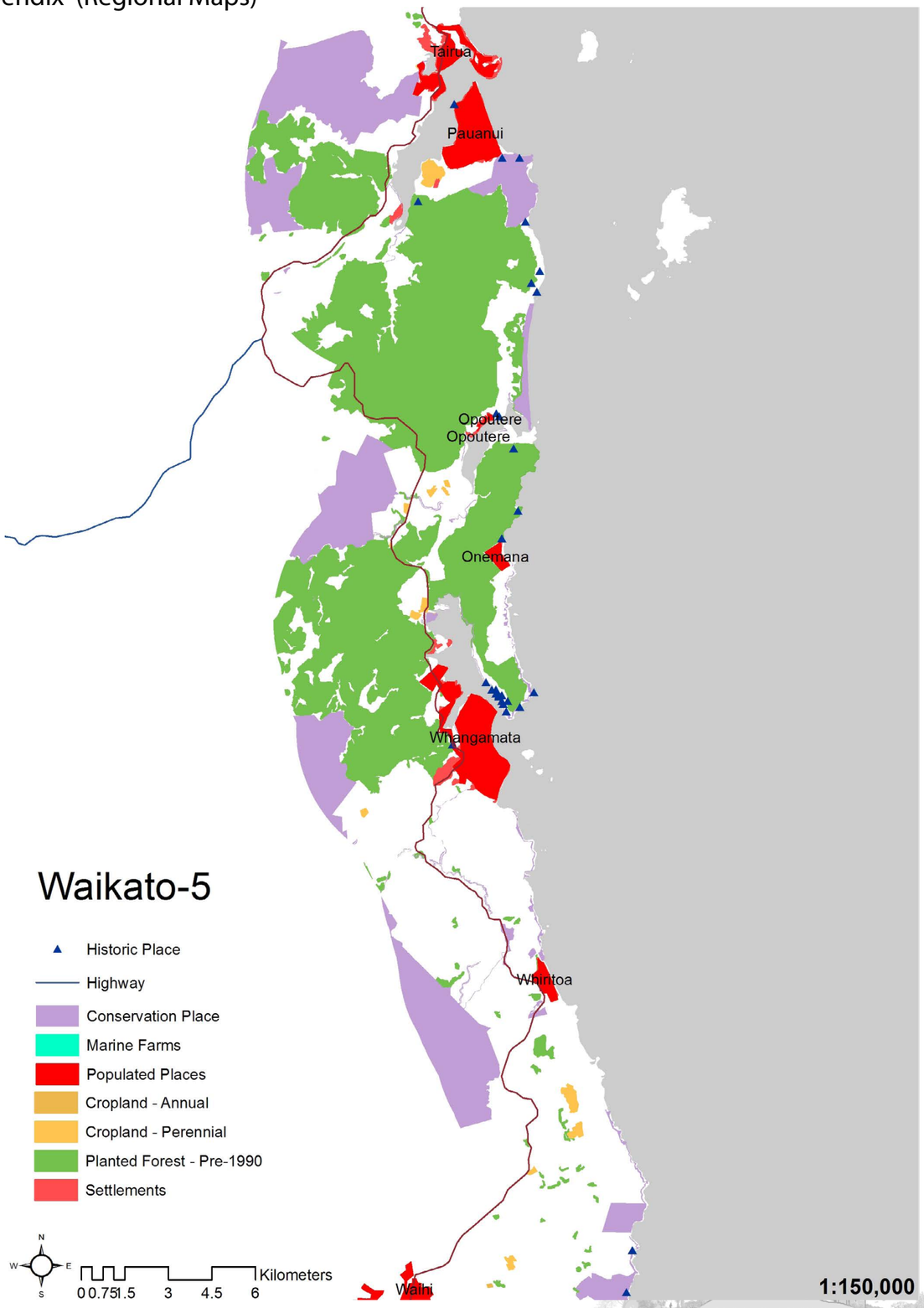

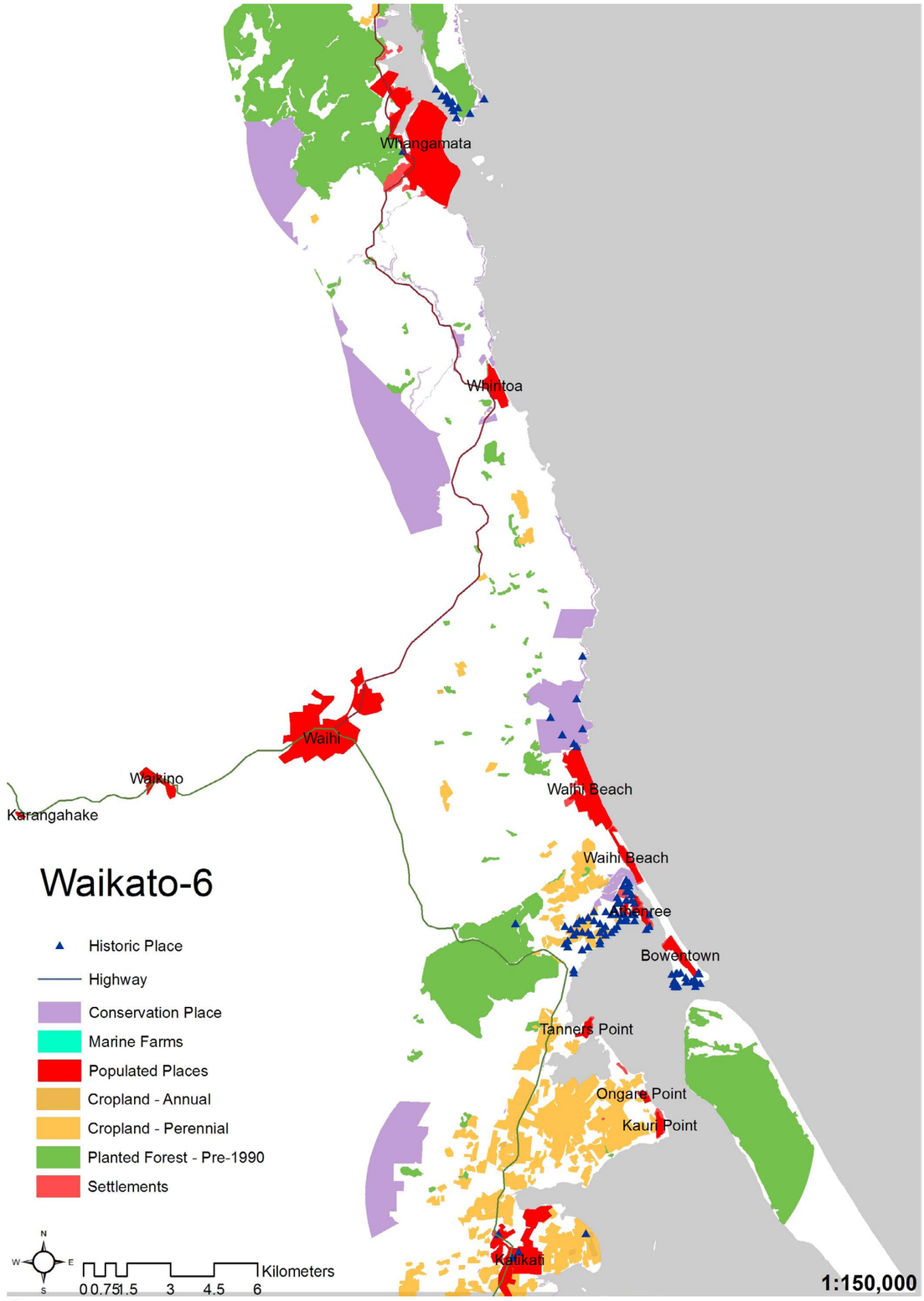

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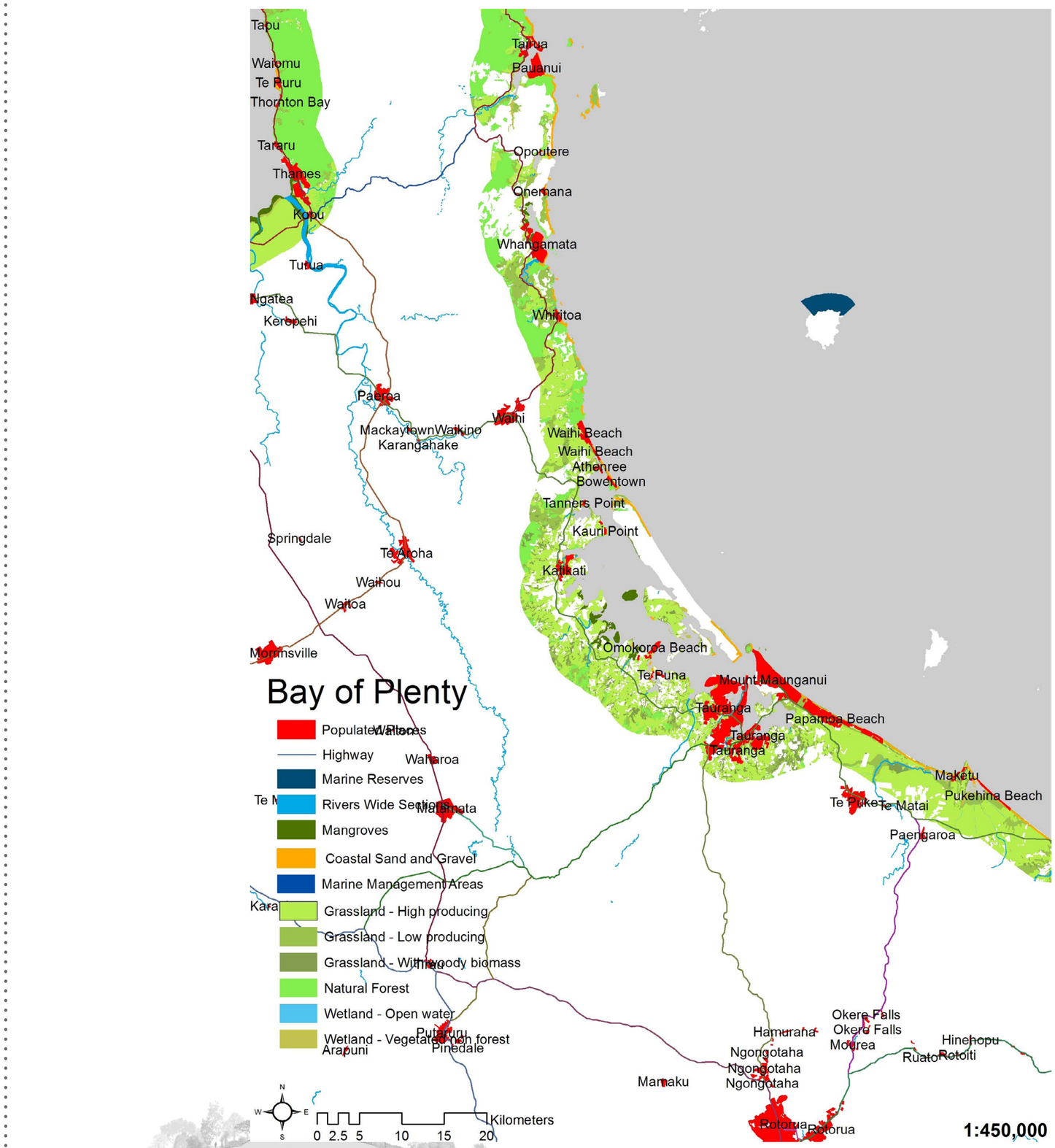

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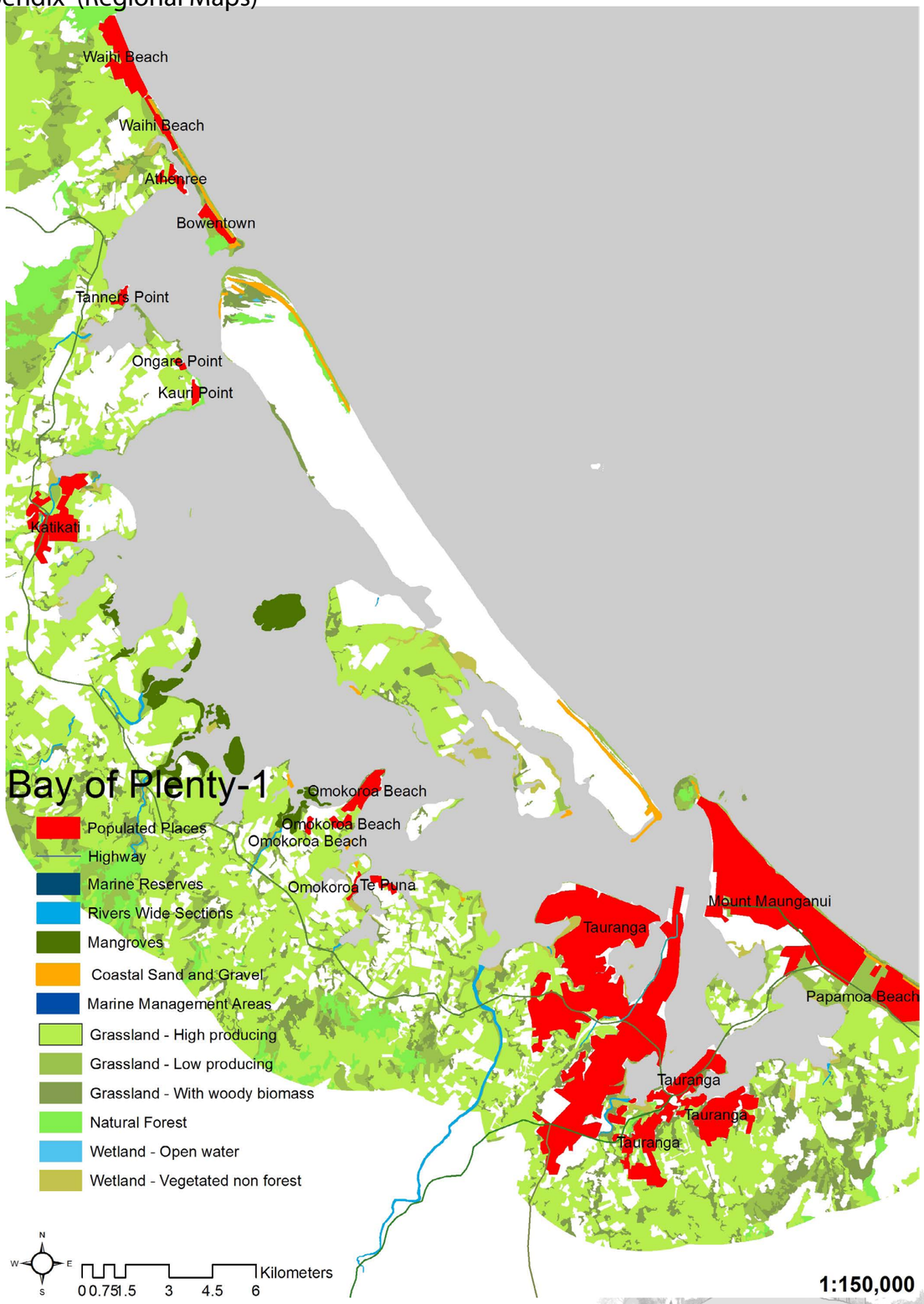

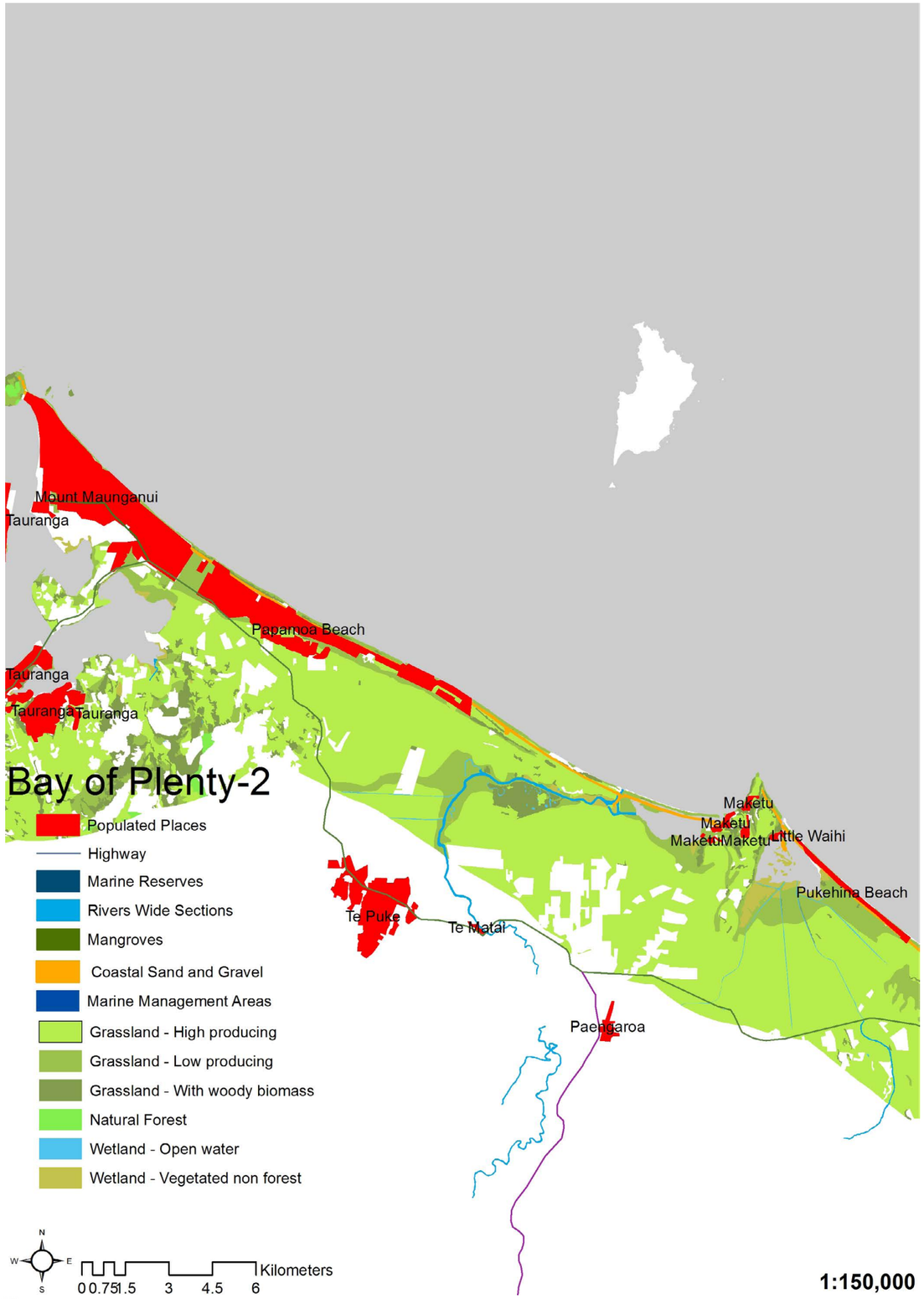

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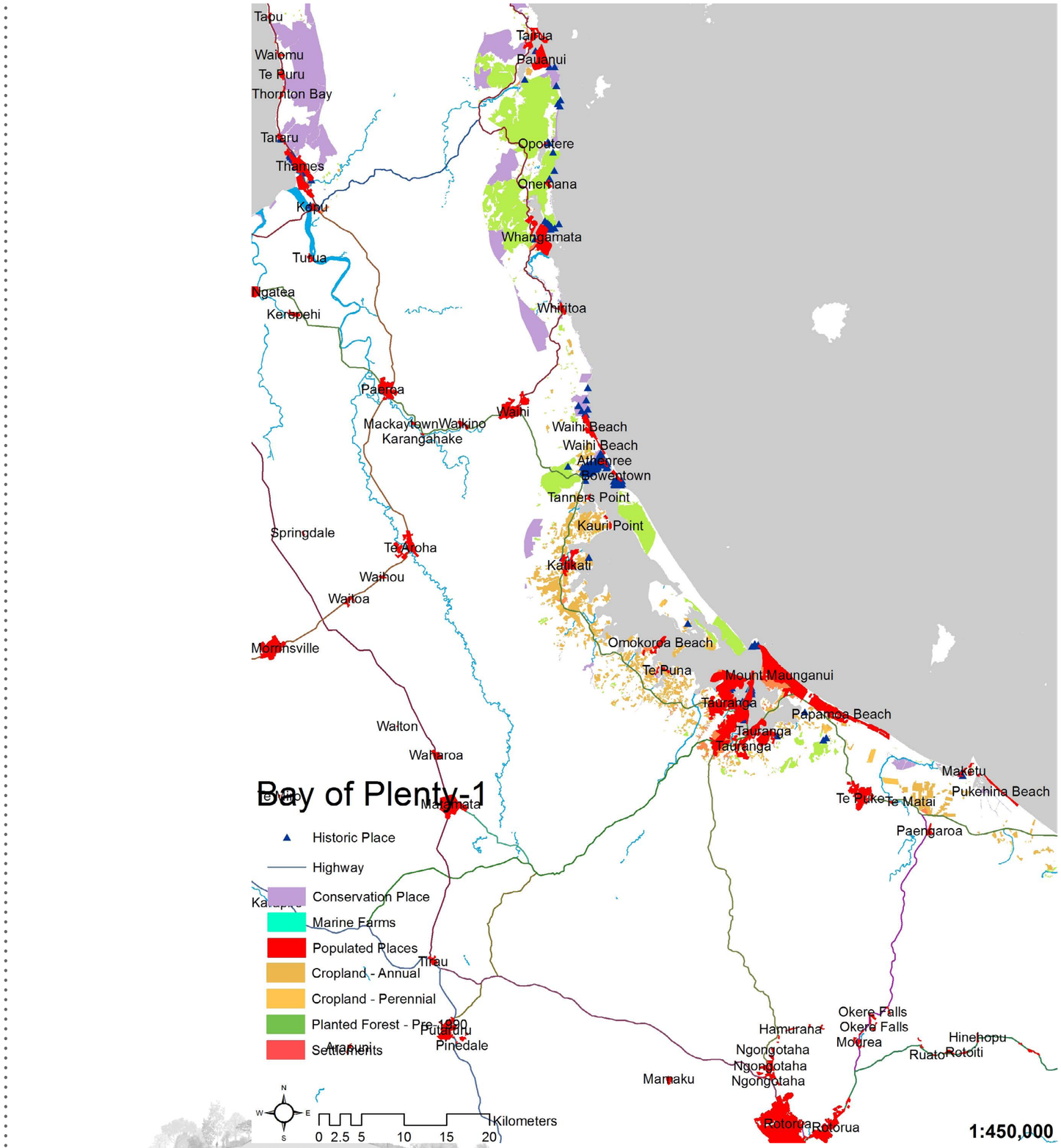

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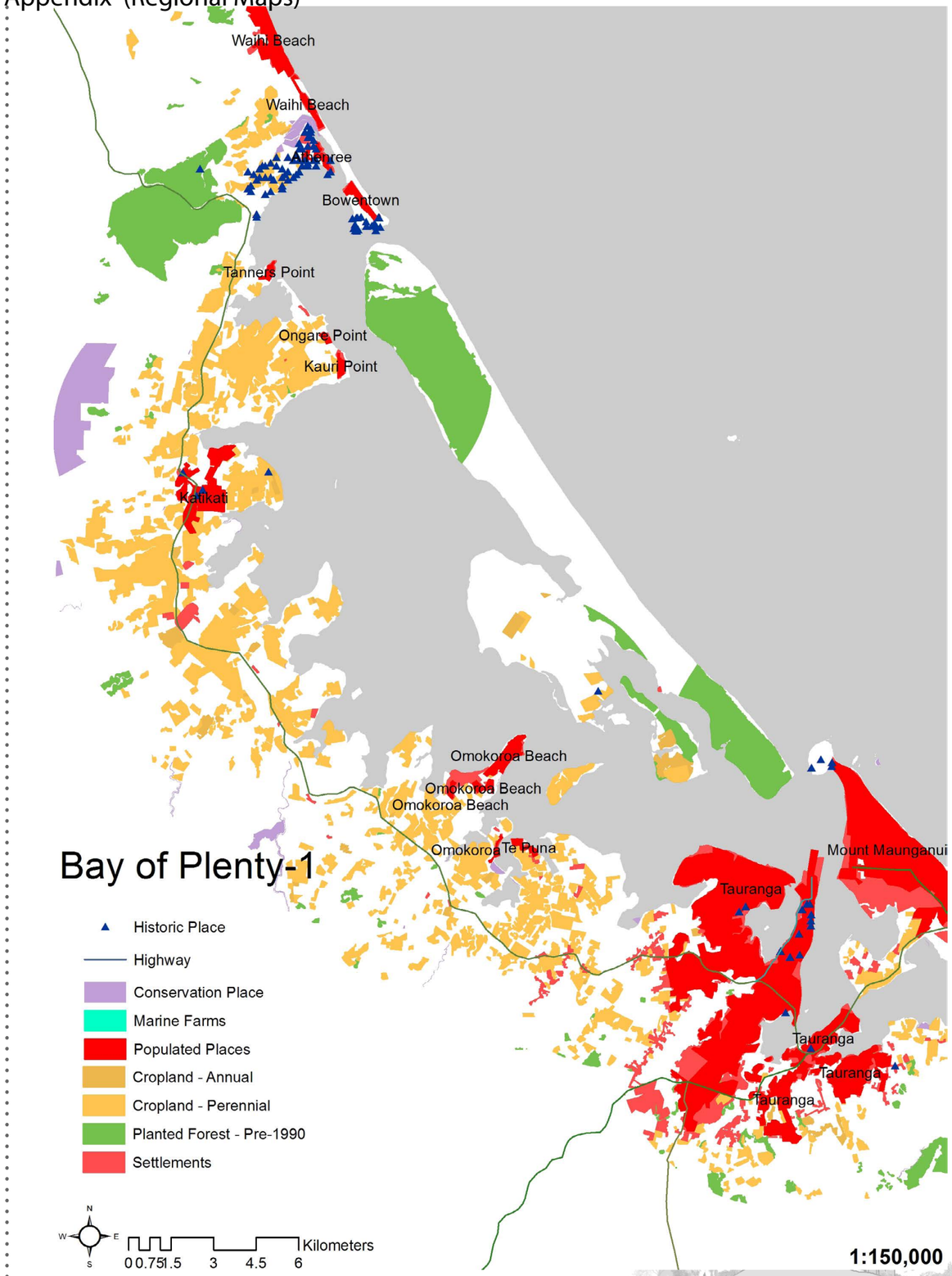

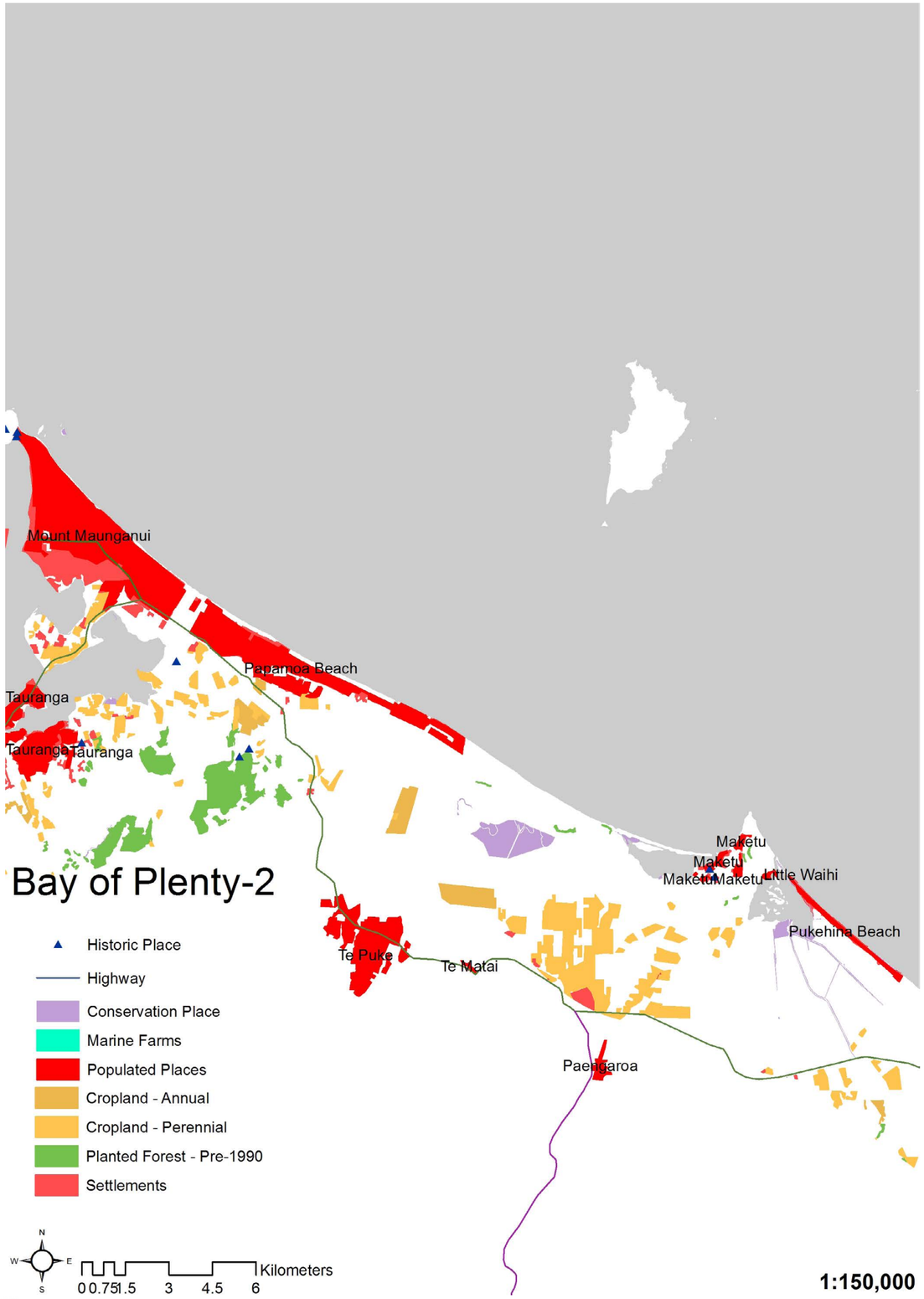

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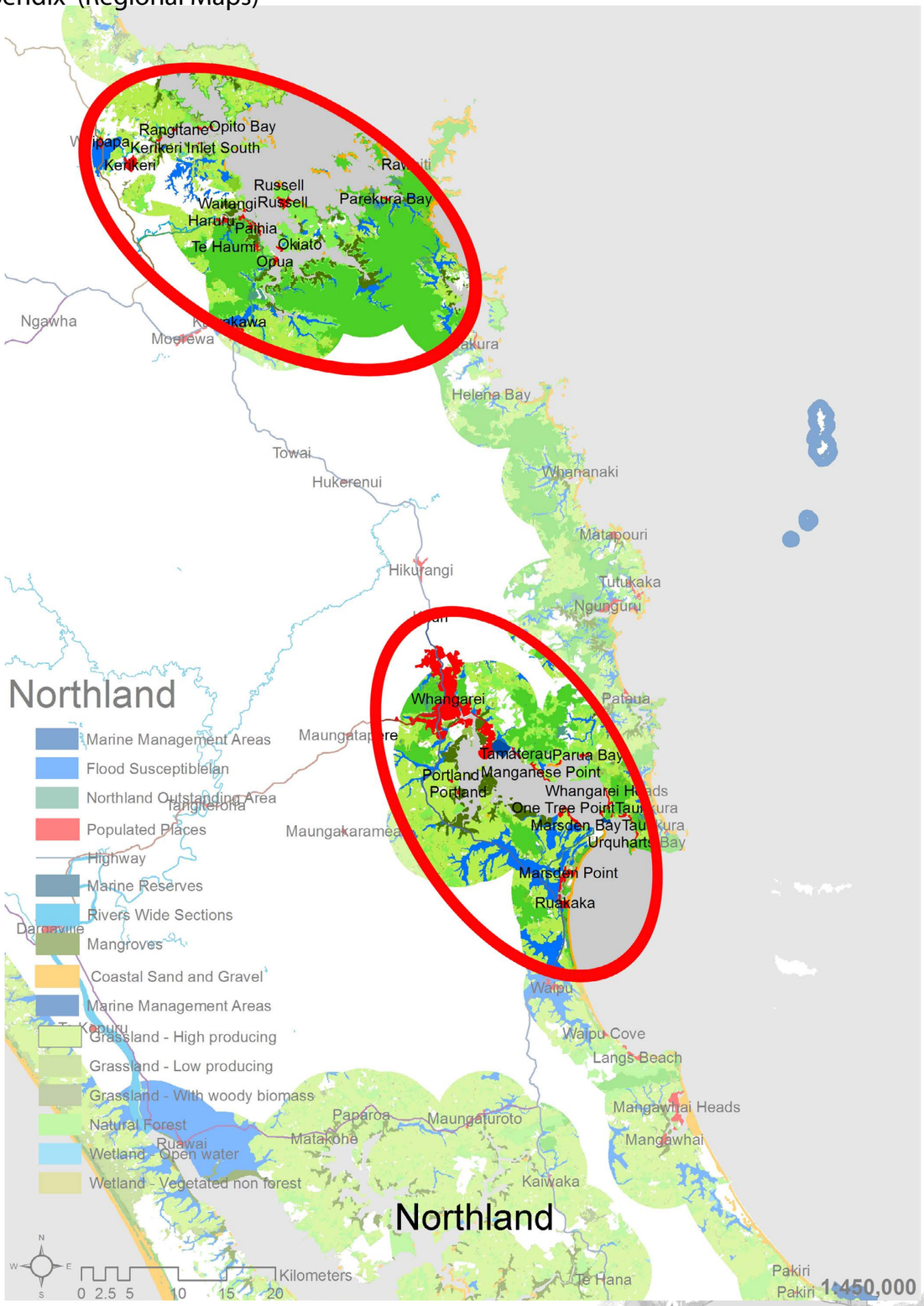
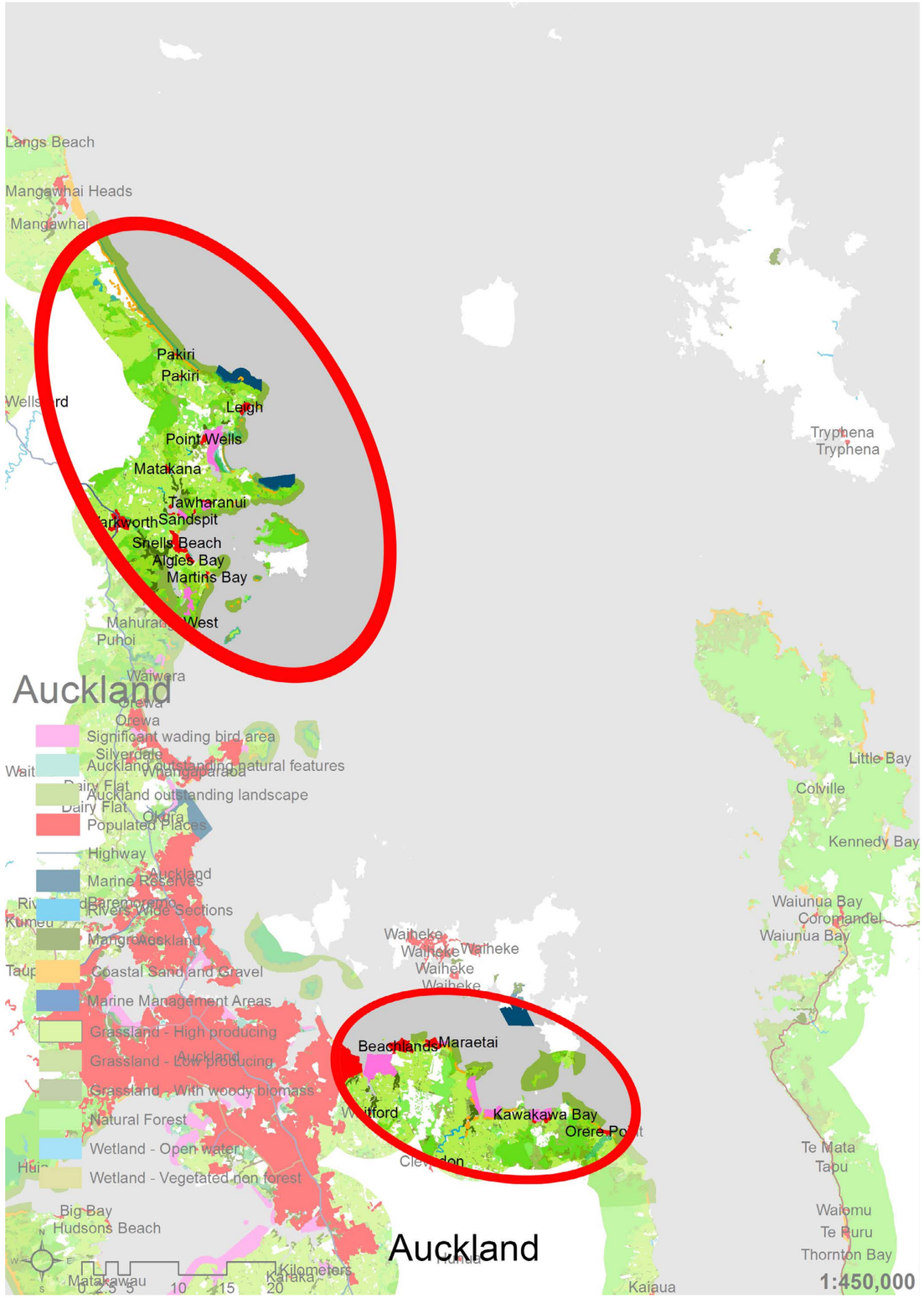
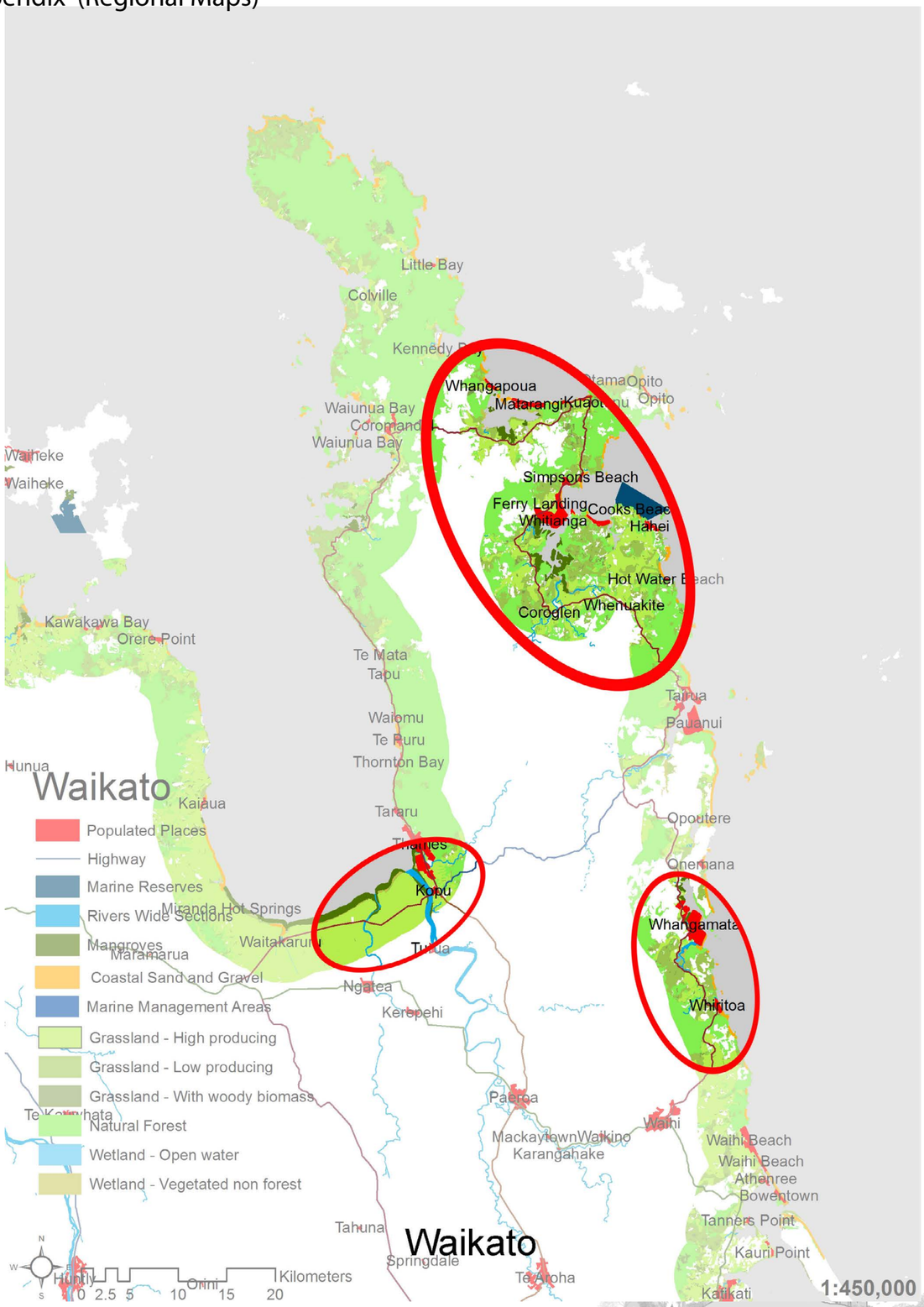




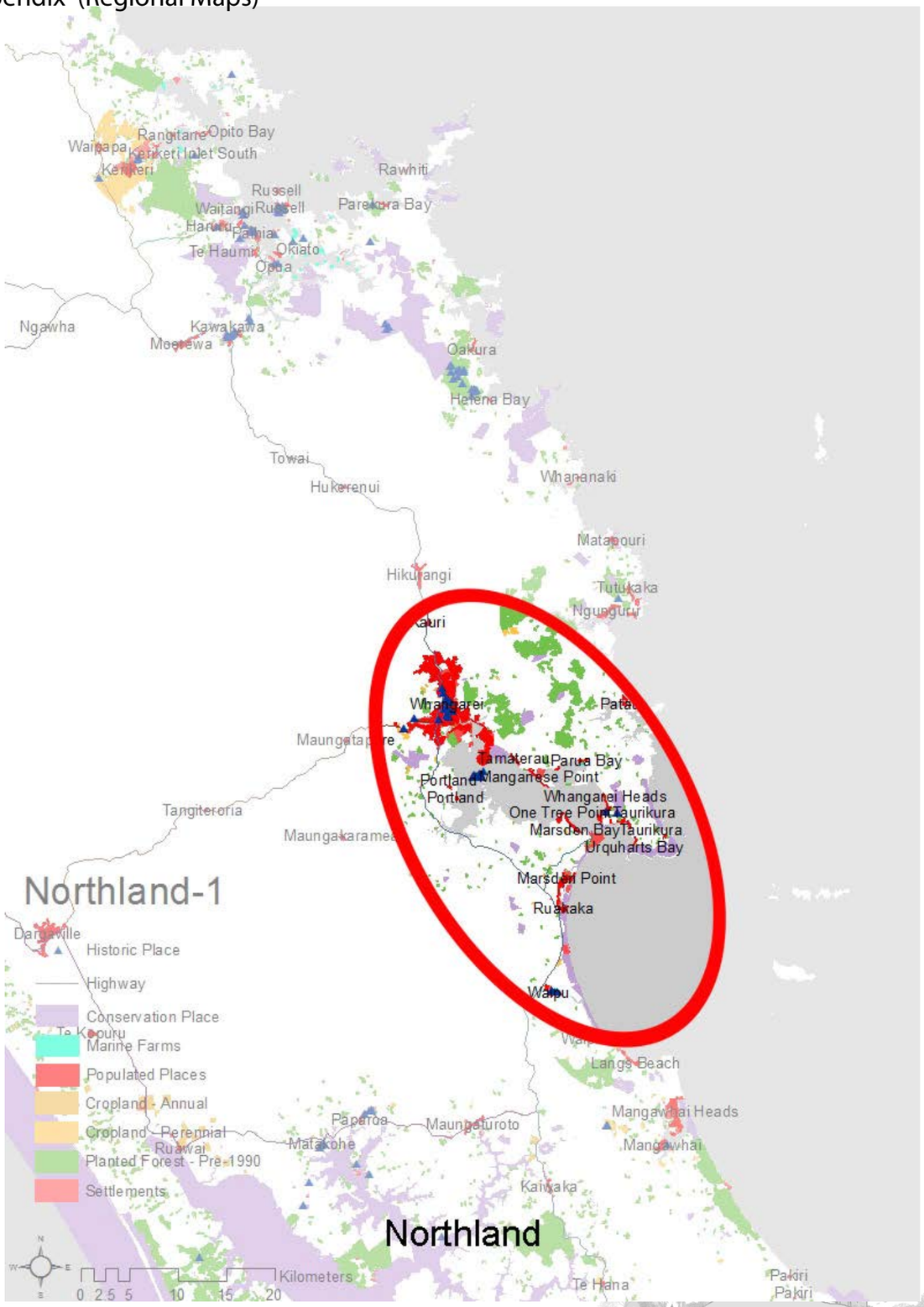
Environmental Sustainability Analysis Map

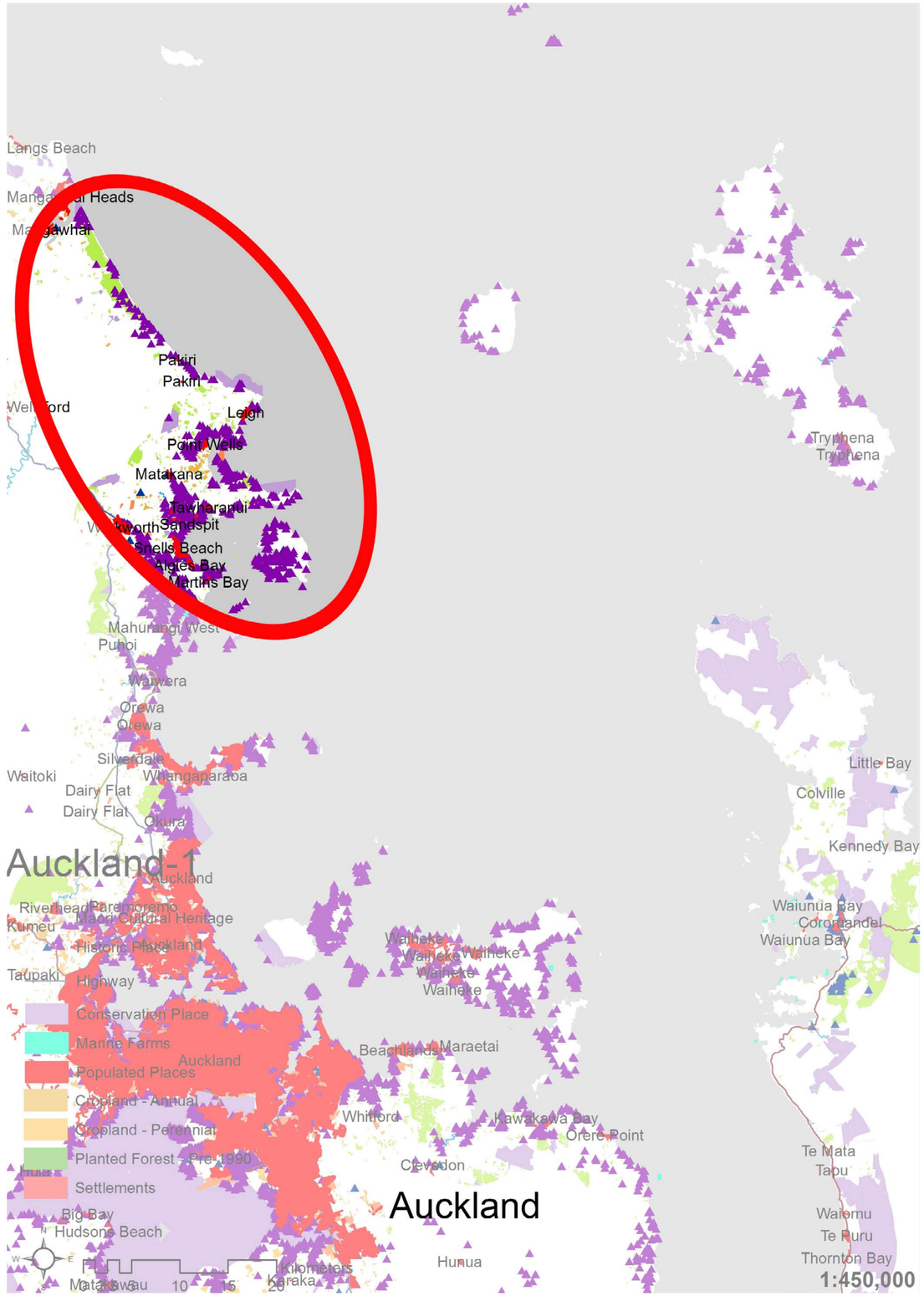
Appendix (Regional Maps)



Environmental Sustainability Analysis Map

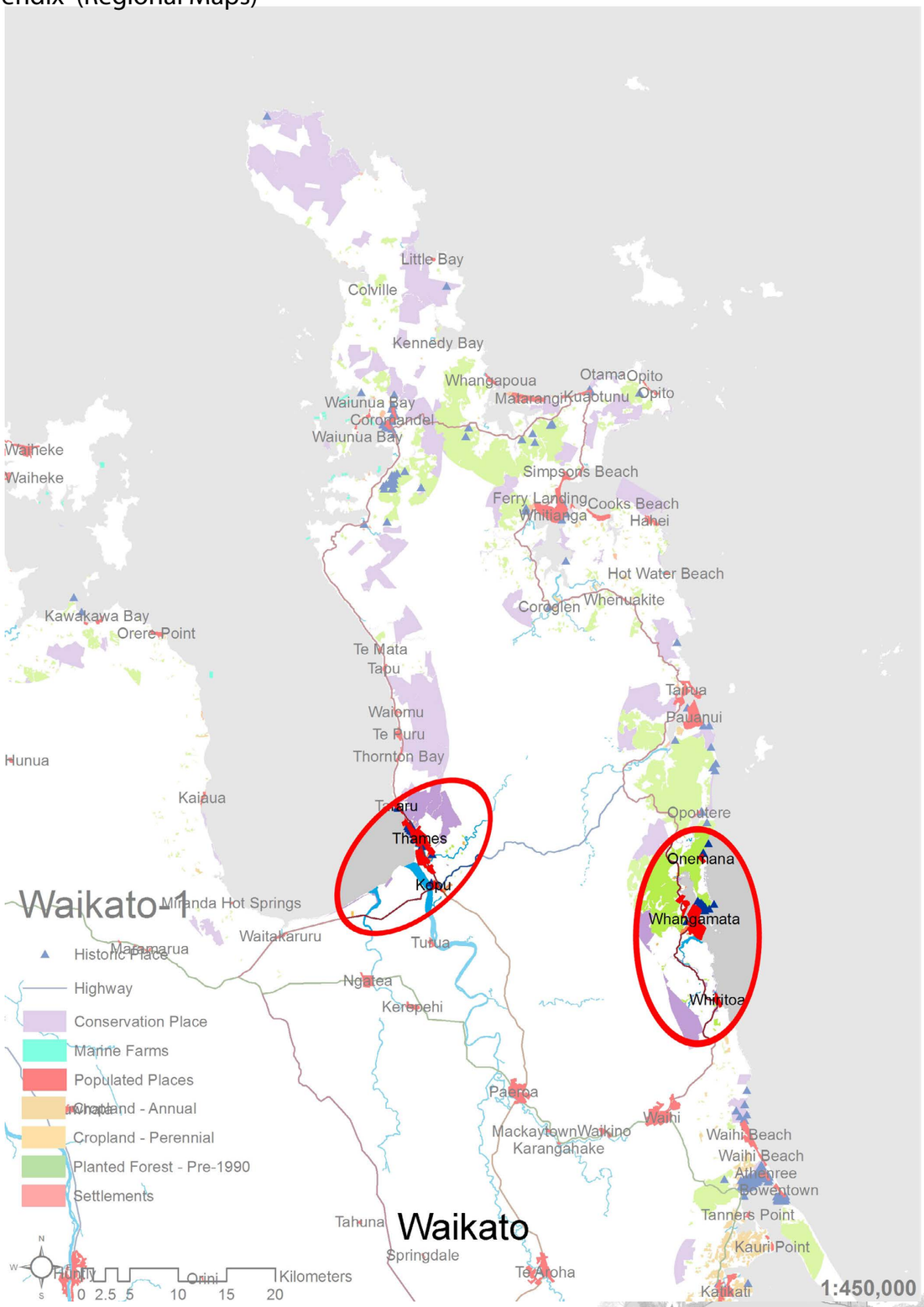
Appendix (Regional Maps)

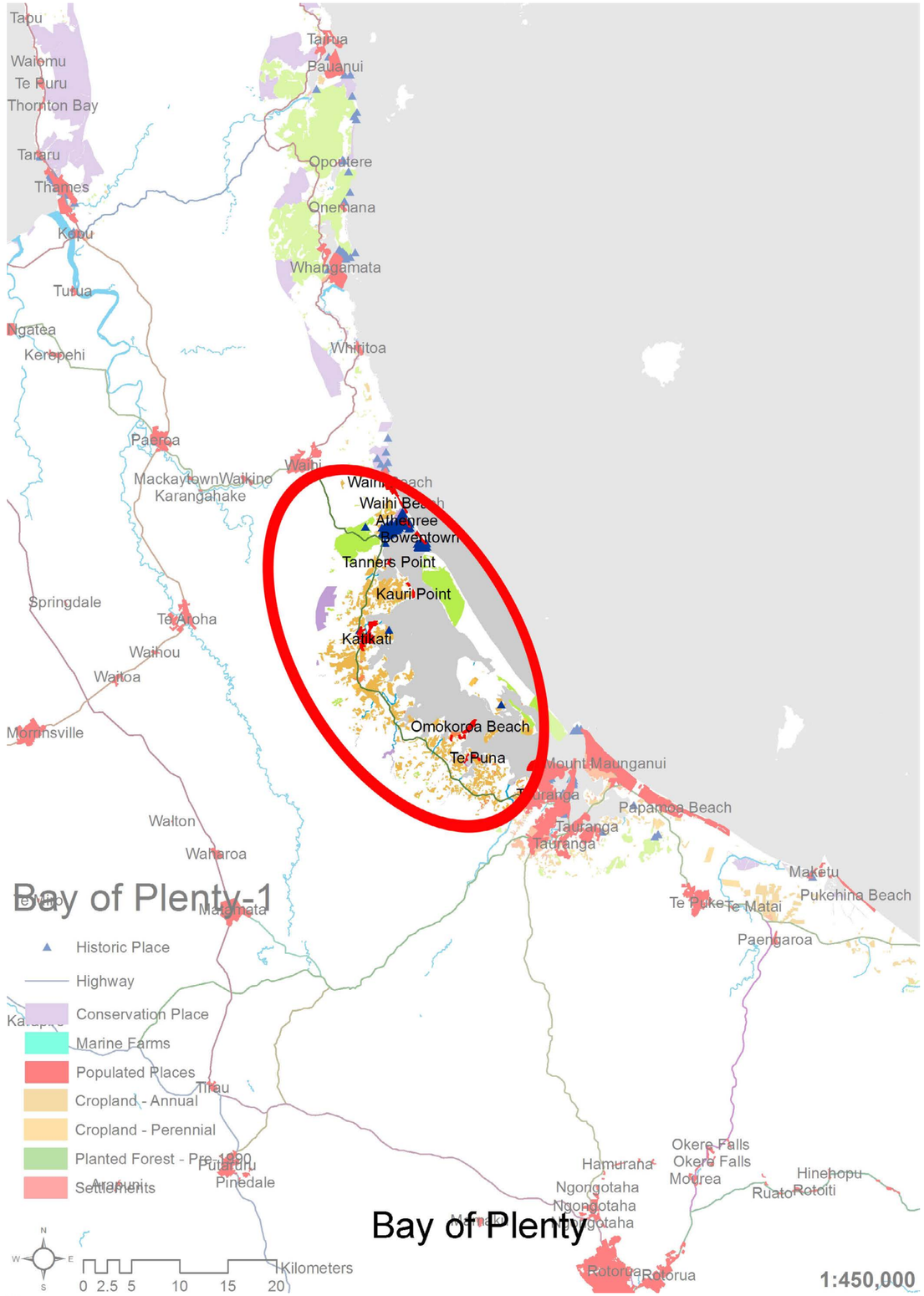




Social Sustainability Analysis Map

Appendix (Regional Maps)

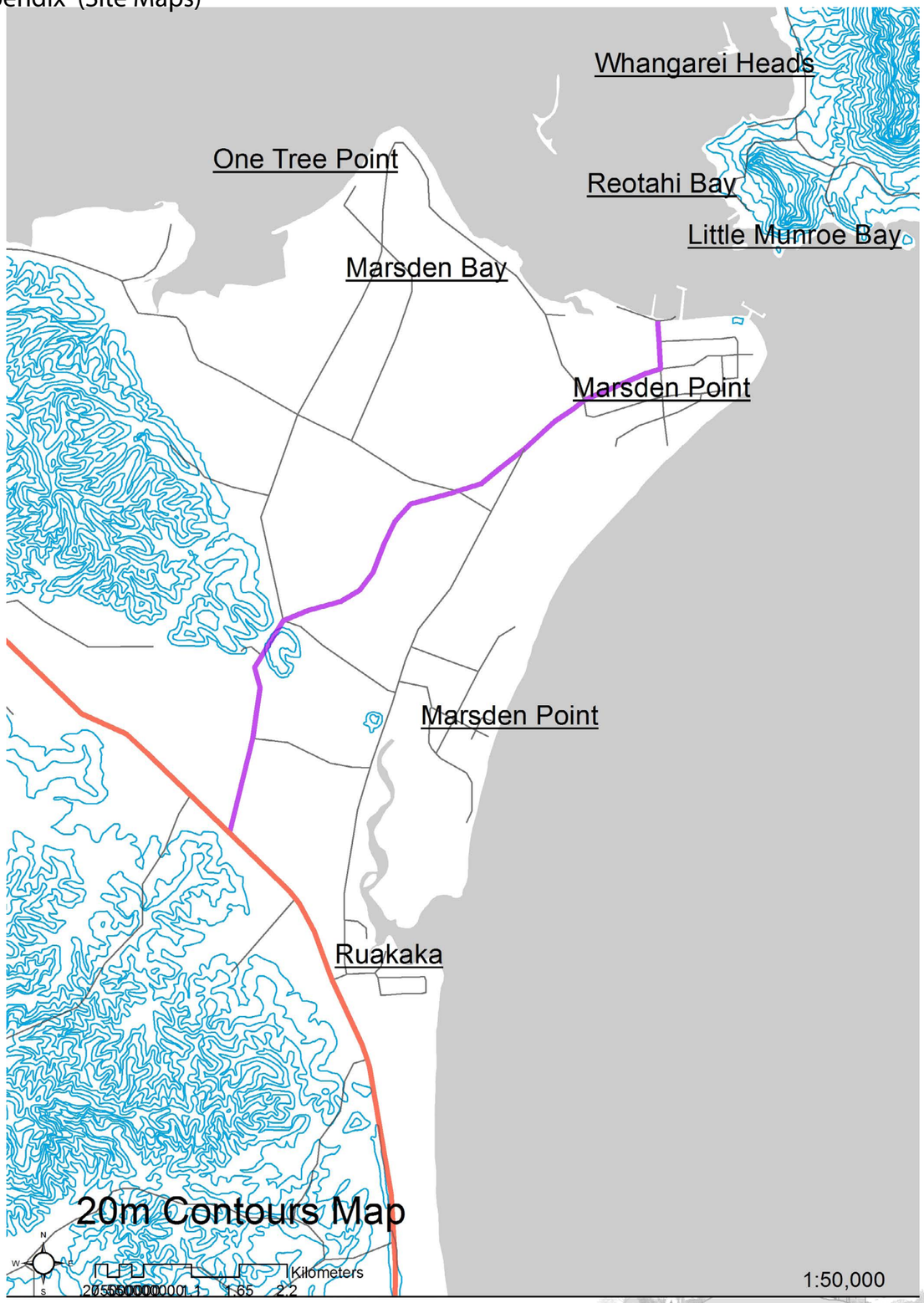


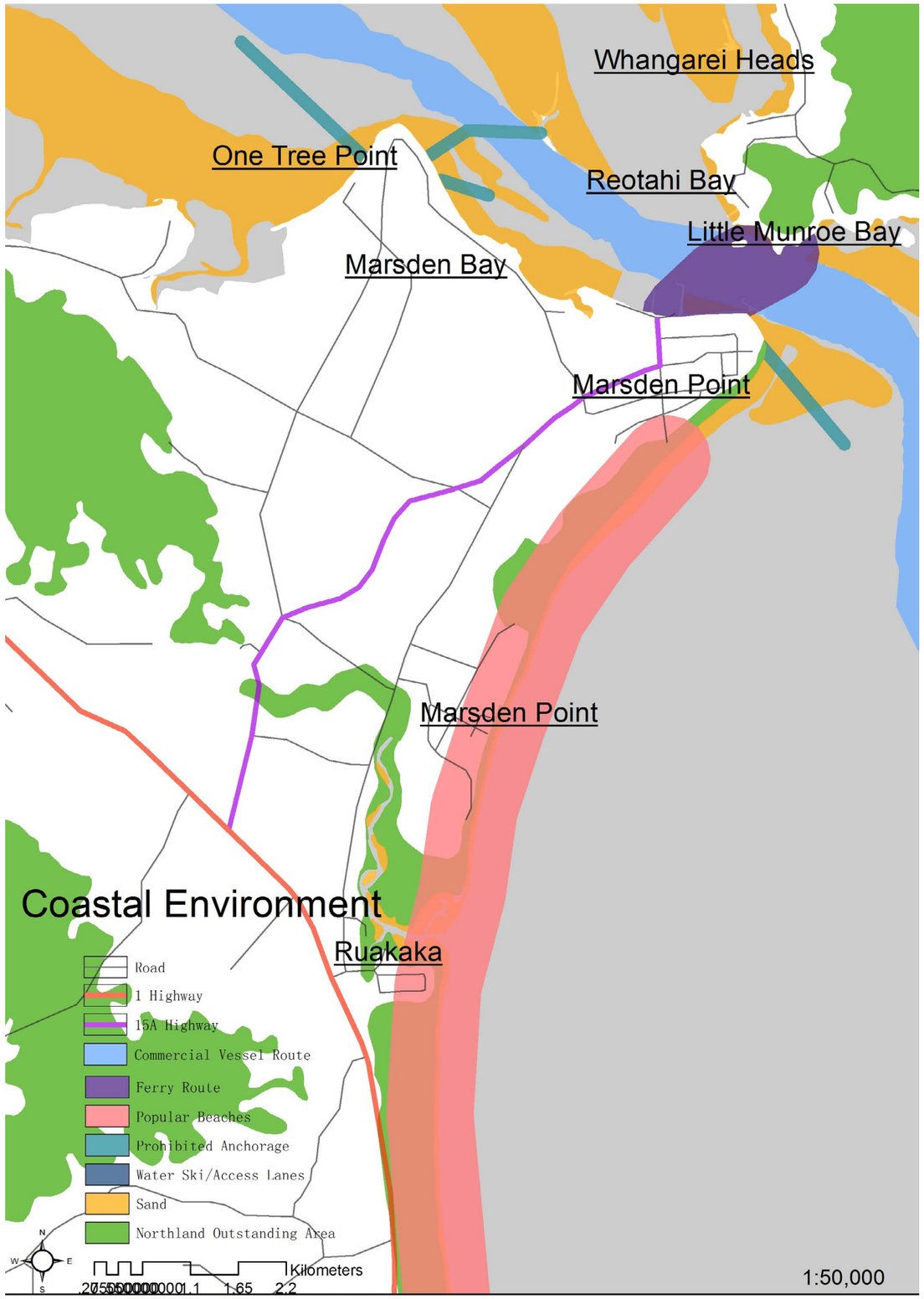


Social Sustainability Analysis Map

Ruakaka GIS Maps (1:50,000)

Appendix (Site Maps)





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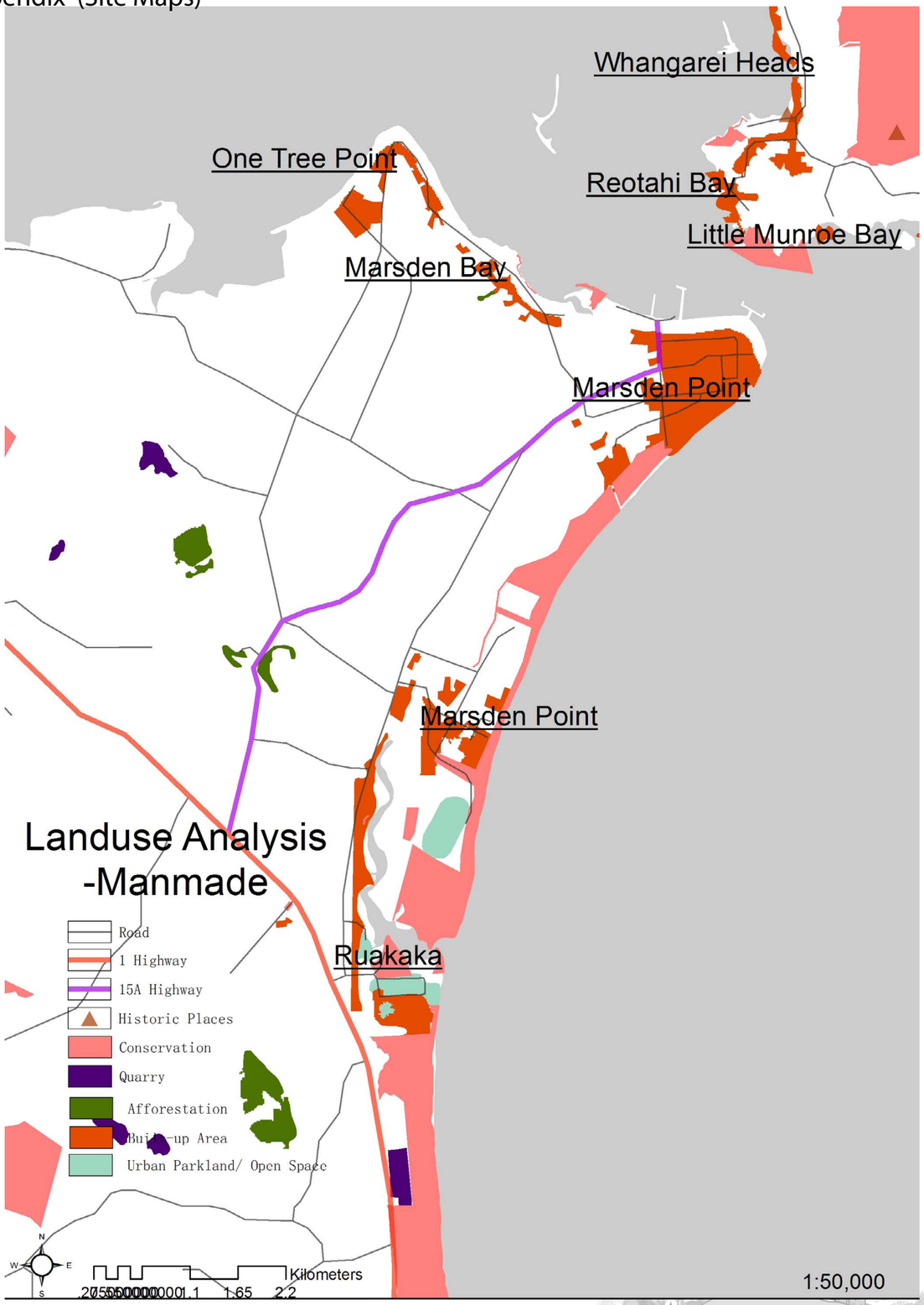

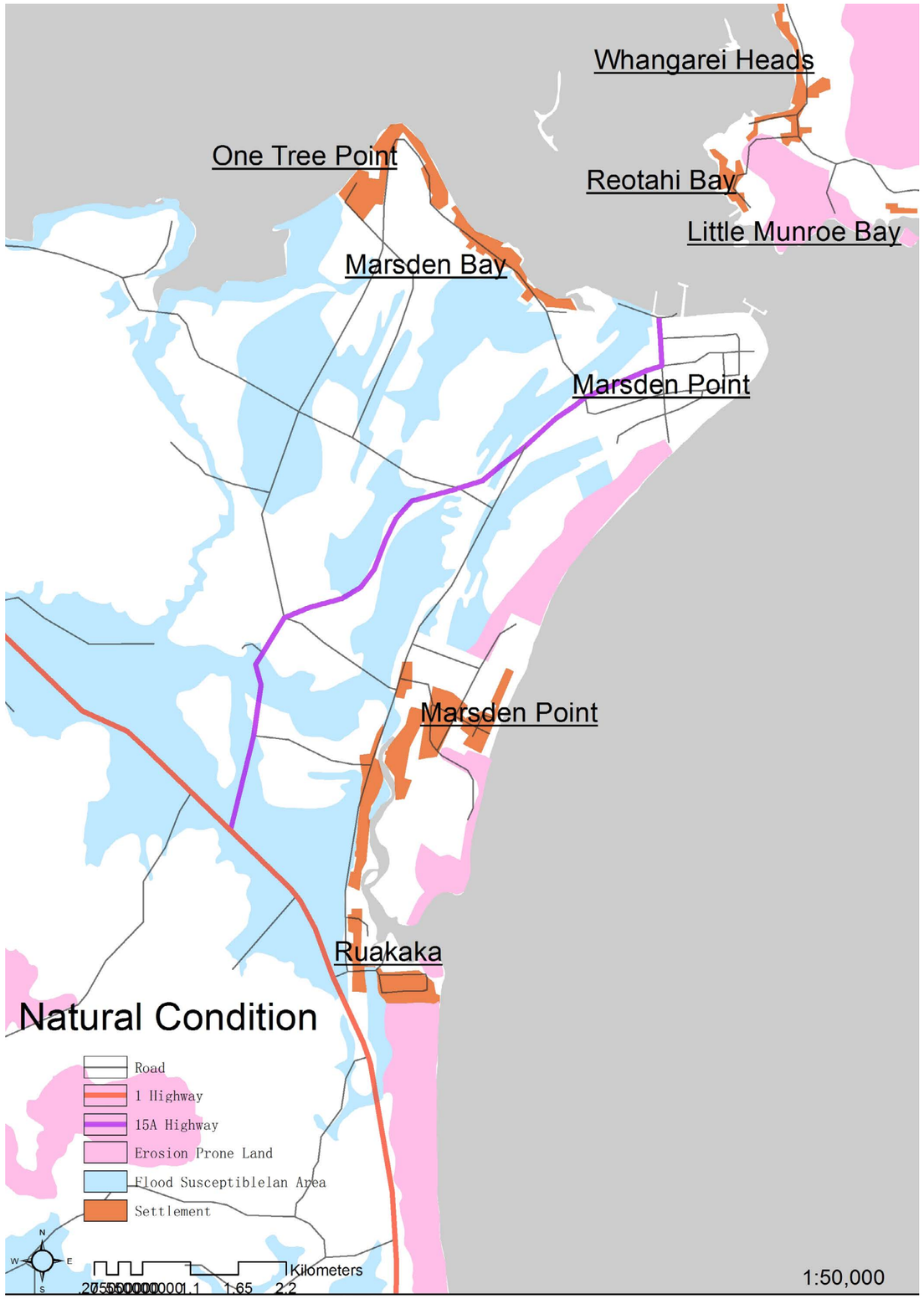

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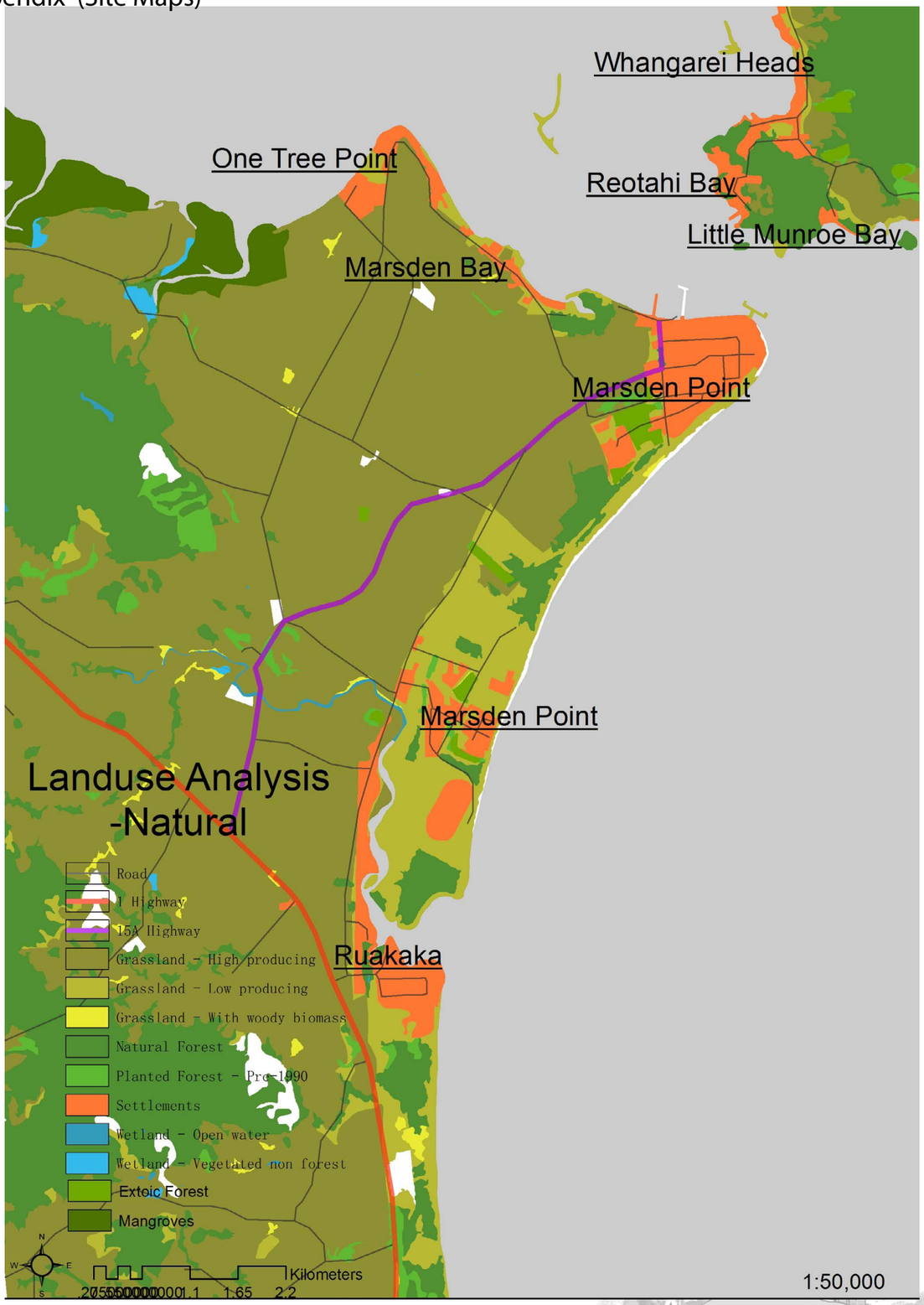
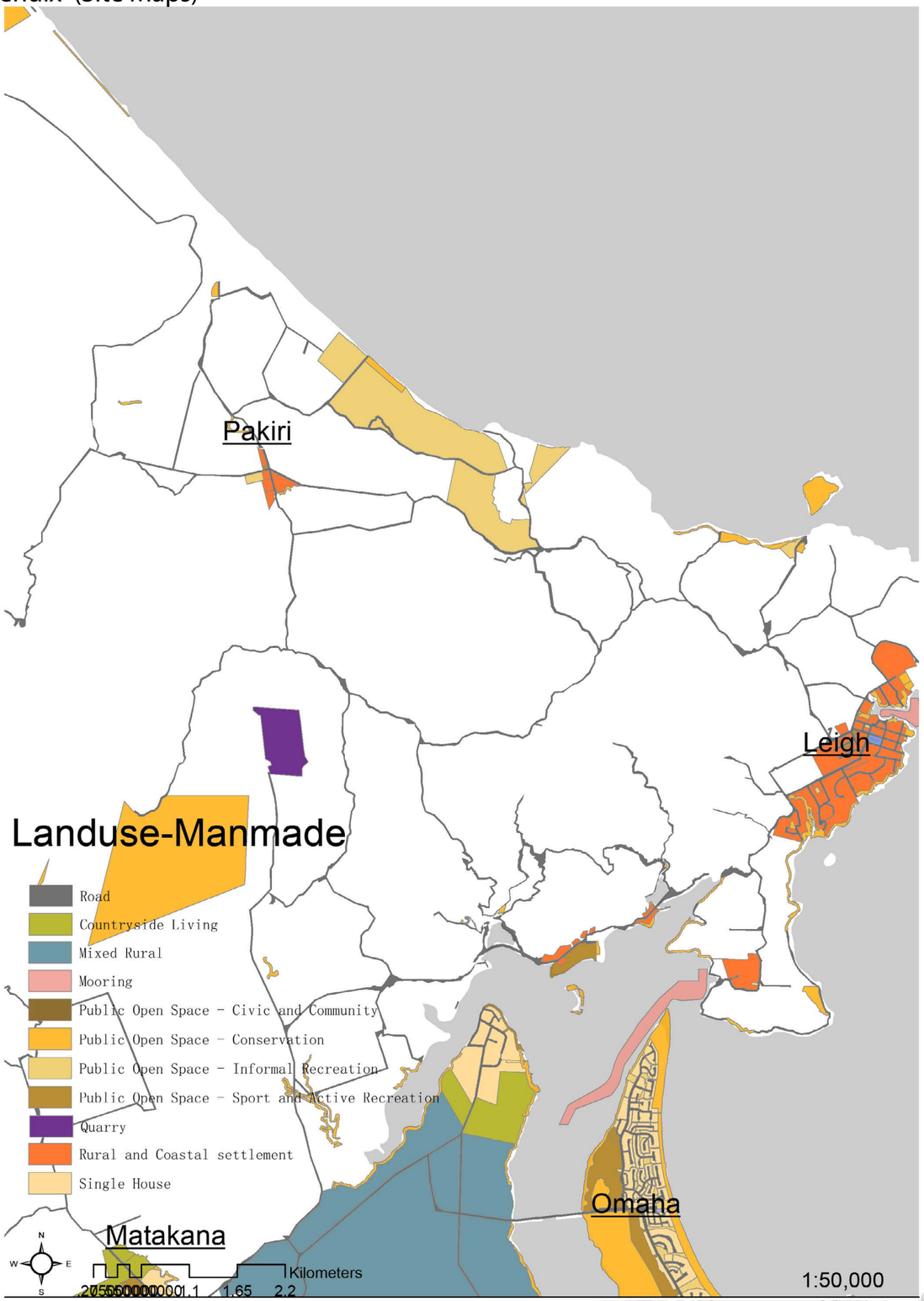
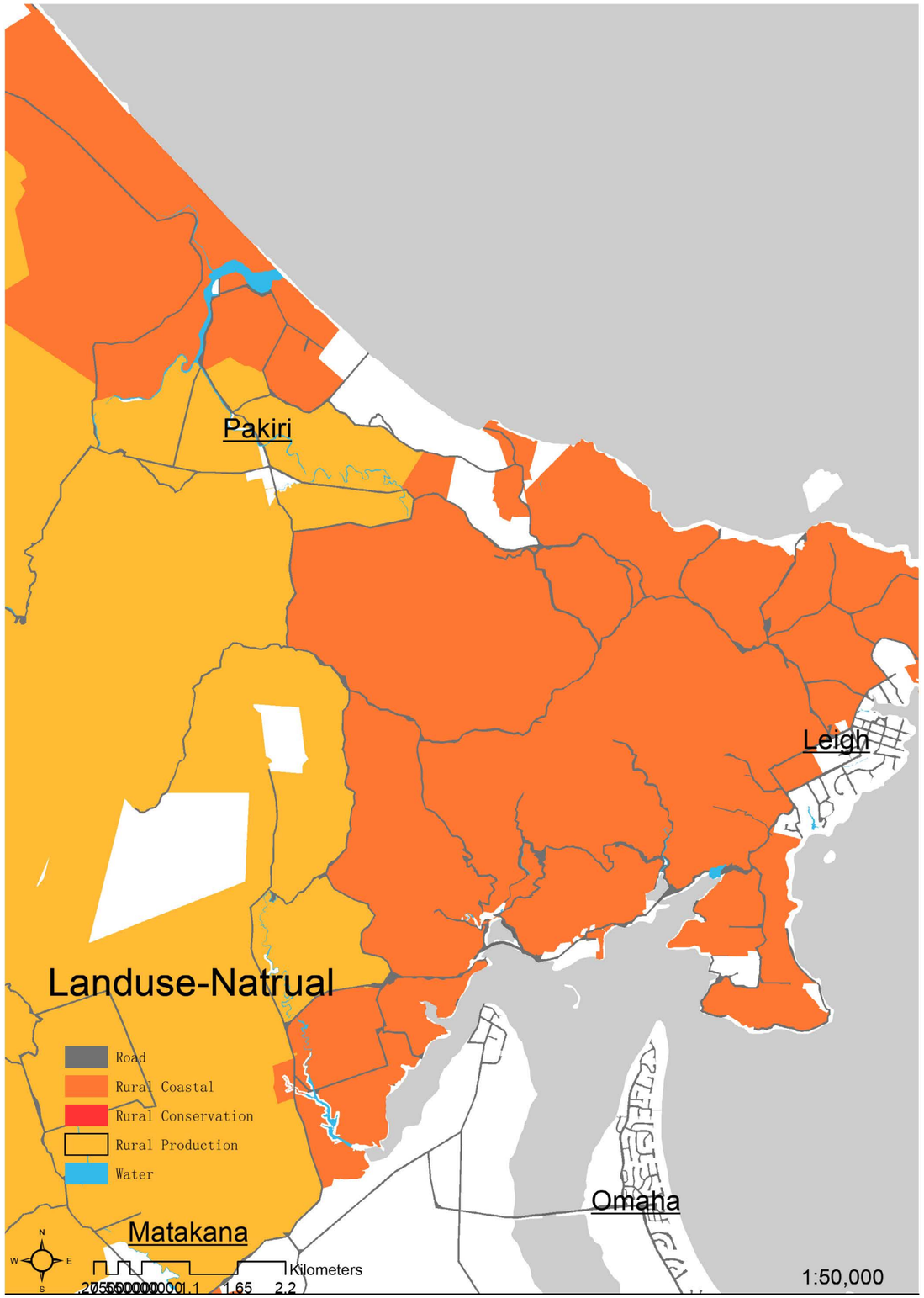


Pakiri GIS Maps (1:50,000)

Appendix (Site Maps)





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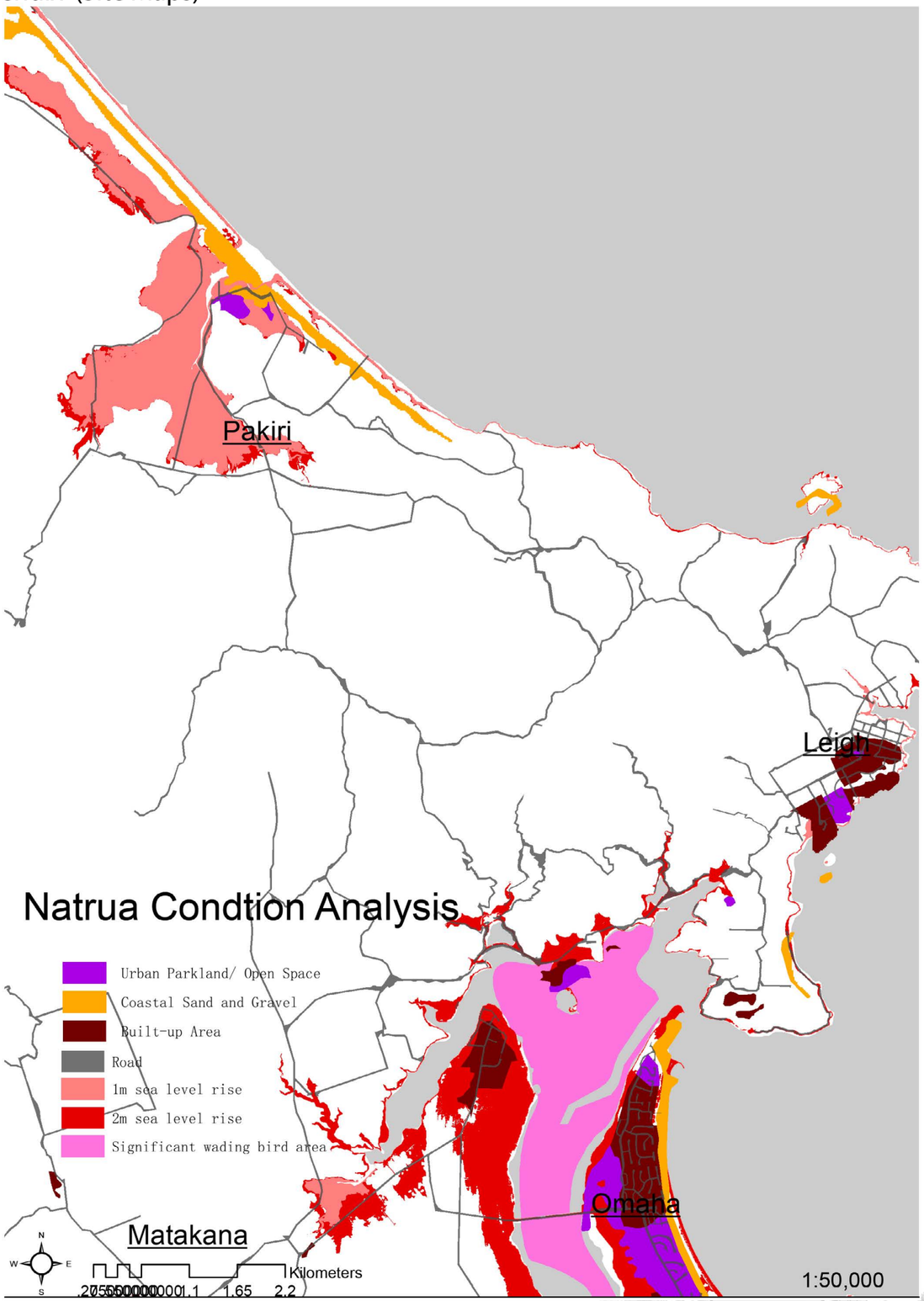

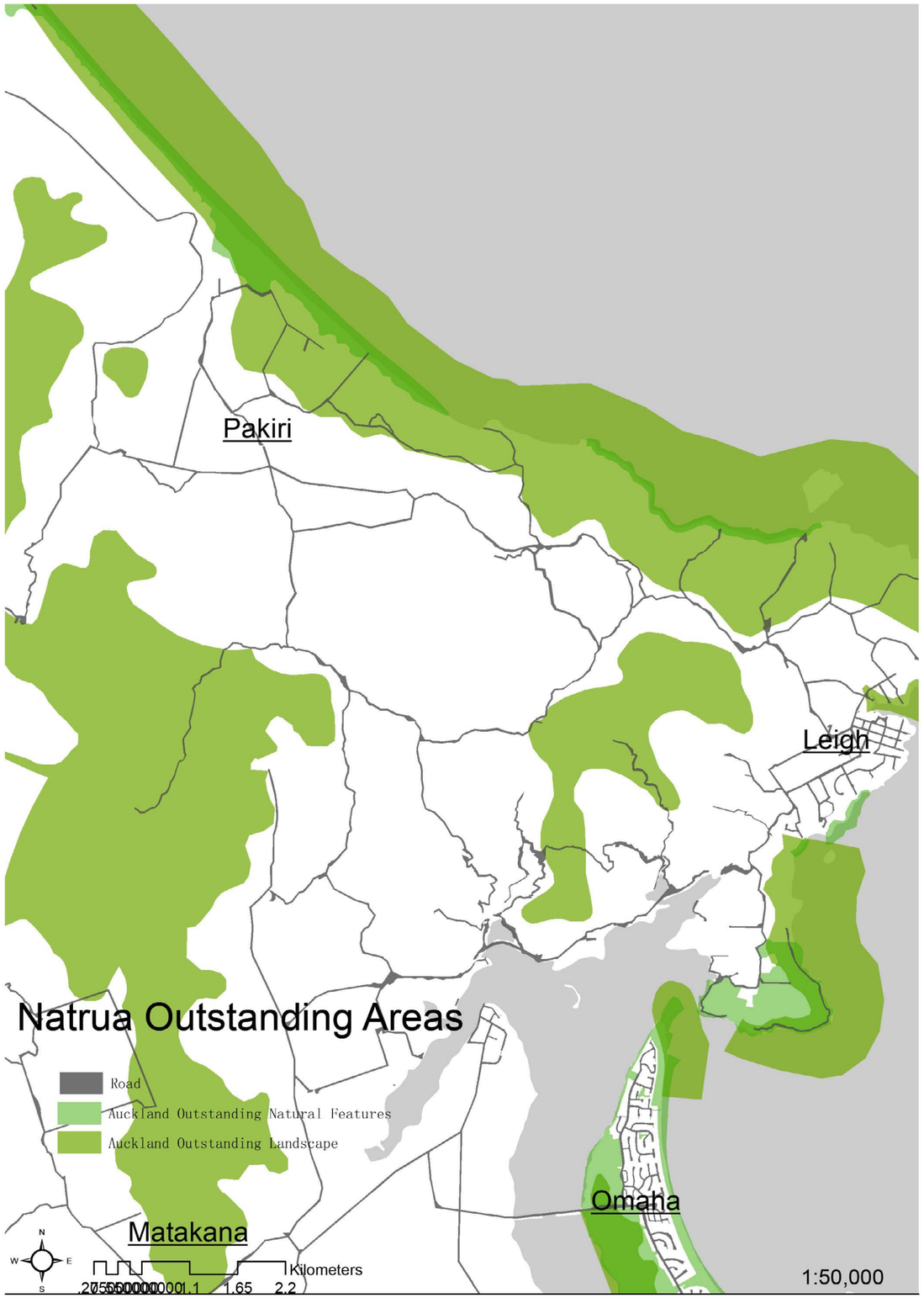

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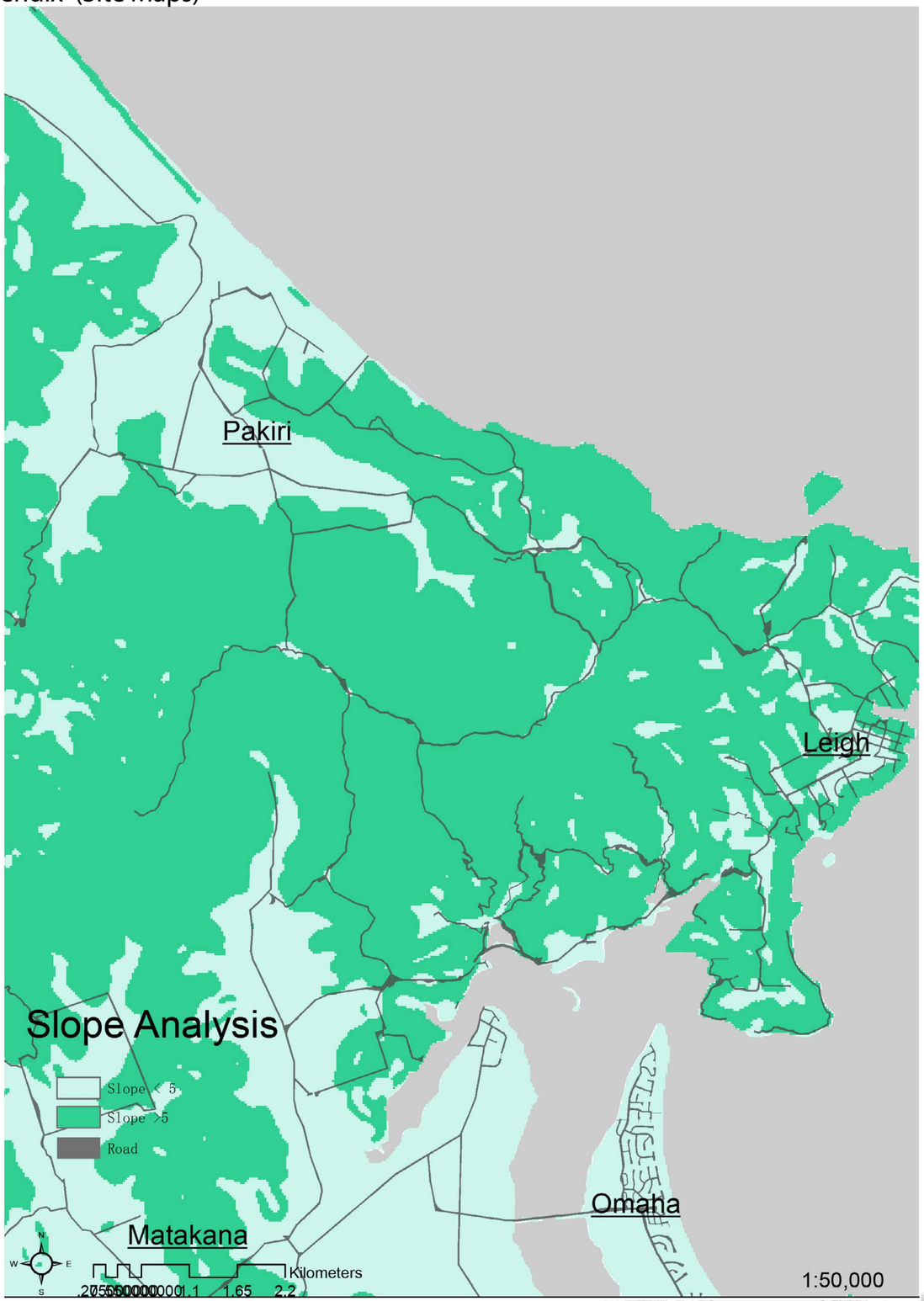

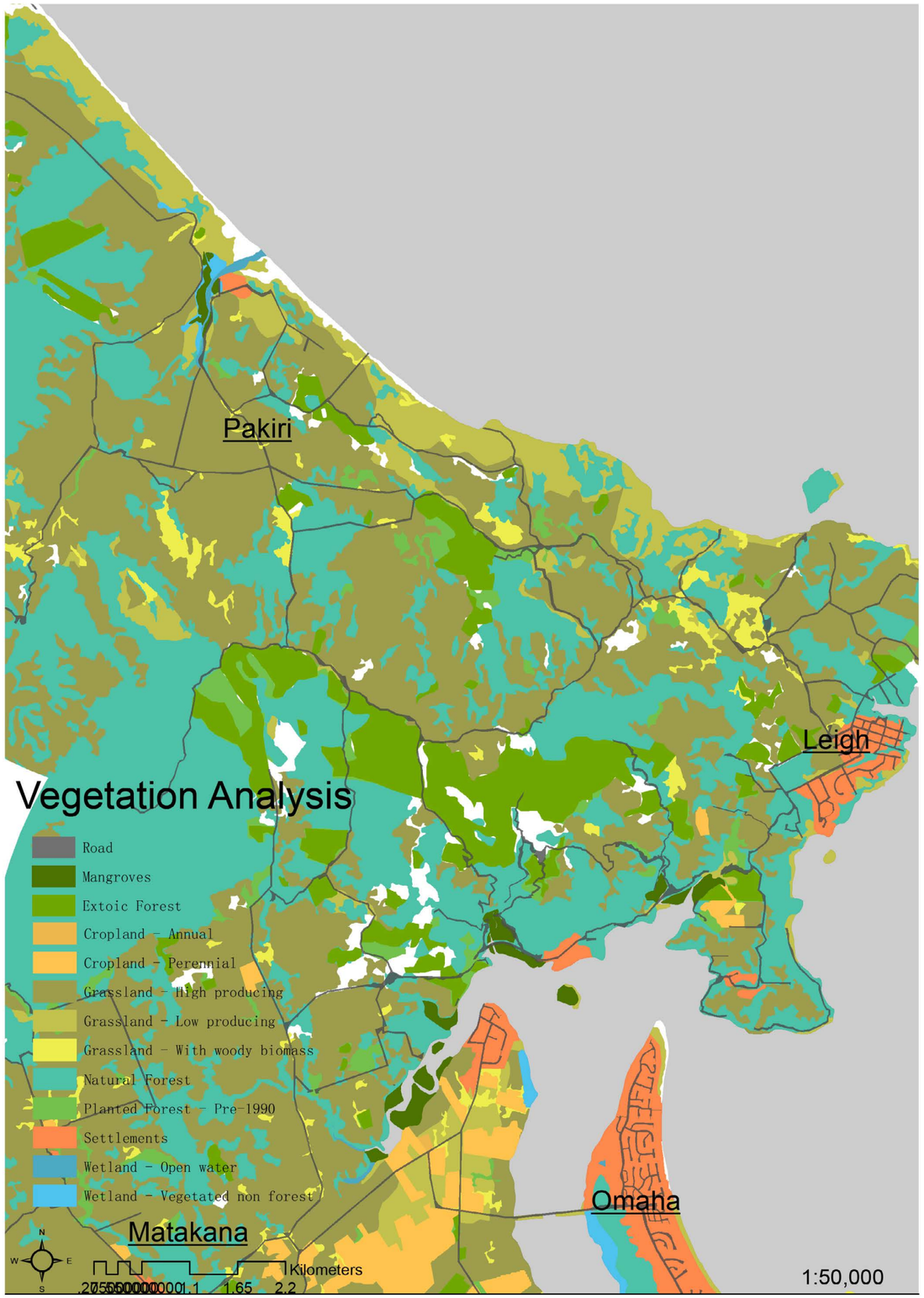

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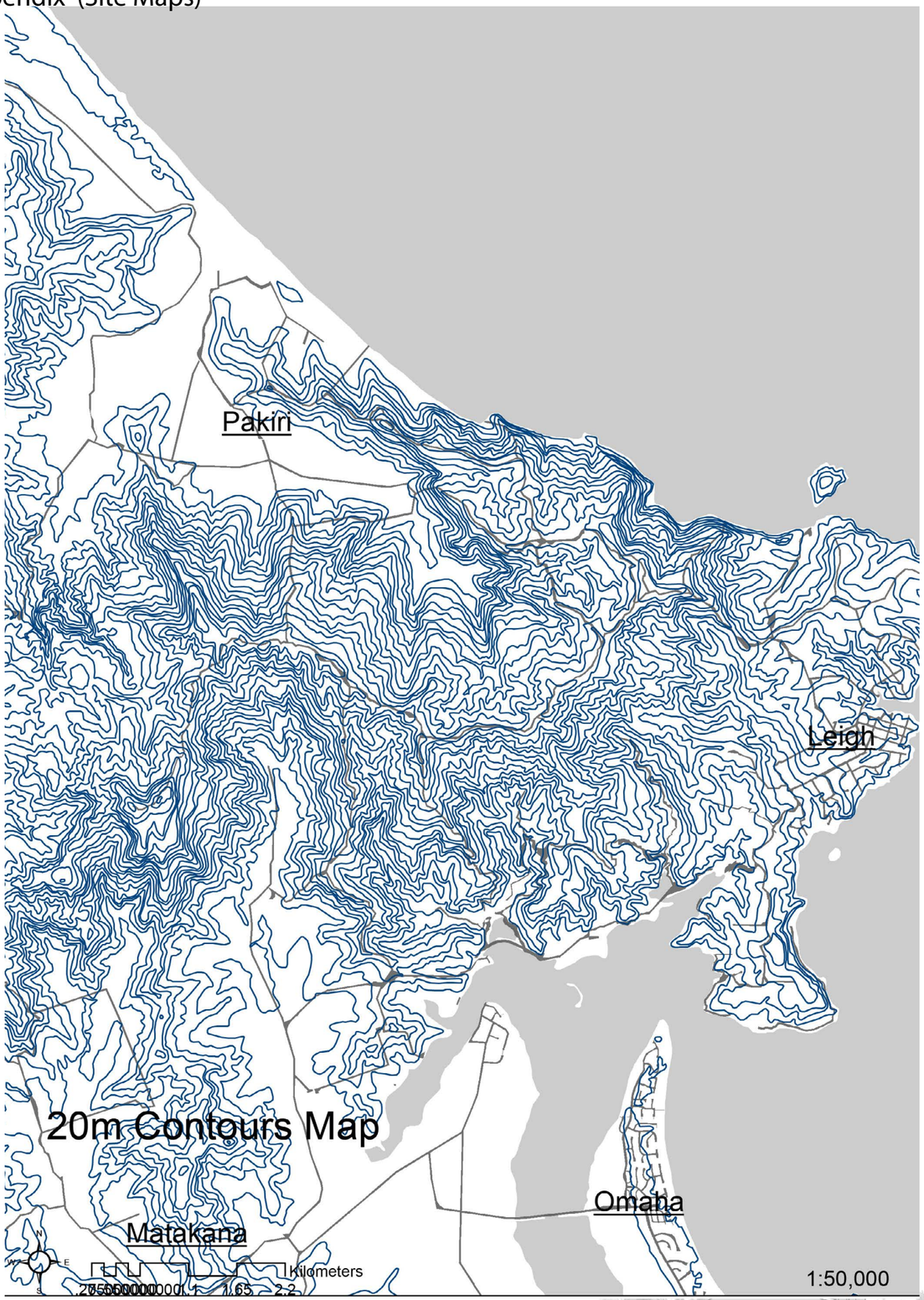

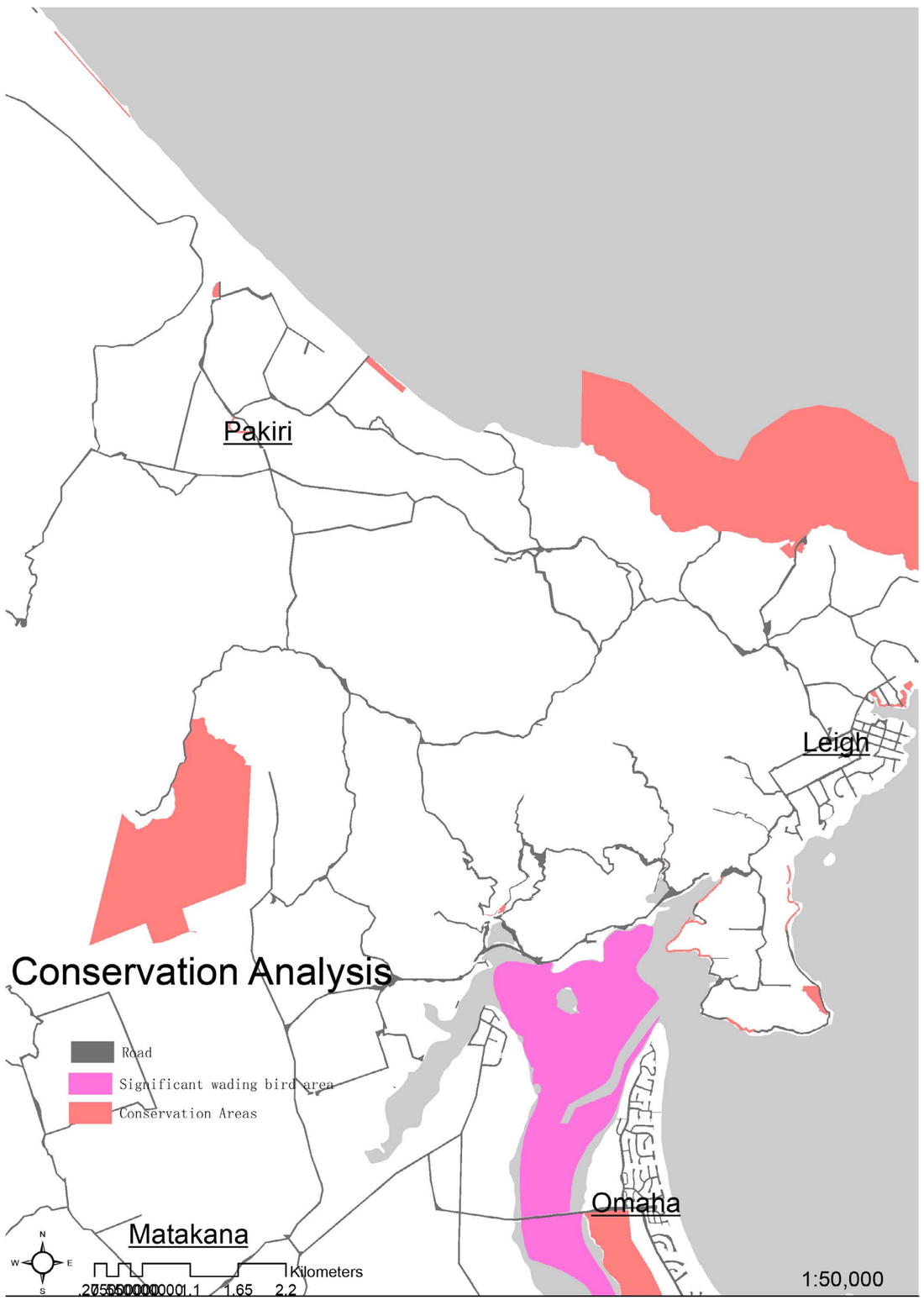

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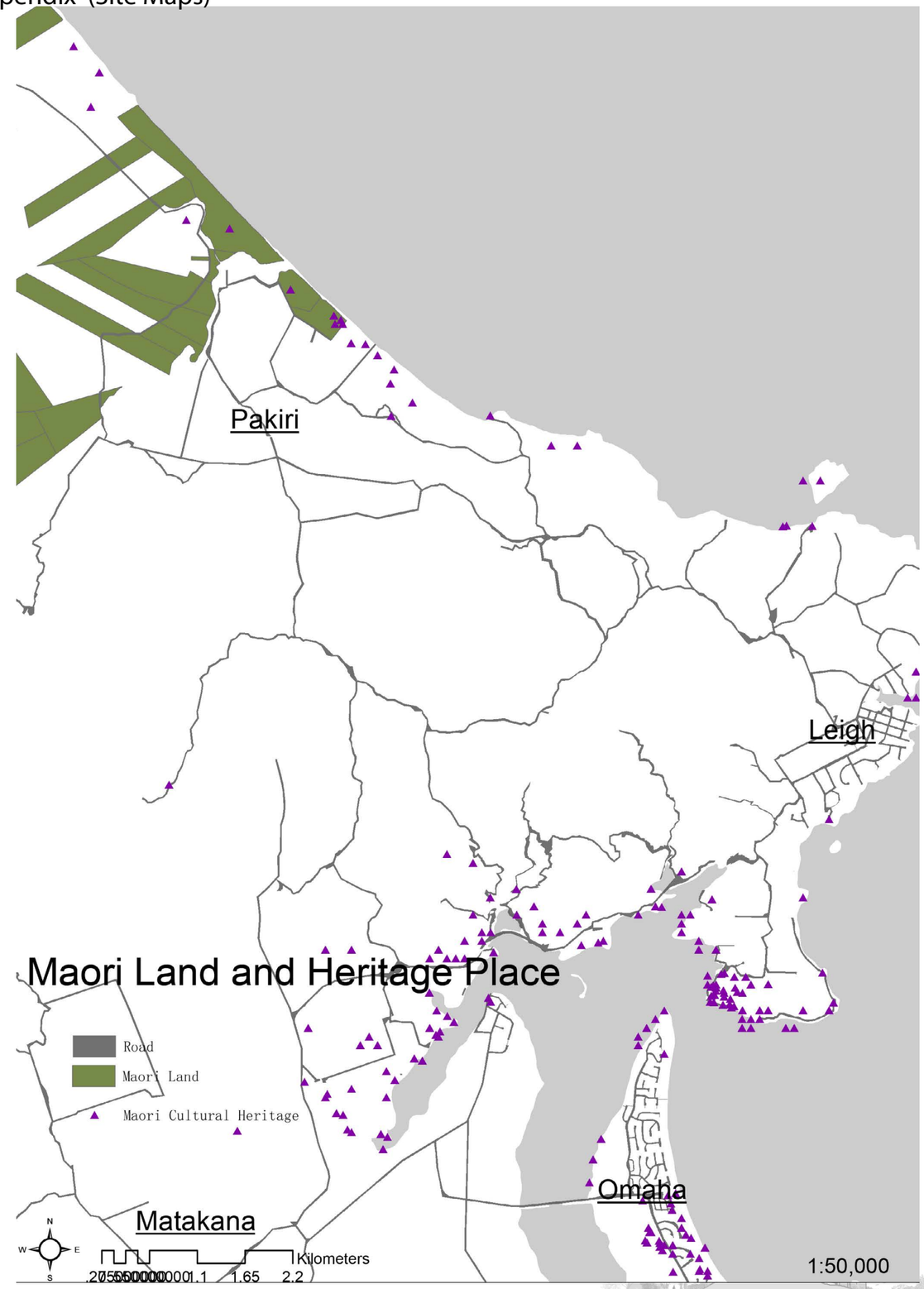
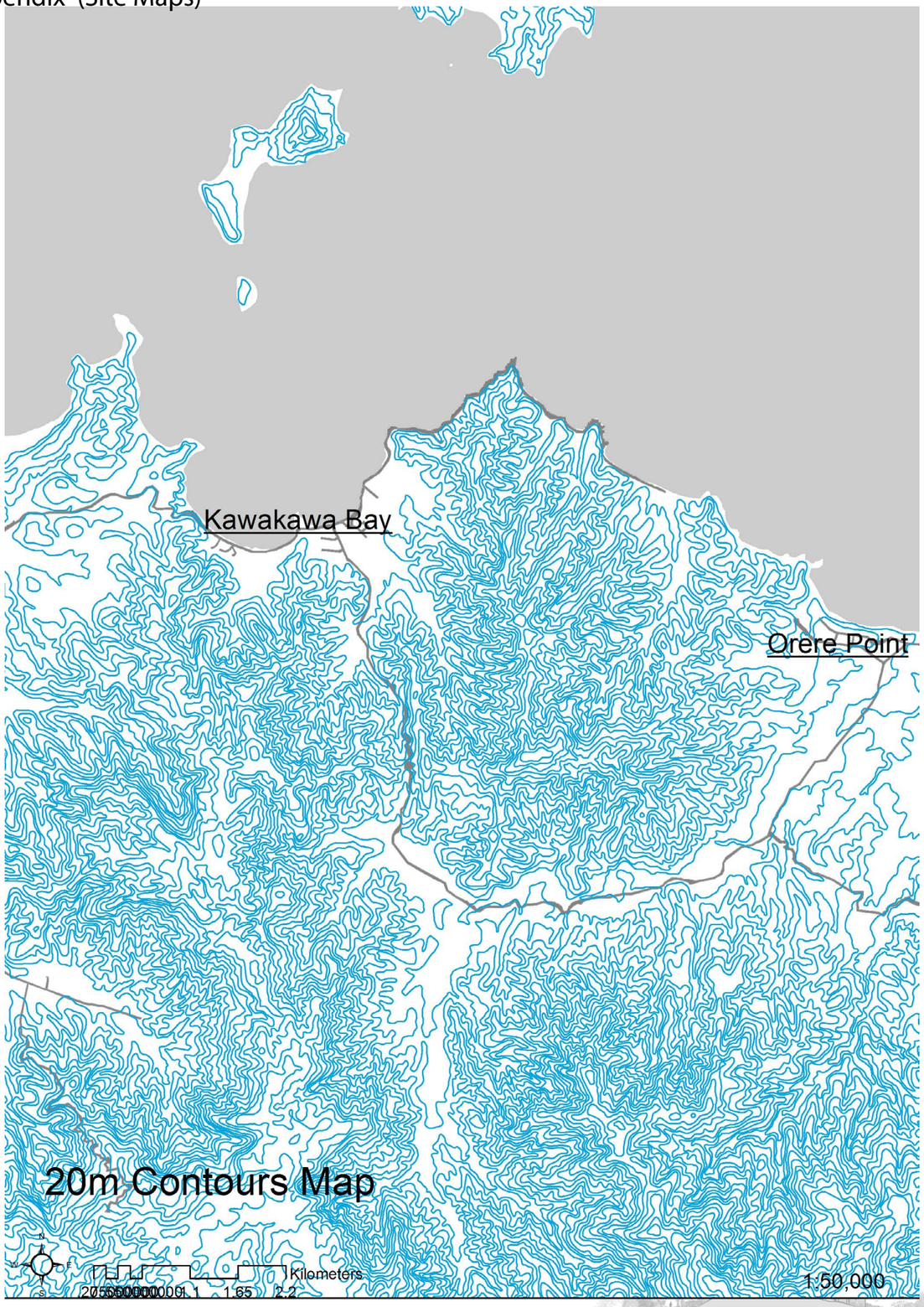
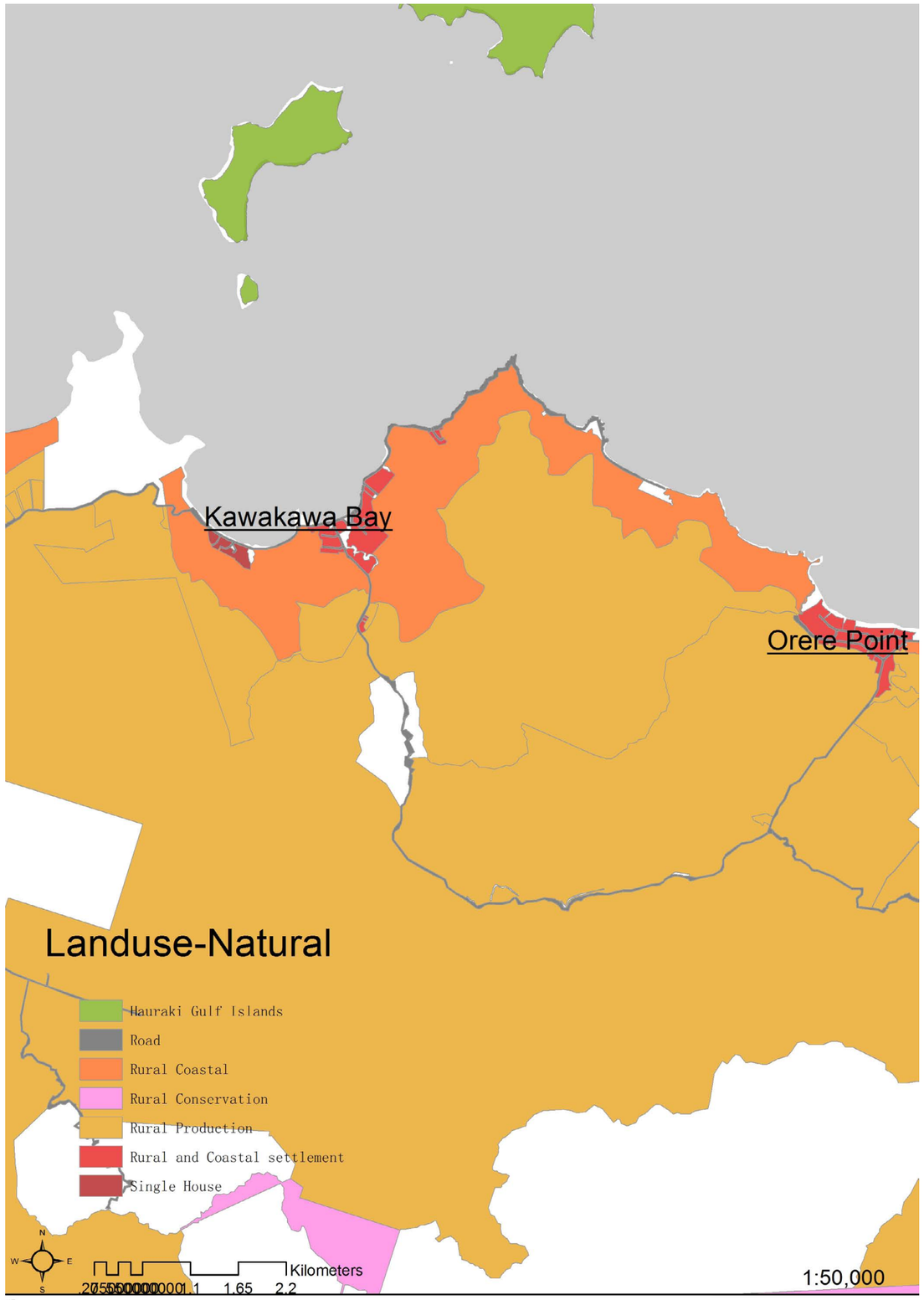


Kawakawa Bay GIS Maps (1:50,000)

Appendix (Site Maps)





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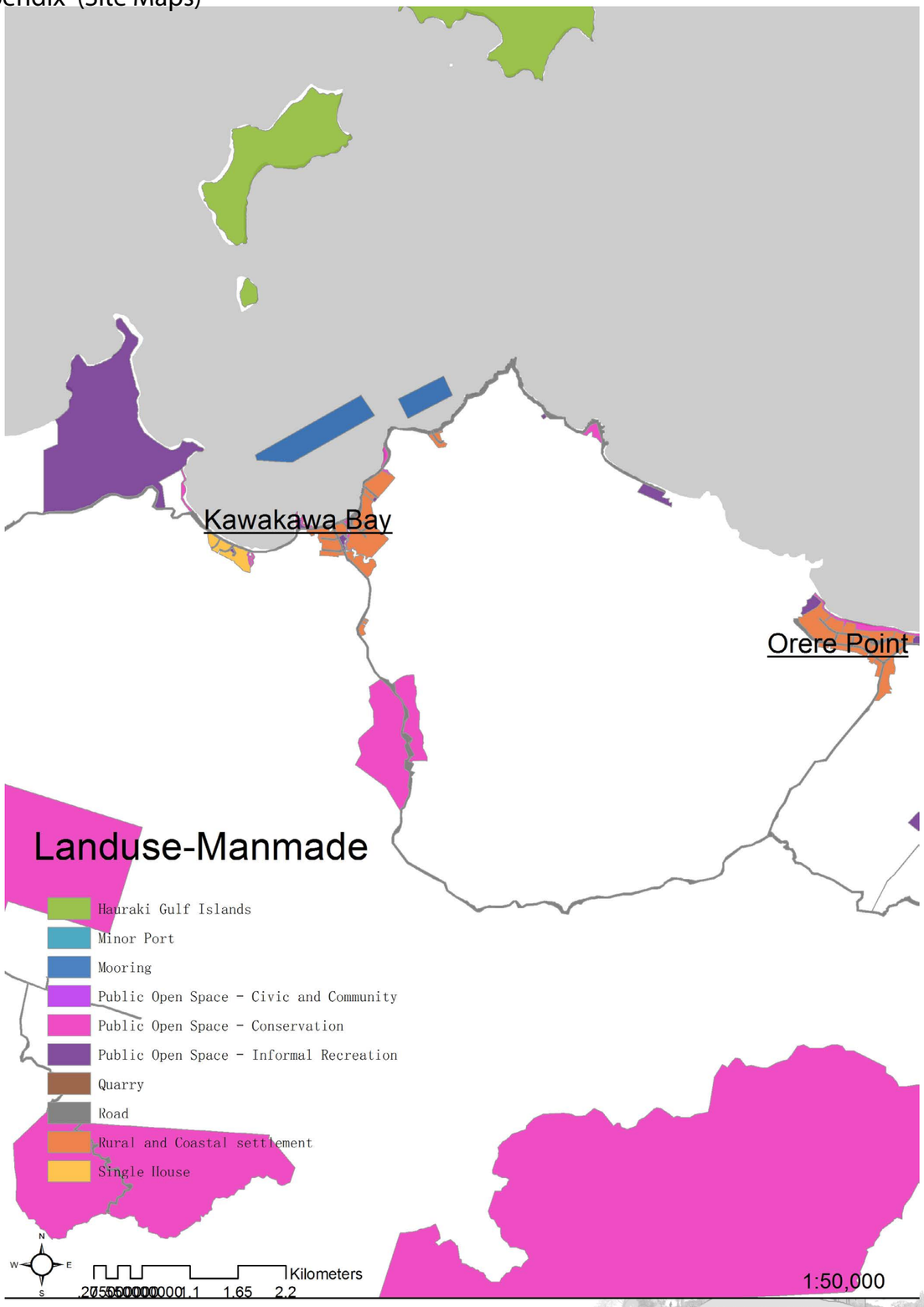

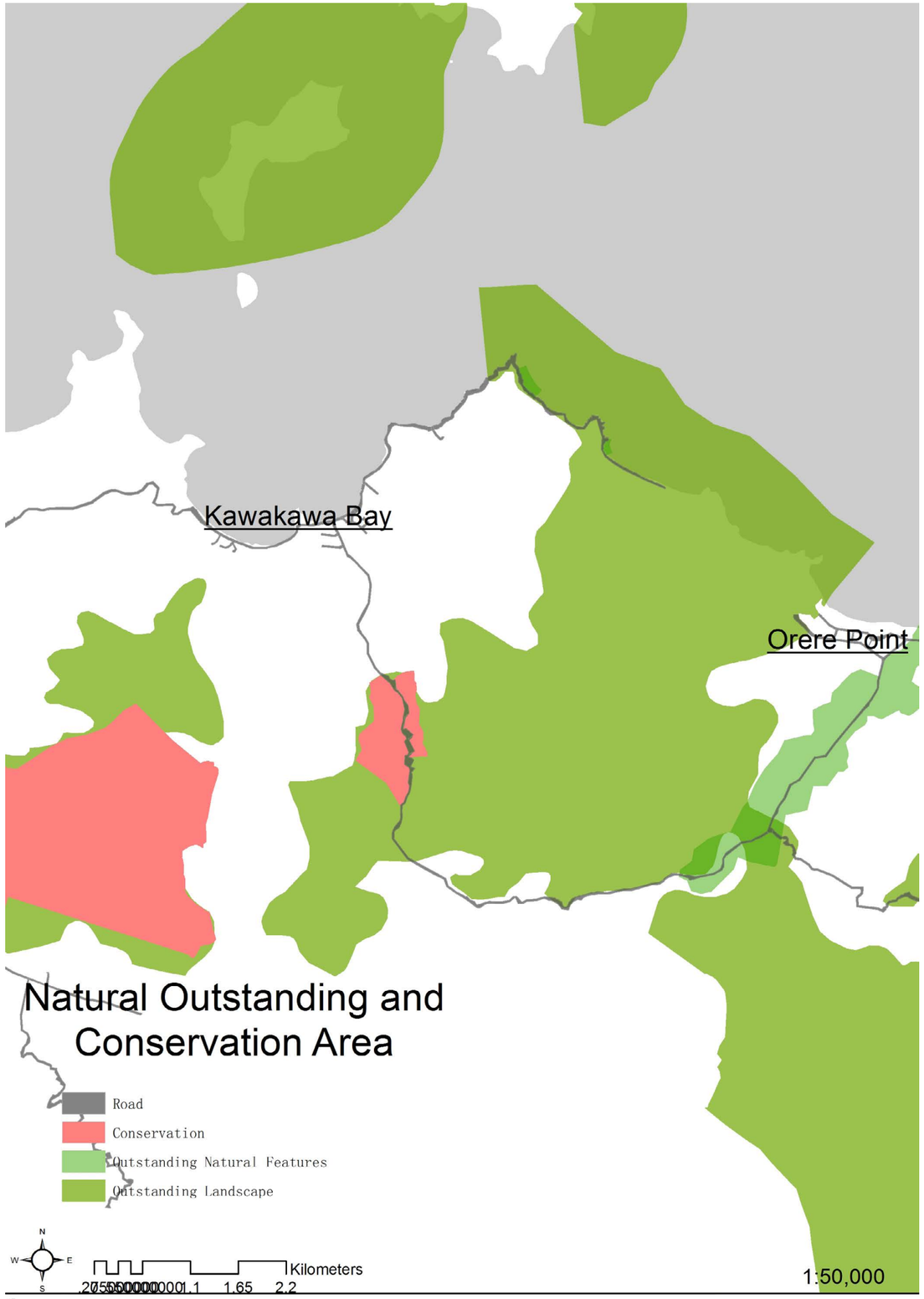

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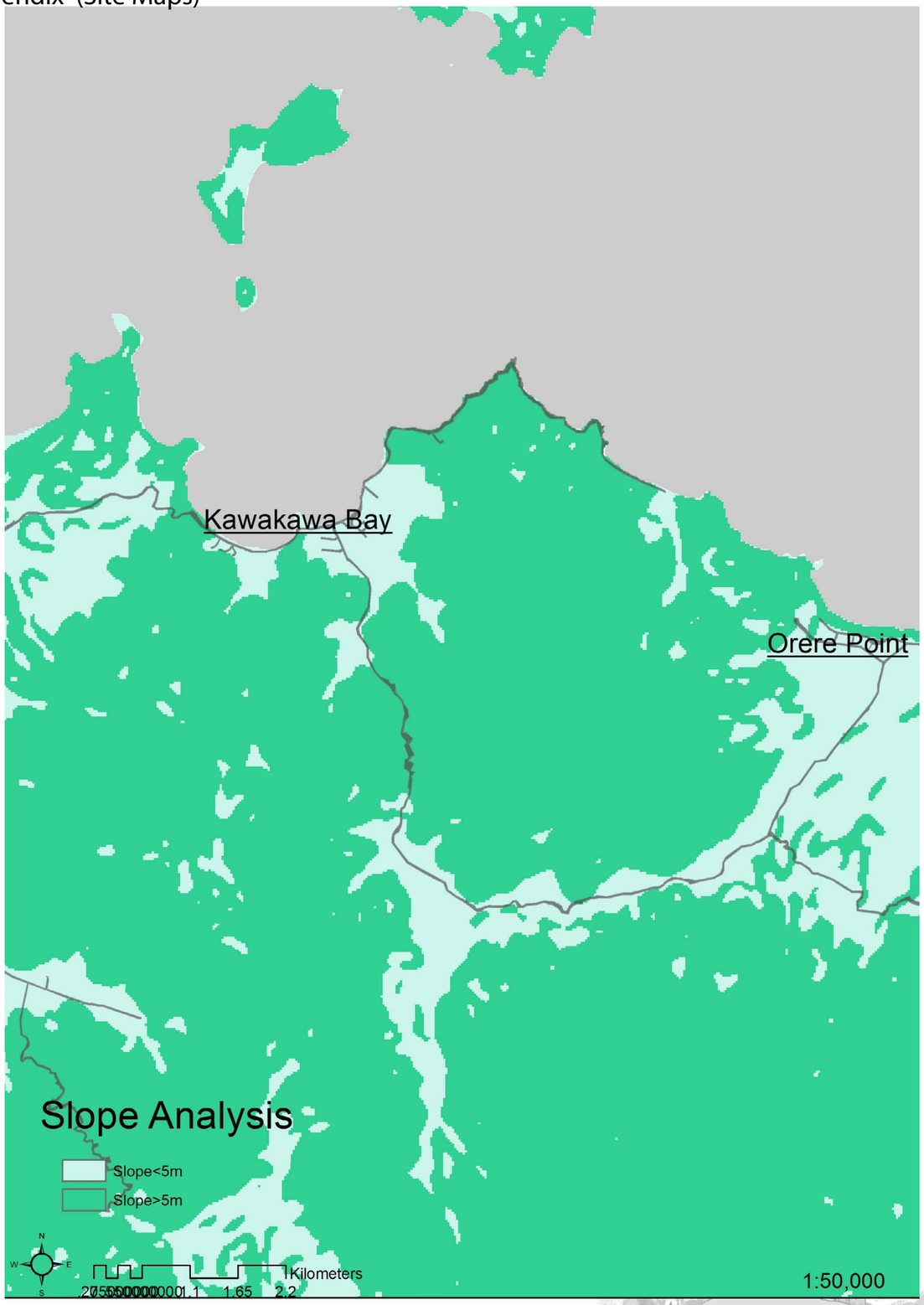

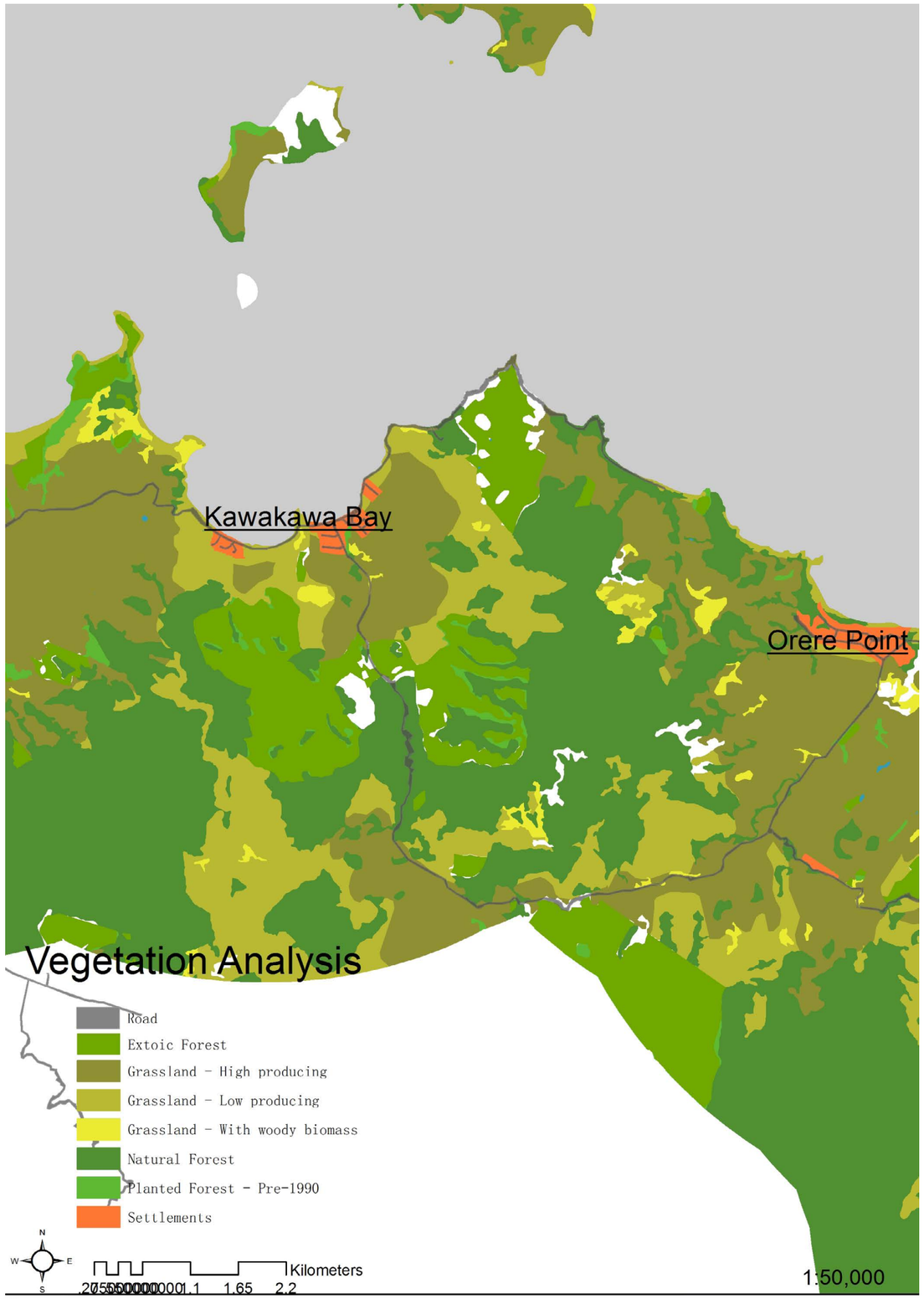

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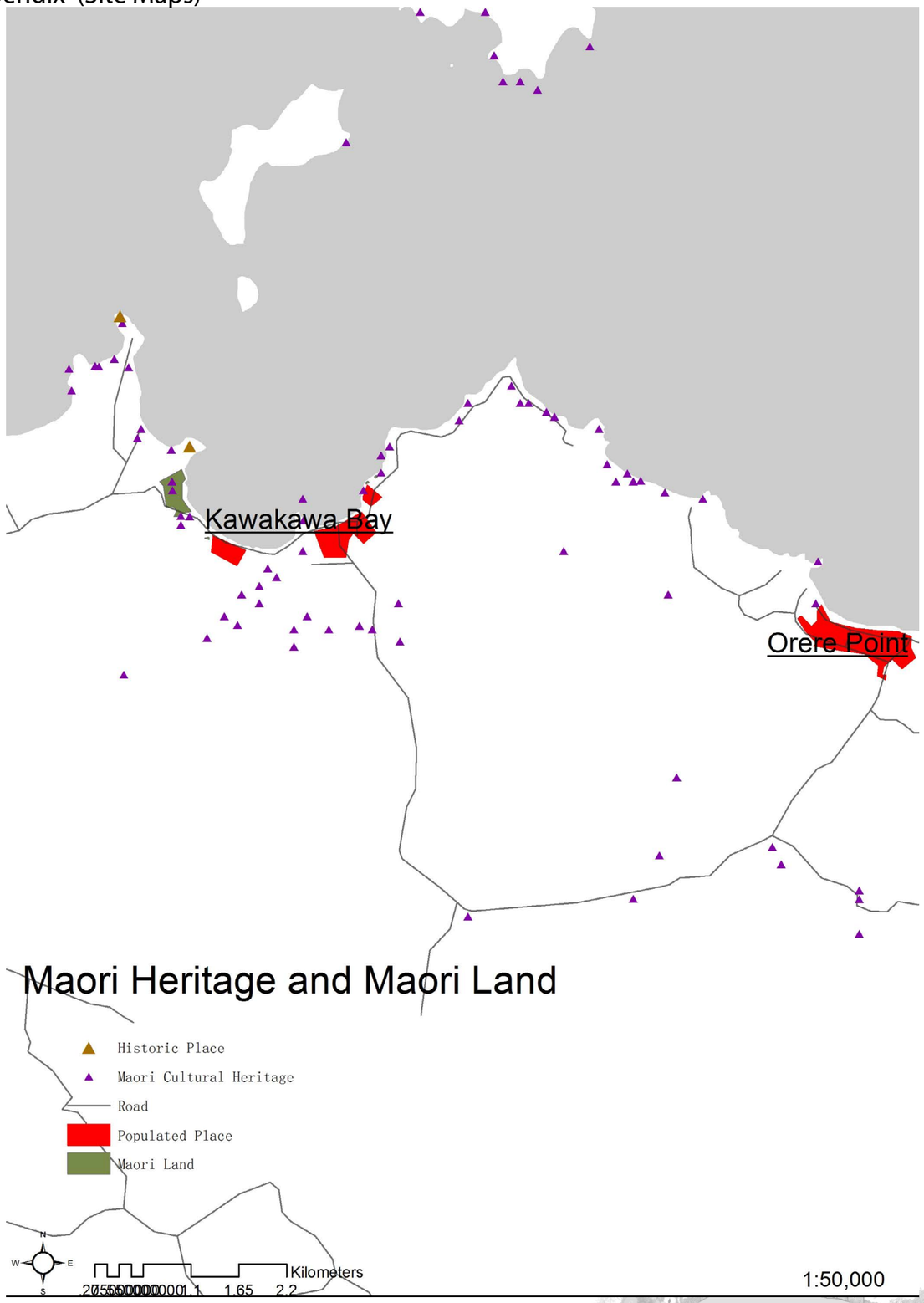


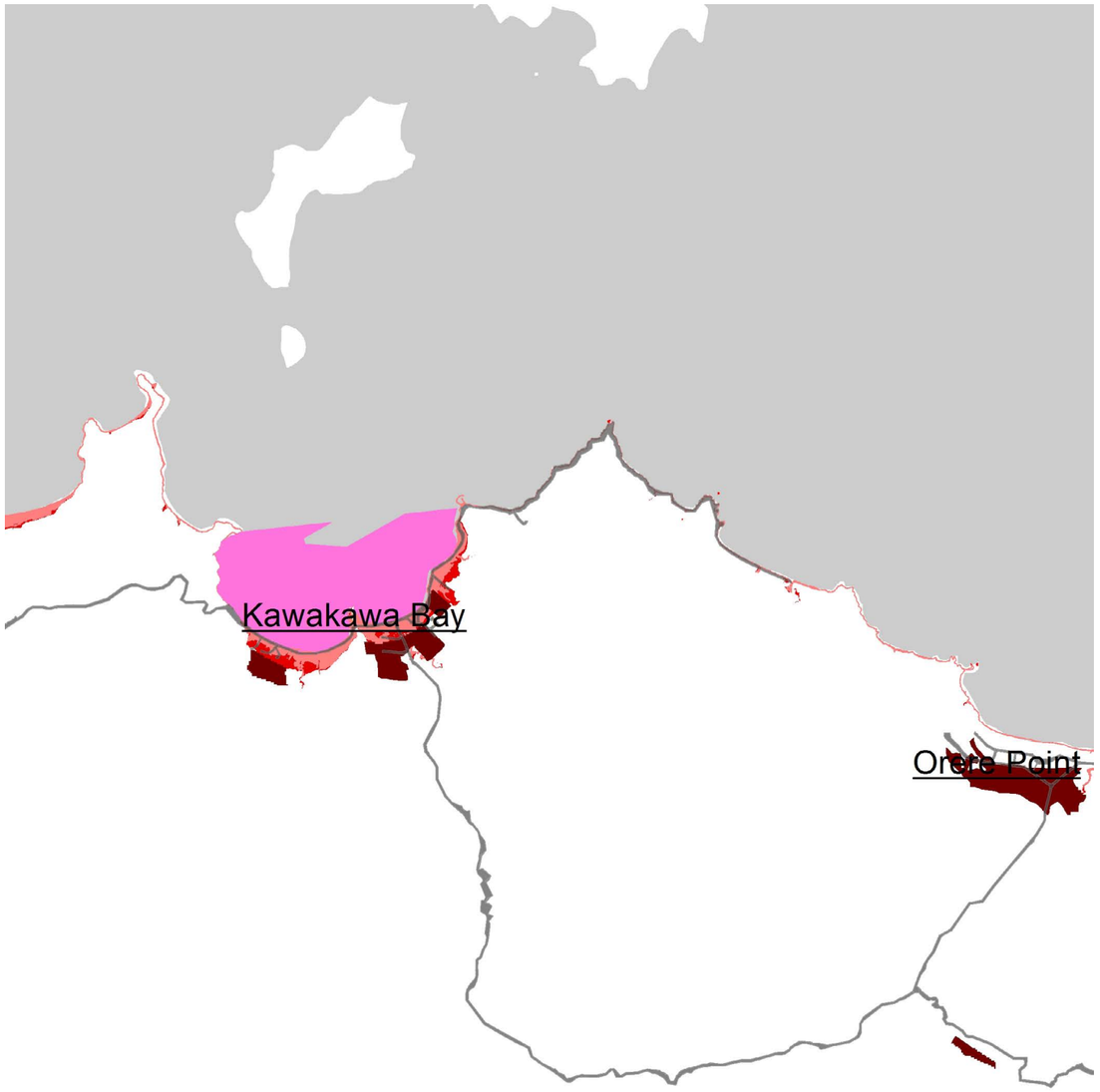
Maori Heritage and Maori Land

- Historic Place
- Maori Cultural Heritage
- Road
- Populated Place
- Maori Land

N W E S

0 0.275 0.55 1.1 1.65 2.2 Kilometers

1:50,000



Natural Condition Analysis

- Road
- Built-up Area
- Significant wading bird area
- 1m sea level rise
- 2m sea level rise

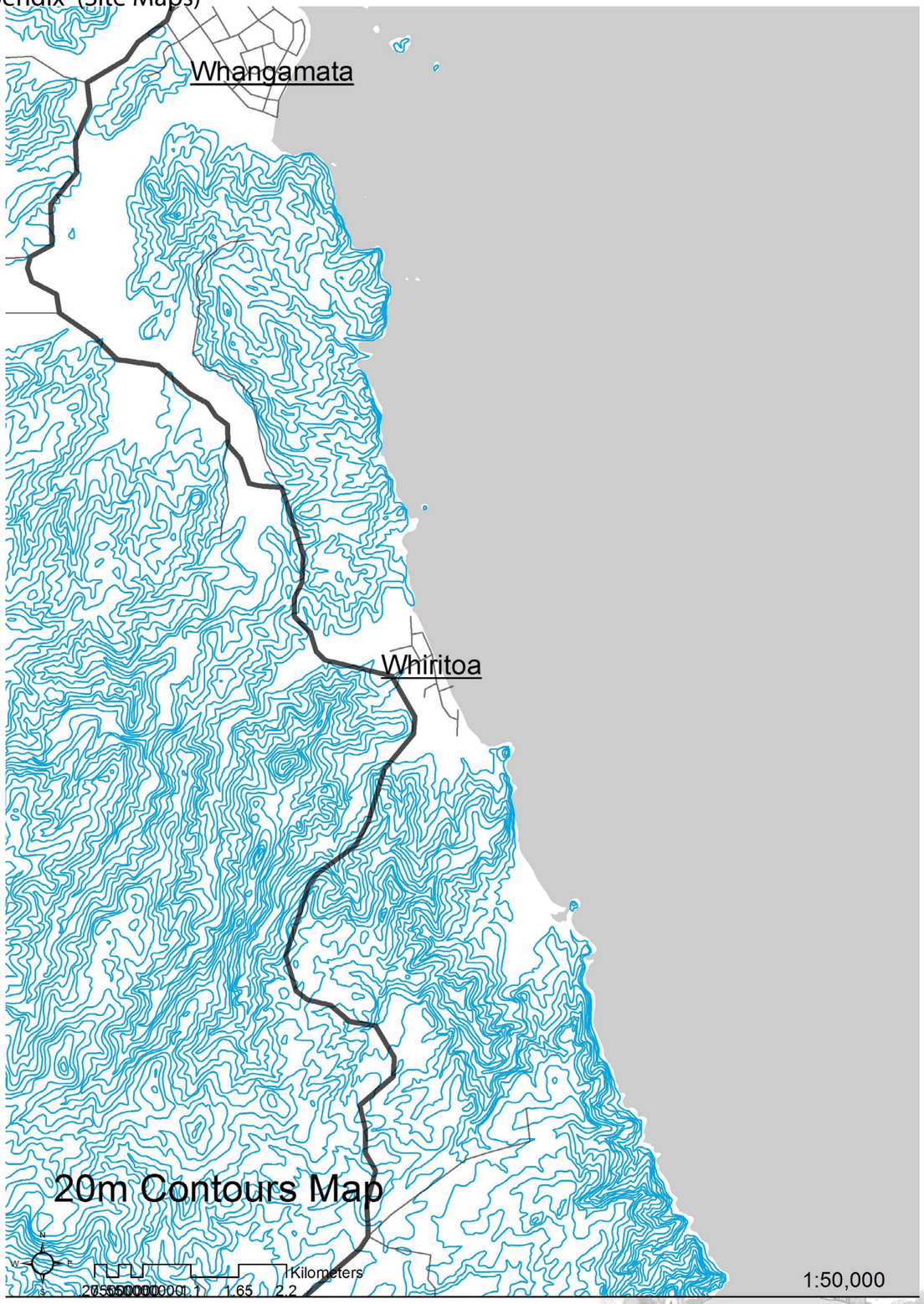
N W E S

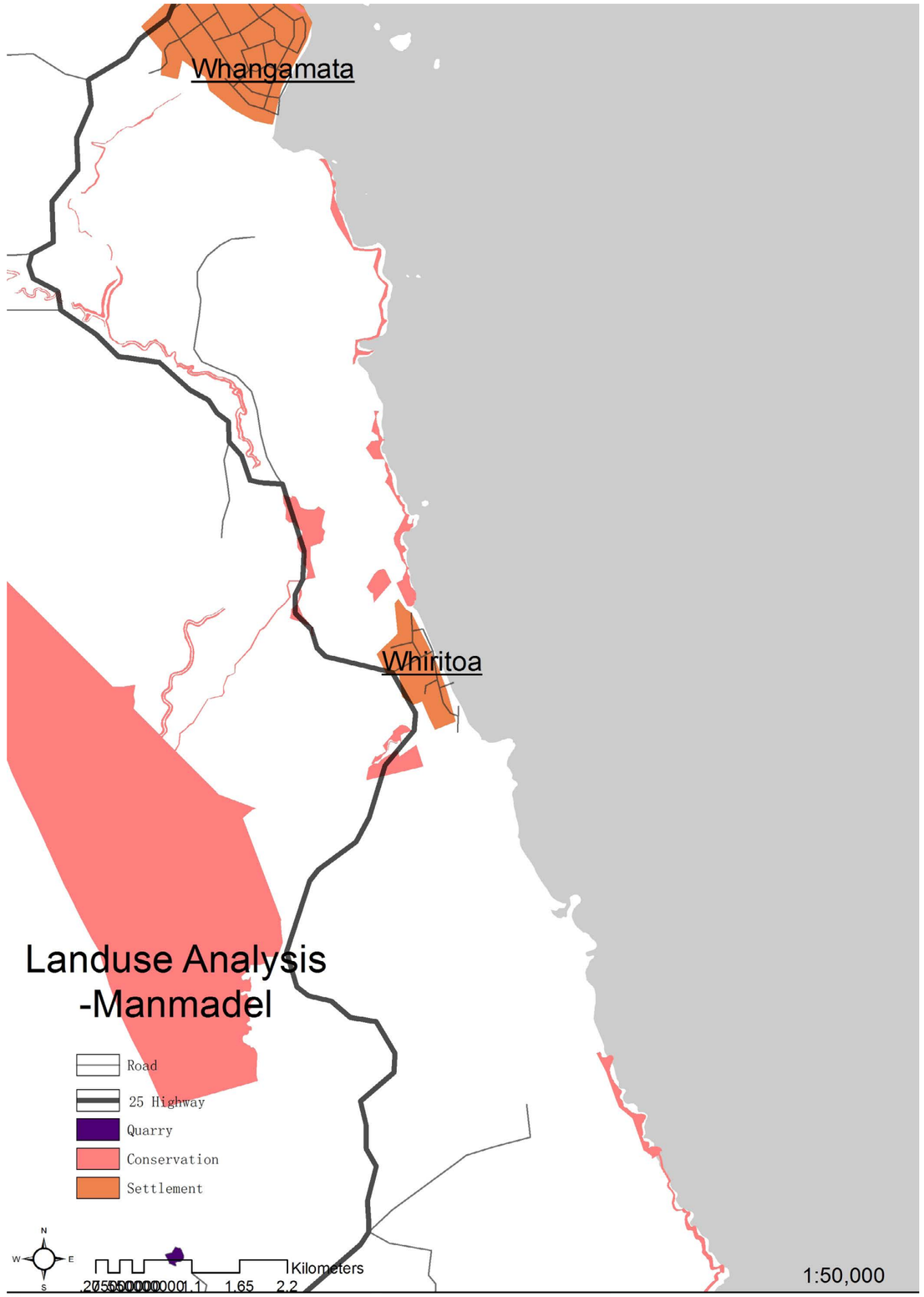
0 0.275 0.55 1.1 1.65 2.2 Kilometers

1:50,000

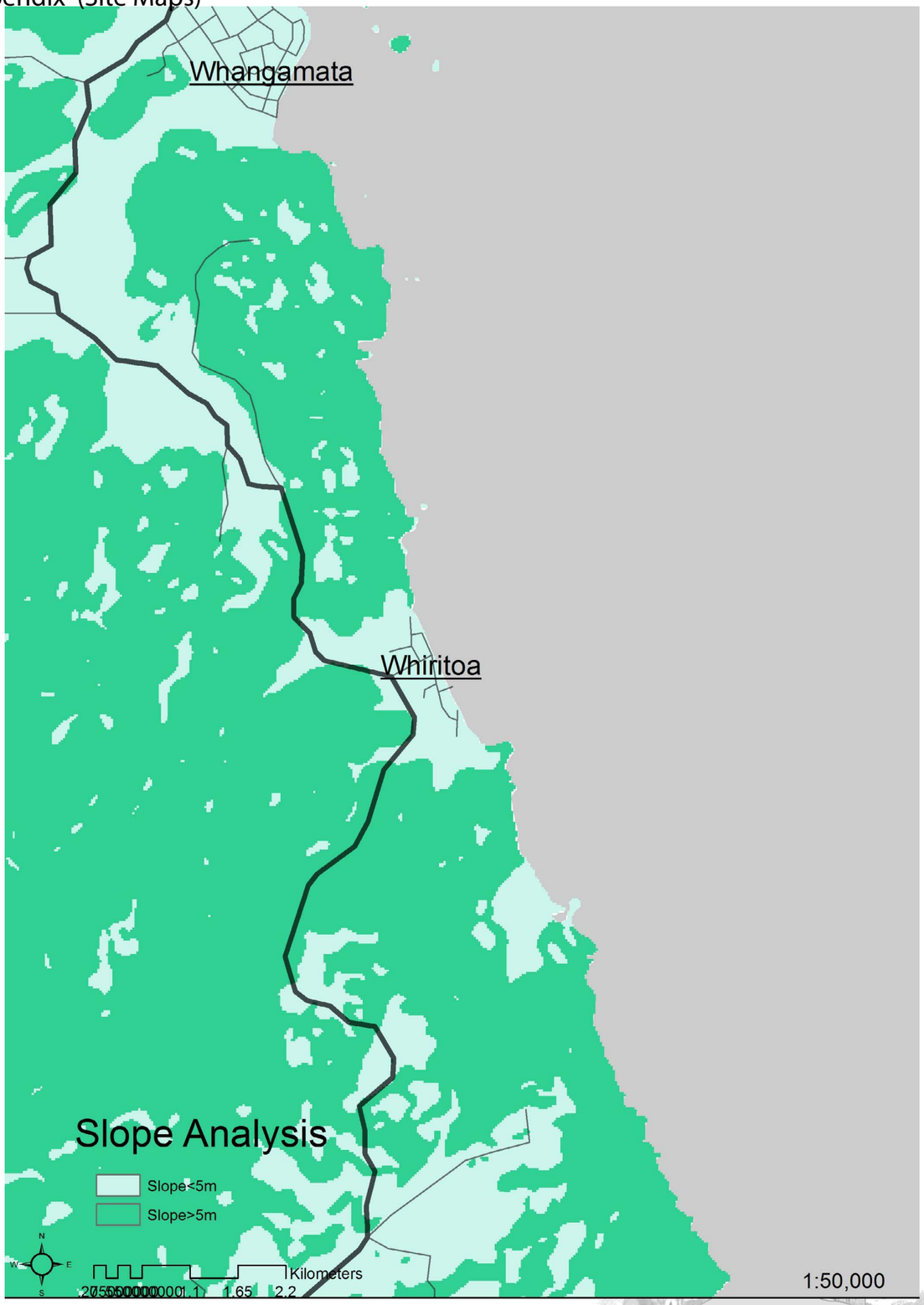
Whiritoa GIS Maps (1:50,000)

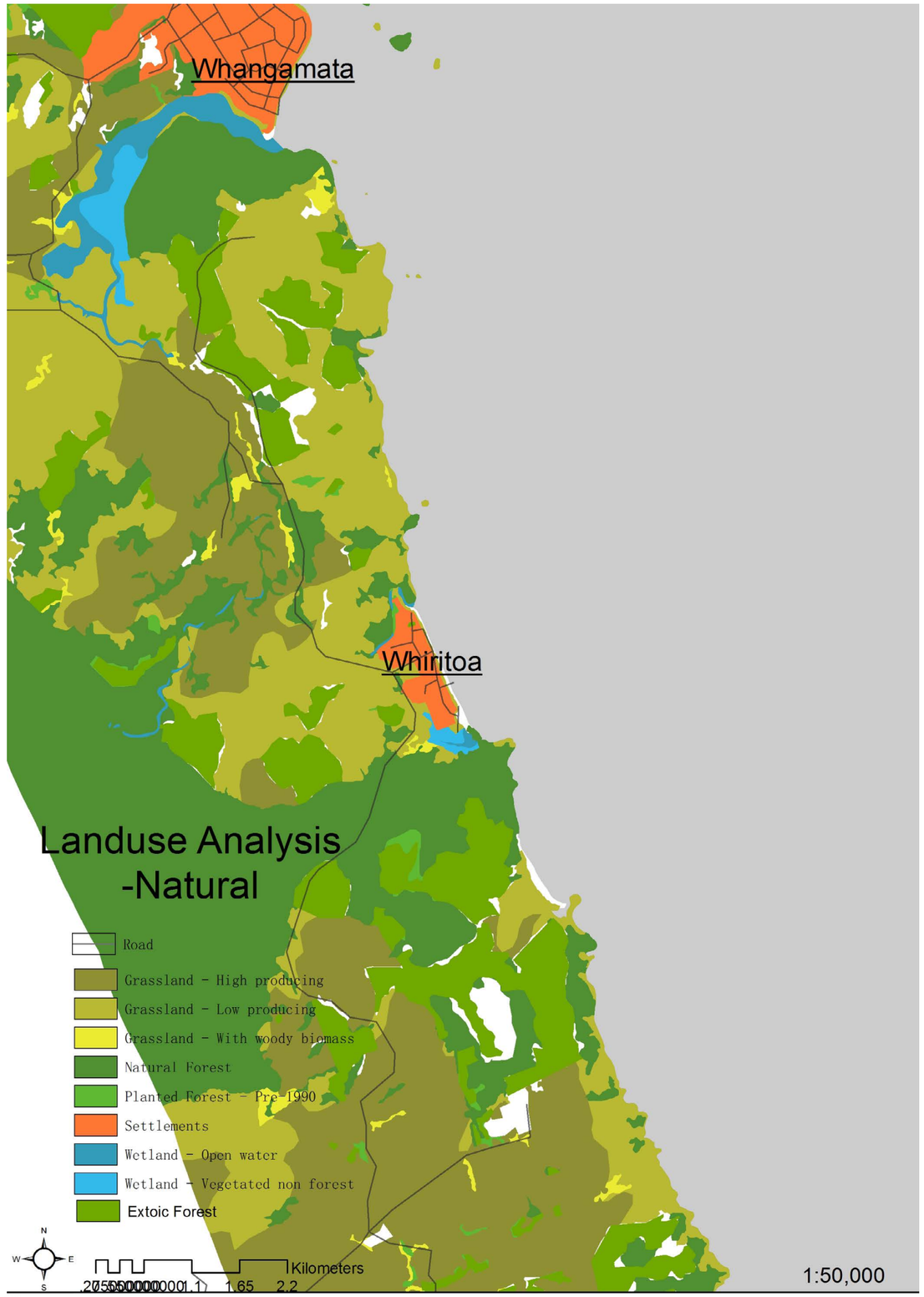
Appendix (Site Maps)





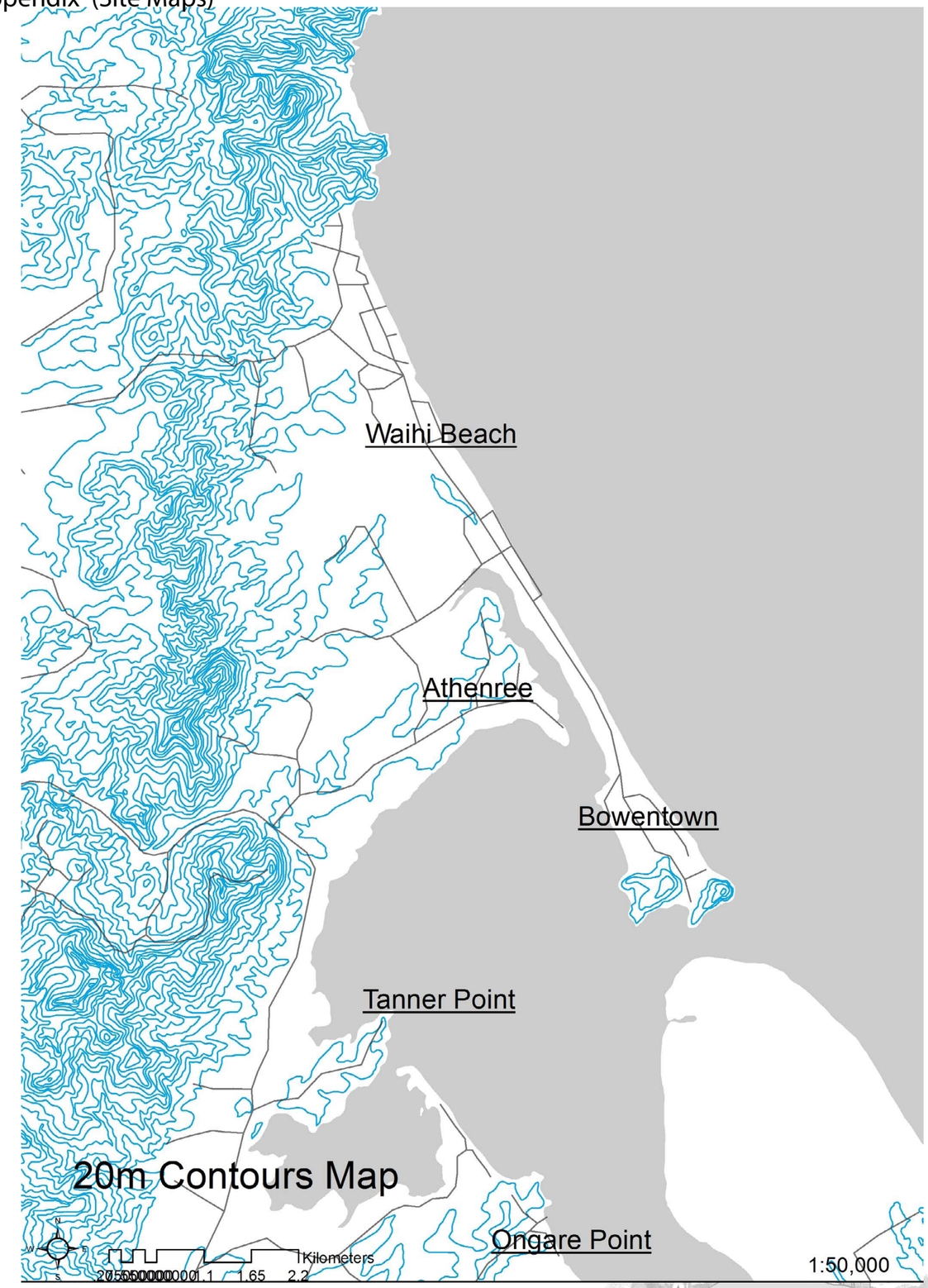
Appendix (Site Maps)

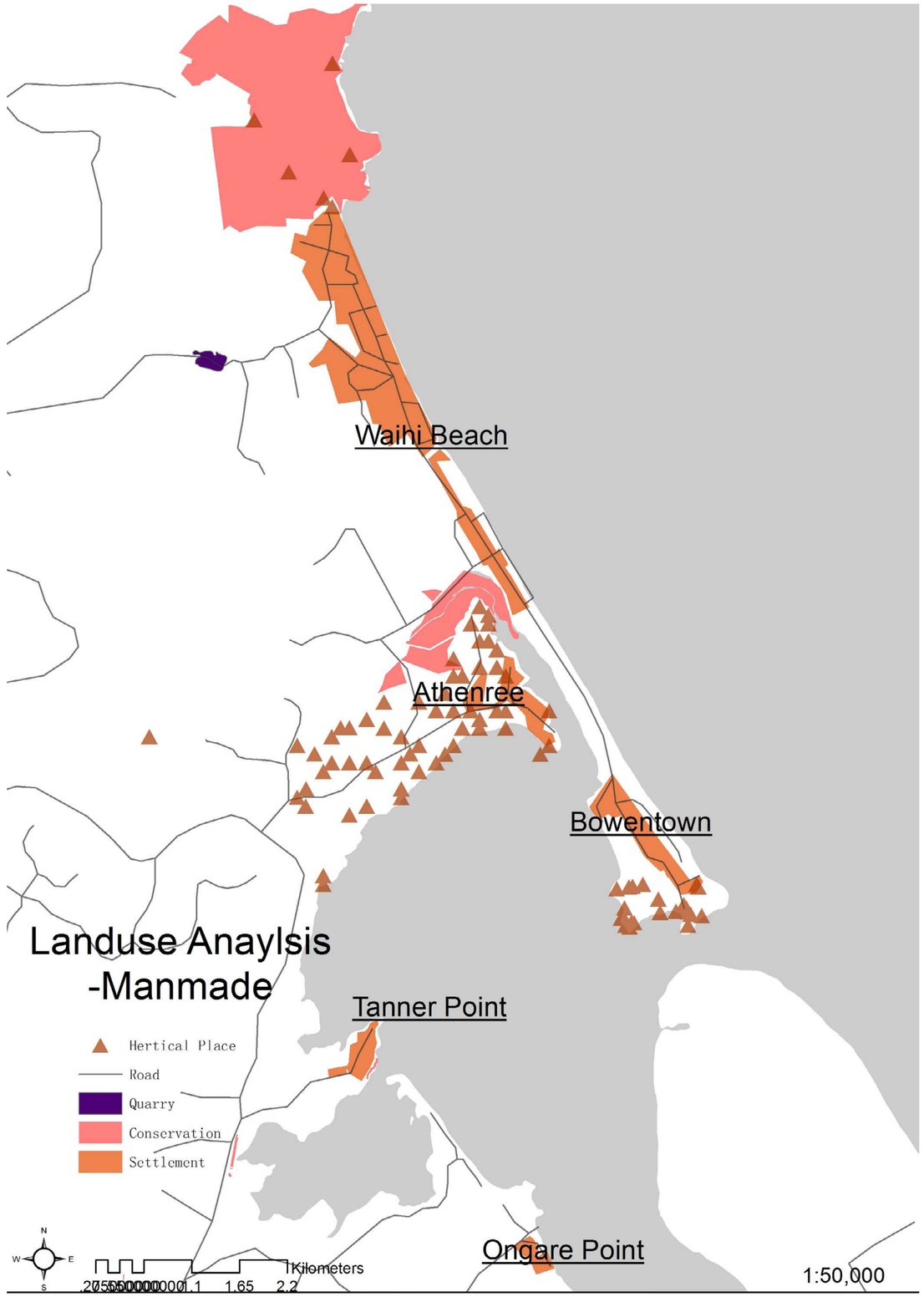




Waihi Beach GIS Maps (1:50,000)

Appendix (Site Maps)





Appendix (Site Maps)