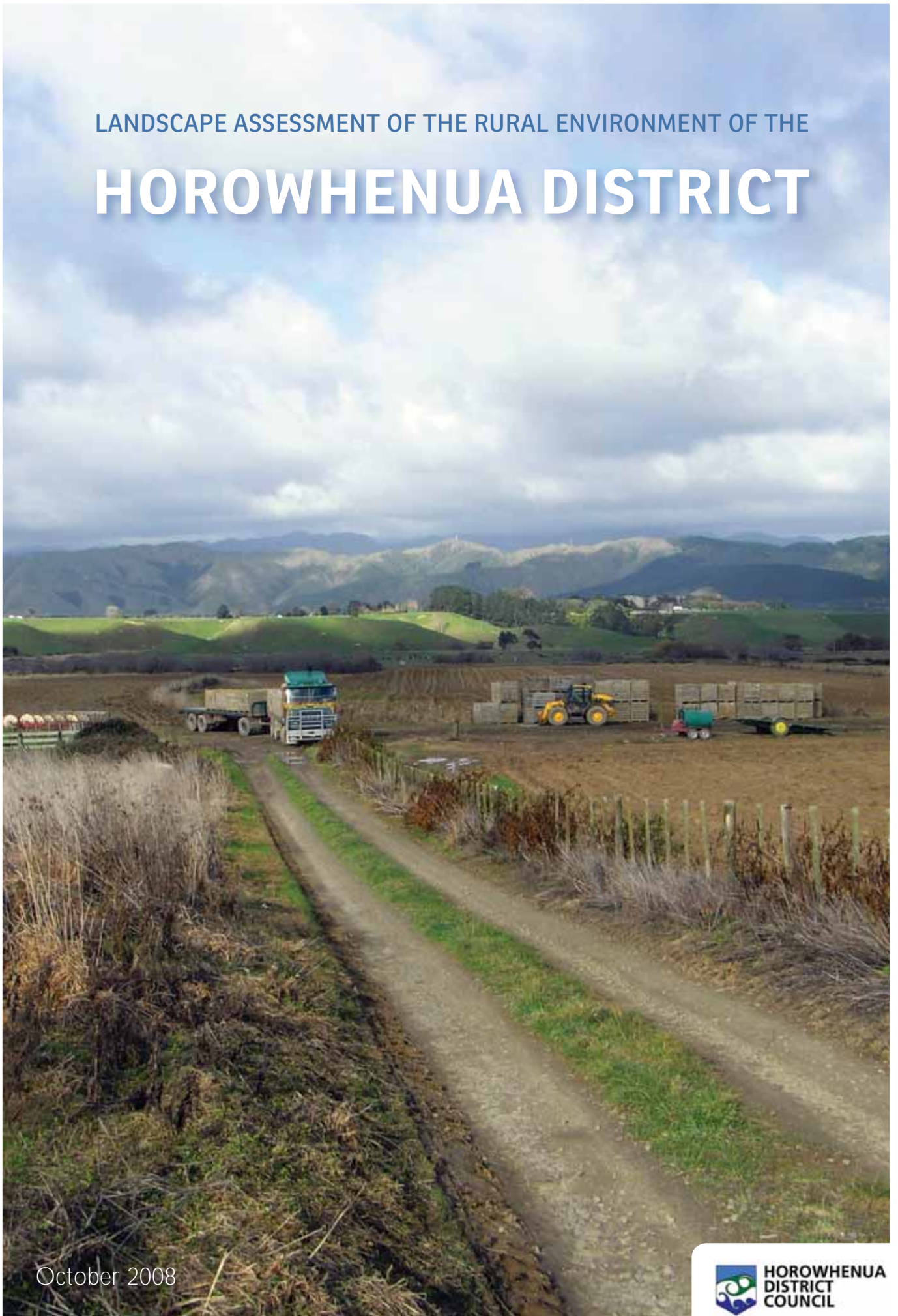


LANDSCAPE ASSESSMENT OF THE RURAL ENVIRONMENT OF THE

# HOROWHENUA DISTRICT



October 2008

## CONTENTS

<b>1</b>	<b>Introduction</b>	<b>4</b>
<b>2</b>	<b>Methodology</b>	<b>4</b>
2.1	Analysis of Landscape Character	4
2.2	Analysis of Visual Quality	4
2.3	Landscape Sensitivity	5
2.4	Opportunity and constraints	5
<b>3</b>	<b>Mapping Process</b>	<b>5</b>
3.1	Rationale for mapping	5
<b>4</b>	<b>The Landscape Domains</b>	<b>6</b>
<b>5</b>	<b>Matrices</b>	<b>6</b>
<b>6</b>	<b>Landscape Analysis &amp; Assessment</b>	<b>6</b>
6.1	Coastal Environment	9
6.2	Foxton Dunefields	11
6.3	Coastal Lakes	14
6.4	Moutoa – Opiki Plains	17
6.5	Tararua Terraces	21
6.6	Levin – Koputaroa	22
6.7	Levin – Ohau	24
6.8	Kuku	26
6.9	Manakau Downlands	28
6.10	Hill Country	30
<b>7</b>	<b>Conclusion</b>	<b>33</b>
	APPENDICES	33
	Appendix 1: Landscape Geomorphological Matrices	34
	Appendix 2: Landscape Character Comparative Matrices	38
	REFERENCES	52

## 1. INTRODUCTION

This assessment is to provide Horowhenua District Council with information regarding the landscape values contained within the Rural Environment (those areas zoned rural under the Operative Horowhenua District Plan (1999), and excluding those areas identified as the Greenbelt and Urban expansion areas identified in the Horowhenua Development Plan 2008).

This information can then be used to:

- Assist Council to evaluate the existing effects of rural subdivision and associated development, and identify any issues arising from these effects.
- Determine the impact of cumulative effects of subdivision on landscape character.
- Identify areas within the district where rural subdivision can be more readily integrated into the existing landscape, or where the effects of development are likely to bring about beneficial or adverse change
- Provide guidance in developing the objectives, policies and rules for a plan change to the Rural zone provision and the upcoming District Plan review.

## 2. METHODOLOGY

The initial task prior to assessment of landscape character and visual quality was to identify:

- The main landscape domains that make up the Horowhenua district;
- Landscape character of the domains, including the interrelationships between landform, land cover and land use;
- Landscape (visual) quality: natural science factors and aesthetic values within each;
- Current sensitivities, values and the qualities of the domains;
- The domains' visual absorption capability and vulnerability to change;
- The Opportunities and Constraints of development within the domains.

## 2.1. ANALYSIS OF LANDSCAPE CHARACTER

The following landscape elements were identified in the domains:

### Landform:

- geology – e.g. dune field formation, river terraces
- topography – e.g. steep, rolling, flat, dissected
- hydrology – e.g. the presence of water bodies or effects of hydrological systems

### Land cover:

- vegetation – e.g. indigenous or exotic, trees, pasture, scrub etc
- water bodies – e.g. lakes, rivers, streams and wetlands
- soil formation – sand, silt, rocky alluvial

### Land use:

- economic – e.g. large or small scale dairy or sheep farming, market gardening, cropping
- social – e.g. settlements, communities, isolated dwellings associated with farming
- sensitive – existing land uses such as landfills, sewerage treatment plants
- significant – historic, scenic or recreational reserves, sites of threatened plant species

## 2.2 ANALYSIS OF VISUAL QUALITY

Visual or landscape quality stems from:

- The natural science factors (the geological, topographical, ecological and dynamic components of the landscape),
- The aesthetic values (rarity, naturalness, expressiveness and legibility, transient values)

NB. Visual quality was determined through identification of aesthetic values; this process did not include rating or scoring the individual factors or values.

## 2.3 LANDSCAPE SENSITIVITY

Landscape sensitivity is a combination of visual quality and landscape vulnerability and involves assessing the domain's ability to absorb change. Analysis of the sensitivity of a domain includes:

- areas within the landscape domain with potential for expansion of settlements or rural residential areas (e.g. the landscape's capability to absorb that change is high)
- areas within the domains where a landscape assessment must accompany development proposals (e.g. the landscape's capability to absorb that change is not considered high, or sensitive landscape components may be affected)
- any significant landscape features that affect the domain's level of sensitivity
- any identified outstanding natural features and outstanding landscapes that affect the domain's level of sensitivity, and
- the type of settlement that would be appropriate in those areas.

NB. The scope of this analysis did not extend to assessing the outstanding natural features or landscapes.

## 2.4 OPPORTUNITIES & CONSTRAINTS

During the analysis it was considered the presence of the following opportunities and constraints can provide guidance on matters such as forms of development, design guidelines and measures to avoid, mitigate or remedy landscape effects:

- Topography;
- Presence of vegetation (exotic and indigenous);
- Visibility;
- Protection of view shafts;
- Proximity to roads and existing settlements;
- Land stability;
- Flood risk;
- Soil class;
- Protection of sensitive landscapes from inappropriate development;

## 3. MAPPING PROCESS

Together with field visits throughout the district, the following resources provided additional information to support the landscape analysis and identification of the landscape domains:

- Topographical Maps - January 2005
- Aerial Photography - 2004
- Land Use Capability Maps - December 2003
- Flooding and Ponding Maps - October 2004
- Land Cover Maps - January 2004
- Cadastral survey plans - March 2008

### 3.1 RATIONALE FOR MAPPING

Following the assessment of the Landscapes and the identification of the domains a map identifying the different landscape domains has been prepared. In recognising the many levels of information that have contributed to the location of the boundaries between domains it is acknowledged that in reality the domain boundaries in some places are blurred, particularly where the transition between domains is much wider than can be represented as a line on a map. Equally though, there were many cases where the domain boundary was very distinctly defined, usually by way of a physical feature such as a road, railway line or river.

In terms of the practicalities of applying objectives and policies for the domains, a level of common sense has been applied to the mapping of the domain boundaries. In most cases the boundaries follow cadastral land parcel boundaries so that the boundary can be accurately identified with some certainty. Where appropriate the domain boundaries follow easily identifiable physical features such as roads, railways, rivers and streams, and where possible the cadastral boundaries of these features have been used. In other cases it has not been appropriate to follow cadastral lines and the domain follows or incorporates a natural feature such as a line of sand dunes, an area of trees or in the case of the Hill Country domain, a contour line.

Where possible the mapping has sought to minimise the number of occurrences where a domain boundary passes through a land parcel. Although at times this has been unavoidable, in other places it has resulted in the domain

boundaries being stretched to extend to the nearest cadastral boundary in an attempt to provide a greater level of certainty and continuity for landowners.

The mapping exercise together with this project has specifically avoided looking at the Greenbelt and Urban expansion areas identified in the Horowhenua Development Plan (adopted 2008). For this reason it should be understood that where an identified Greenbelt or Urban expansion area falls within a landscape domain, it would be the relevant Greenbelt or Urban provisions that would be applied to these identified areas.

#### **4. THE LANDSCAPE DOMAINS**

The ten landscape domains identified are as follows:

1. Coastal Environment
2. Foxton Dunefields
3. Coastal Lakes
4. Moutoa-Opiki Plains
5. Tararua Terraces
6. Levin-Koputaroa
7. Levin-Ohau
8. Kuku
9. Manakau Downlands
10. Hill Country

*These domains and their relationship to each other are illustrated in Fig1: Landscape Domain's Map.*

#### **5. MATRICES**

Appended to this report are a series of tables and matrices that have been used to compare the domains and provide rationale for the boundaries as identified.

The Landscape-Geomorphological matrix utilises the identified natural science factors (topography, hydrology and ecology) to determine how these differ between the domains. The information used was broadly based on a publication written by ecologist Isobel Gabites and produced by Boffa Miskell Ltd (November 2001) which provided maps and analysis of identified geomorphological domains in the Kapiti and Horowhenua Districts.

Additional information sourced from G.L. Adkins' book "Horowhenua It's Maori Place Names And Their Typographical And Historical Background" - was used to provide further detail and historical information.

The Landscape Character Comparative Matrix used data that allowed comparison of the current landscape character of the domains, including land cover, land use, parcel size, sensitive land use features, the level of modification, the level of existing development and the visual context of the domain.

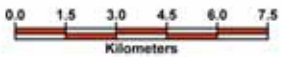
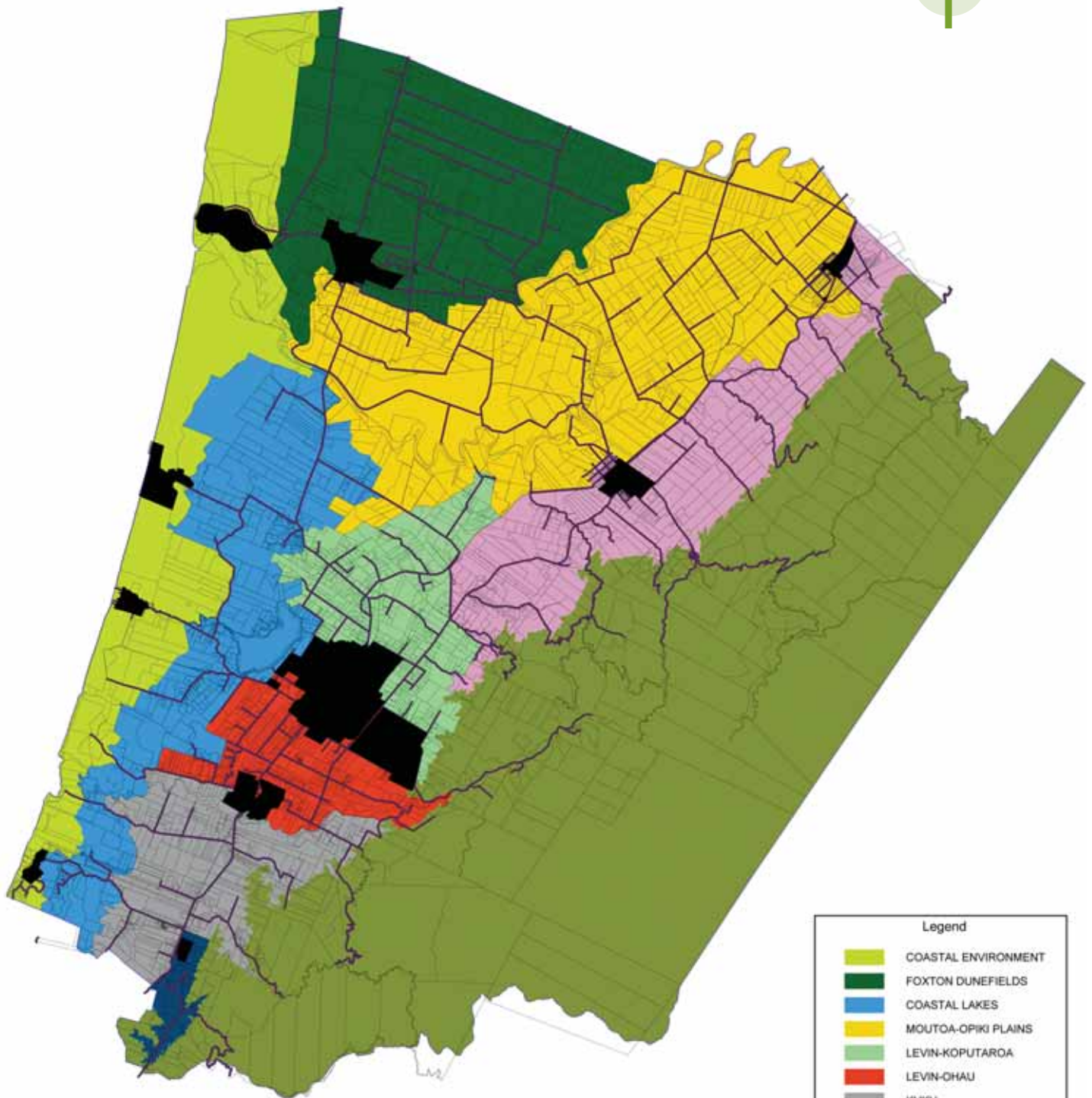
Again, this exercise was undertaken to further examine the accuracy of the domain boundaries as determined through field studies, maps, aerial photographs, plans and reference material.

These matrices are included to assist the understanding of the differences, or distinctions, particularly between adjacent domains.

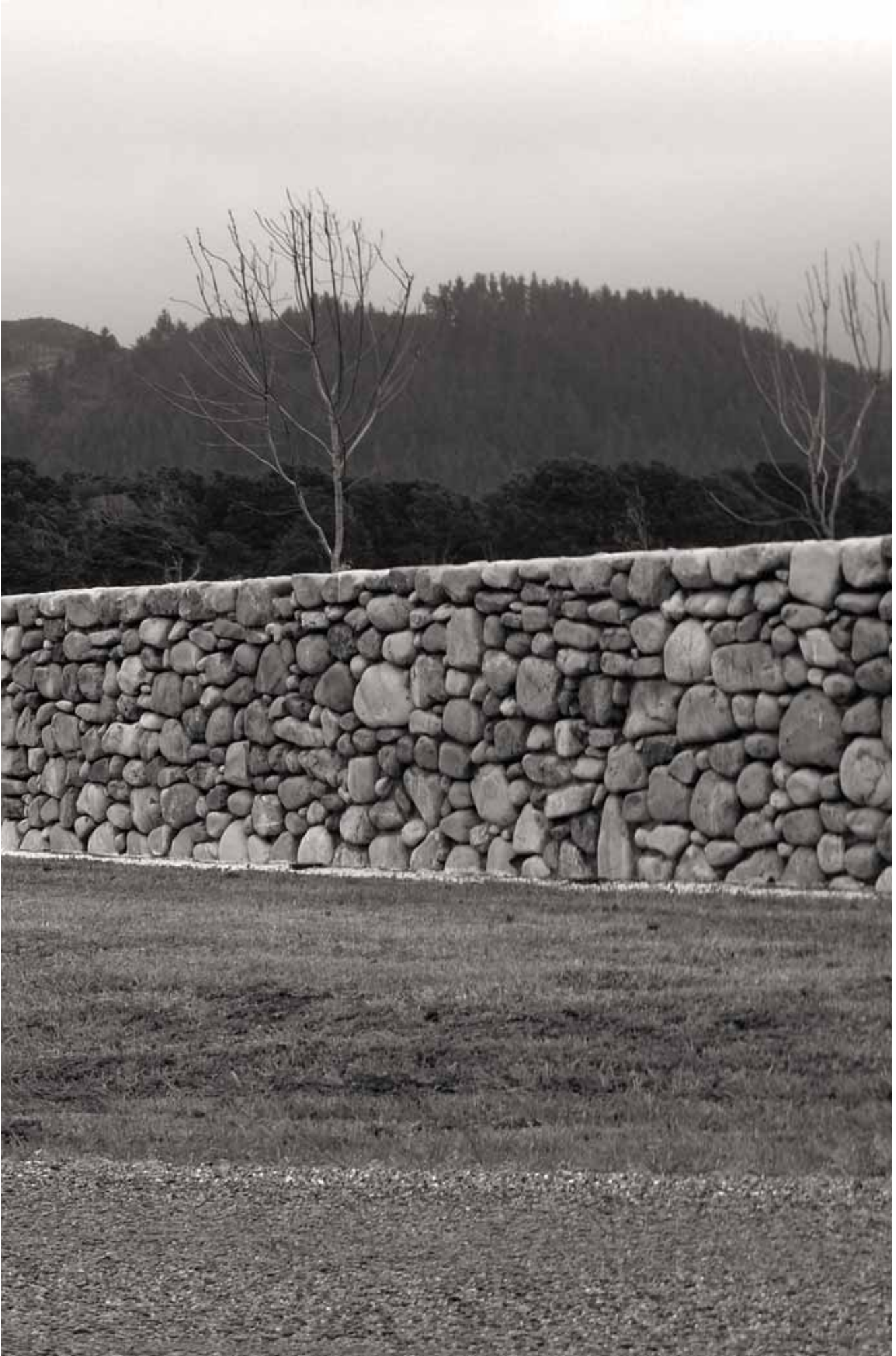
#### **6. LANDSCAPE ANALYSIS & ASSESSMENT**

The following section includes the identified landscape domains and analyses the landscape character, visual quality, sensitivity, vulnerability and opportunities and constraints for development in each.

## LANDSCAPE DOMAINS



Legend	
	COASTAL ENVIRONMENT
	FOXTON DUNEFIELDS
	COASTAL LAKES
	MOUTOA-OPIKI PLAINS
	LEVIN-KOPUTAROA
	LEVIN-OHAU
	KUKU
	MANAKAU DOWNLANDS
	TARARUA TERRACES
	HILL COUNTRY
	ROADS
	PROPERTIES
	DISTRICT BOUNDARY
	URBAN/DEVELOPMENT AREAS



## 6.1 COASTAL ENVIRONMENT

### LANDSCAPE CHARACTER

Clearly coastal in its character, this domain contains a mix of both mobile and stable dune systems<sup>1</sup>. Although primary production is not a dominant element, pine forestry covers a large proportion of the dunes in the area.

#### Landform

The dune systems result in a dynamic landscape, with the strong prevailing winds contributing to the constant movement of sand on the dunes near the coastal edge.

Inter-dunal hollows provide dune lakes and swamps where the water table is elevated; and the area also includes the estuaries for the District's lakes.

#### Landcover

Apart from exotic forestry, land cover is restricted to sand dune species and exotic pastoral grasses. In the estuarine areas particularly, there are significant areas of indigenous vegetation which support a wide range of indigenous fauna. Similarly, the remnant wetland and kanuka/manuka forest areas also provide important habitats.

#### Landuse

Land use in this area is restricted to exotic plantation forestry and some pastoral farming. There is increasing residential development in the coastal settlement areas.

### VISUAL QUALITY

#### Natural Science Factors

The unique parabolic dune system has high value, due to its rarity and the sheer magnificence of the large dune ridges. Additionally, the dune system is fragile and is easily damaged through modification.

The dominant waterbody within this domain is the Manawatu River, plus several associated streams, which takes a meandering course from the headlands of the Tararua Ranges to the estuary at Foxton Beach. The estuary is considered one of the most important estuarine ecosystems both in New Zealand and internationally, and is recognised as a RAMSAR World Heritage Site.

The estuaries are also specific to this district's coastline and support a wide range of indigenous fauna.

#### Aesthetic Values

The aesthetic values stem directly from the natural values, described above. The coast appeals to most people, but perhaps particularly to New Zealanders as an 'island' people.

This appeal results in a range of activities, from day visits to the construction of holiday homes, and more recently an increase in permanent dwellings within the established settlements.

#### Sensitivity

The uniqueness and dynamism of the coast and its processes result in a high level of sensitivity to modification, which is currently being tested through an increasing number of applications for resource consent for development.

#### Visual Absorption Capability

The VAC for this domain is reduced through its very simple but distinctive landscape character. The only exception to this would be in the areas of large pine plantations, or where modification is such that the character to have almost gone completely.

#### Opportunities & Constraints

The existing coastal settlements may present opportunities for expansion as identified in the Horowhenua Development Plan. Any future development should provide ecological and amenity benefits through design that enhances biodiversity through the rehabilitation of wetlands and the planting of appropriate indigenous coastal vegetation.

The forested dunes can provide screening and absorption of development where this is carefully located. Alternatively, sites currently with a forestry cover also provide opportunities for development that promotes the planned harvesting of the pines and the replanting of the sites with indigenous, local dunal species. Where this is planned to occur, harvesting should be undertaken in such a way that disturbance of the surface of the dunes is as little as possible (e.g. root raking should be avoided).

<sup>1</sup> *The Kapiti Coast: Maori tribal history and place names of the Paekakariki-Otaki district.* W.C. Carkeek, Reed Publishing, Auckland, N.Z.



COASTAL ENVIRONMENT

The limited road access from SH1 to the coastal settlements places constraints on where development can be successfully located, in terms of existing infrastructure and community building.

While development can enhance degraded sites, the Coastal Environment has particular and unique ecosystems and biological processes that require protection. This includes the integrity of the dune formations and protection of them from modification; the functioning of wetlands and swamps; and protection of the high water tables, aquifers and other hydrological systems, above and below ground.

This environment also provides habitats for a range of indigenous fauna; some of which are at risk from the modification of the above environmental elements. This includes indigenous fish species, wading birds and those that nest within the dunes. Ecological assessments are recommended to ensure these habitats are protected.

Similarly, this environment is known for the presence of cultural sites of importance to tangata whenua. Where such sites are known or have been identified, cultural and archaeological assessments of any sites destined for construction or excavation are also recommended; as is consultation with local iwi to gain awareness of known or potential sites.

The dunes in the Coastal Environment are an important characteristic of the area by virtue of being visible from much of the district, they form part of the character the district itself. Construction on or modification to the dunes will therefore also be visible and together with the potential to adversely affect the environmental sensitivities of the dunes, should be restricted.

## 6.2 FOXTON DUNEFIELDS

### LANDSCAPE CHARACTER

The Foxton Dunefields landscape domain is located between the Coastal Environment domain and the Moutoa-Opiki Plains domain. The landscape is characterised by the dissected parabolic dunefields, large areas of pastoral grazing and pine forestry, resulting in dynamic topography with diverse vegetation cover.

### Landform

The linear dunes stretch some 20km plus in a northwest-southeast orientation. The inland dunes are of the Foxton sands, which began accumulating 6500 years before present (BP)<sup>2</sup>. The age of the dune-building phase means the dunes are stable, and the planting of forestry has further settled the elevated areas and contributed to the developed soil surface. Some modification to the dunes has occurred to allow for the use of irrigation devices, but in general they remain intact and are a distinctive landscape element of the area.

Nearer the coast, the dunes are younger and of the Motuiti phase (1720 years BP), with those closest to the coast being of the Older Waitarere phase (400 years BP)<sup>3</sup>. Both these phases are also stable, and large areas are covered in forest plantations.

The inter-dunal areas still contain some important remnant wetland areas, including Lake Koputara, however most swamp areas have been drained and are used for grazing. High class soils (LUC 1 and 2) are found in the south-western part of the domain where it extends to the fertile river terraces.

Despite the significant modification through pastoral and forestry activities, the area contains some remnant areas of indigenous vegetation, including Himatangi Scenic Reserve and Roundbush Reserves.

### Landcover

Due to their age, the dunes themselves would have been forested prior to human occupation of the area. Species within the plant commdomains would have included tawa, matai, hinau, miro, totara, pukatea and kahikatea<sup>4</sup>. At the time of European settlement, however, clearance by the first people meant the vegetation on both Motuiti and Old Waitarere dunes was largely bracken fern, scrub, and natural grasses<sup>5</sup>.

Now the dominant cover is pastoral in nature, with forestry plantations on many of the dunes. The inter-dunal swamps areas and peaty backswamps would have originally contained swamp forest and wetland species – where these landforms remain intact, the wetland shrub and reed species have persisted.

<sup>2</sup> Muckersie and Shepherd 1995 in McFadgen, B. Department of Conservation 1997

<sup>3</sup> Sparks et al 1995 in McFadgen, B. 1997

<sup>4</sup> Adkin, G.L. 1948

<sup>5</sup> *ibid*



**FOXTON DUNEFIELDS**

## Landuse

Due to the peaty wet soils, flax production was integral to the initial economic growth of the area; at one time 50 mills were operating within a 16 km radius of Foxton. Later reliance on pastoral use meant that the soils became dryer through drainage and flood management, and much of the flax and kahikatea has now gone.

Dairy and sheep farming are now the dominant productive activities in the rural area, along with market gardening and poultry farming.

## VISUAL QUALITY

### Natural Science Factors

The dune field system in this area is unique to the country – and contributes strongly to the character of this area. As noted above, the dunes in this area are of the oldest occurring along the coast of the Kapiti and Horowhenua districts and as such have a high level of value in their rarity and distinctiveness.

The scale and linear form of the field is quite distinct from other local elevated topographical features (such as terraces and foothills) and is a product of the processes of winds, wave action and hydrology. The linear advancement of the dunes inland is a particular characteristic of this domain, and has influenced the location and direction of roads, siting of houses and provided view shafts through to both the Tasman Sea and the Tararua Ranges.

### Aesthetic Values

Subsequent human activities of deforestation and re-forestation have added other aspects to the quality of the dunes, both in terms of the natural processes and also the aesthetic qualities.

While the forestry emphasises the difference in elevation between the dunes and inter-dunal depressions, it also has an homogenising effect in terms of texture, light and density of the dunes themselves. The height and dense nature of the vegetation also blocks views within and through the dunes and therefore the extended visual combinations of dunes, wetlands and coastal features that would have been previously available.

Similarly, the drainage of the wetlands and conversion to pasture has removed the changeable, delicate textures provided by reed species and grasses. However, the usually lush bright green of the pasture

grasses contributes strongly to the perceptions of rural character, providing a sense of openness and expanse.

### Sensitivity

The dune fields are of high value and are sensitive to modification through earthworks. The rarity of this type of formation, and its importance in contributing to the landscape character of this domain requires continued protection be afforded to the dunes, in particular.

### Visual Absorption Capability

Despite its complex evolution, this landscape presents as relatively simple in its topography. As mentioned above, part of its particular character comes from the two visually distinct topographical elements – the inter-dunal flats/hollows and the extensive, linear elevated forms of the dunes themselves.

This simplicity results in the landscape's ability to absorb change as being low; structures, landform modification and even alteration in vegetation will impact at a level higher than that in a more complex and varied landscape.

Currently, despite the elevated sites the dunes offer, built structures on the tops of dunes are relatively few and where this has occurred, buildings have generally been reasonably well integrated through planting and other measures. Existing district plan provisions have afforded some protection to the landform through limiting earthworks and roading; however this has not been the case where modification has occurred through the positioning of large pivot irrigation systems.

### Opportunities & Constraints

This is one of the few domains that is not strongly characterised by high class soils. This in itself creates more flexibility for development location, however the distinctive landform and land patterning requires any development, or change in land use, to acknowledge the domain's particular characteristics.

Foxton township itself is situated on SH1, however the locations of the main arterial routes within the majority of the domain area are strongly influenced by the dune ridges extending inland. This results in long straights running east-west, with few secondary roads intersecting these. This has meant that in the main, the dune formations have been protected from major modification, and their linear form is somewhat

## 6.3 COASTAL LAKES

accentuated. It also results in the roads forming permanent view shafts from the mountains to the sea and vice versa.

The existing parcels also reflect the road and dune patterning; they tend to be large, with frontages on the roads and boundaries across the dune ridges indeterminately defined by shelterbelts and/or forestry plantations.

Therefore, the insertion of additional intersecting roads or significant driveways running perpendicular to the existing roads and cutting through the dunes would be ecologically and visually at odds with the character of this domain.

Similarly, settlement types need to acknowledge the integrity of the dune formation; measures to ensure this include the considered design and location of the development itself in relation to the strong linear patterning, and the avoidance of the dune ridges when locating fencelines, building sites and structures.

The opportunity exists, however, to use development as a means to enhance biodiversity through the rehabilitation of wetlands and the dune vegetation cover. As with the Coastal Environment, change in land use from forestry to residential development can enhance the ecological and environmental values of the domain, but the process involved in the physical change needs to be carefully staged and managed so as to avoid disturbance of the dune structures and related wetlands, while utilising remaining pines for screening and absorption purposes.

The Foxton Dunefields are renowned and unique to New Zealand; their presence is a dominant characteristic of the area and their form and role in the landscape requires protection from visual degradation or damage from modification.

### LANDSCAPE CHARACTER

The Coastal Lakes landscape domain is so named because of its proximity to the Coastal Environment domain and the inclusion of dune lakes within this area. It is of a very diverse nature, with high, dry dunes interspersed with low wetland hollows, as well as the regionally significant lakes.

#### Landform

Most of this domain consists of parabolic dunefield topography, which extends in a latitudinal fashion over 10km inland. It tends to be of the younger dune-building phase, which results in the dunefields extending less of a distance inland, but the topography is no less distinctive than that found in the Foxton Dunefields domain. The most significant of the dunes, Moutere Hill, is identified as an outstanding landscape/natural feature in the Horowhenua District Plan (1999).

The hydrology is complex and dynamic, although extensive modification has occurred through the imposition of deep channelled drains. Meandering streams and contiguous wetlands maintain their natural patterning under the grid-like drain system. Despite the drainage systems, the elevated water table allows the remaining wetland areas to function naturally and provide habitat for a range of indigenous flora and fauna.

There are a number of freshwater dune lakes in this domain, two of which - Waipuahau (Lake Horowhenua) and Waiwiri (Lake Papaitonga) - are significant natural features which have high historical and cultural values; however, in the case of Waipuahau - Lake Horowhenua the environmental values have been significantly reduced.

Waipuahau – Lake Horowhenua has a surface area of 290ha and an average depth of less than 2 metres. It is drained by a single outlet, Hokio Stream, and the lake level is controlled by a weir within this outlet. Water input is received from both surface flow and groundwater; the latter via a number of submerged springs. The lake is in an advanced state of eutrophication however the kaitiaki, the Muaupoko people, have instigated a major restoration process.<sup>6</sup> Waiwiri - Lake Papaitonga is a 61.8 ha dune lake with two islands, Motukiwi and Motungarara. It is located within a 122 ha protected scenic reserve, managed

<sup>6</sup> [www.mfe.govt.nz/publications/water/managing-waterways-jul01/case-study-3-jul01.pdf](http://www.mfe.govt.nz/publications/water/managing-waterways-jul01/case-study-3-jul01.pdf)



**COASTAL LAKES**

by the Department of Conservation (DoC) and is far better environmental health than Waipuhau.

Soils are generally low nutrient sands, except in areas adjacent to the Manawatu River margins where peaty wet soils exist. Isolated pockets of high class soils are found near the two lakes, but otherwise are not a dominant soil class of the area.

## Landcover

As mentioned above, much of the dunefield near the coast has been planted for extensive commercial forestry production, while the stable inland fields have a mix of scattered small-scale forests on the residual dunes and pastoral activities on the low and inter-dunal areas.

However, the Lake Papaitonga scenic reserve is a significant habitat for indigenous flora and fauna; to a lesser level the remnant bush areas scattered throughout the area and the functioning wetland swamps also provide habitat for indigenous fauna.

## Landuse

Despite the continuation of the quite elevated dunes from the coastal edge, the domain includes extensive areas of pastoral grazing, although this tends to occur mainly on the inter-dunal flats. The dunes themselves are generally utilised for exotic forestry and for the location of dwellings associated with the farms.

## VISUAL QUALITY

### Natural Science Factors

The diverse nature of this landscape domain, despite the modification that has occurred, results in a fairly high level of natural value. This is, of course, enhanced by sites such as Waiwiri - Lake Papaitonga.

The dunefields in this domain have been created during the younger dune building phases – the ‘Old Waitarere’ and the ‘Young Waitarere’ phases<sup>7</sup>, as opposed to the Motuiti phase of the Foxton dunefields.

The dunes in the Coastal Lakes domain are also parabolic and run in a linear fashion in a northwest-southeast direction, but do not extend as far inland as the older dunes. However, they are still distinctive and a dominant landscape characteristic of this domain.

As mentioned above, the Lake Papaitonga scenic reserve includes some 122ha of protected indigenous flora; together with a number of other significant natural habitats that supporting a wide range of indigenous flora and fauna. These include remnant areas of indigenous vegetation, such as kanuka/manuka forests and broadleaf remnants, as well as a number of significant wetlands.

### Aesthetic Values

As in the Foxton Dunefields domain, the deforestation and drainage of the area has resulted in a major change to the ‘look’ of the area. Similarly, the re-forestation of the dunes in a very limited number of species has lessened the intricacy and diversity of the texture of the vegetation cover, although the result is a strong contrast between the elevated areas and the grassed flats.

Such a reduction in complexity of the landscape as well as the contrast between the two dominant topographical elements results in this landscape's ability to absorb change being low; structures and roads on either land form will require careful location to avoid having prominence.

Both the lakes discussed above contribute significantly to the aesthetic values of the area, despite the degraded state of Waipuhau – Lake Horowhenua. Amenity values provided by the waterbodies themselves, together with the scenic reserve and park-like surrounds of Waipuhau – Lake Horowhenua are highly valued by the local community.

### Sensitivity

As with the other domains on the western coastal part of the district the dune system, including the lakes, presents high value in landscape terms and therefore requires consideration as to the effects of development and landform modification.

Residential development already extends from Levin to within 1km from the eastern side of Waipuhau – Lake Horowhenua, whereas Waiwiri - Lake Papaitonga is located in a more rural and currently less populated area to the south, although rural residential development is increasing. The reserve area surrounding Waiwiri - Lake Papaitonga acts as a visual and physical buffer between the lake and settlement areas, but the reserve itself requires protection from potential visual and other adverse effects of development.

<sup>7</sup> Land Resources Inventory, Cowie and Fitzgerald (1966) AND Adkin (1948) in McFadgen (1997)

## 6.4 MOUTOA-OPIKI PLAINS

The ongoing efforts by Muaupoko iwi to rehabilitate the Lake require that serious consideration be given to any developments that could hinder those efforts or exacerbate the existing ecological problems. Projects that encourage regeneration of indigenous flora and fauna – at any scale – will assist in providing ecological corridors and seed source for revegetation of the lake's margins, while storm water and waste water management will help reduce eutrophication.

### Visual Absorption Capability

The presence of the significant dunes, including Moutere Hill, as well as the two significant lakes results in the VAC for this area being low. The level of the landscape values in this area is high because of the natural character, amenity value and aesthetic values.

### Opportunities & Constraints

This domain has very limited high class soil areas and there is the potential to enhance natural values through the provision of environmental or conservation lots available. The roading network provides a better level of connectivity within this domain; particularly compared to the adjacent domains of the Coastal Environment and Moutua-Opiki.

The extensive areas of pine forestry also provide visual integration of potential development within this area.

Constraints to development include the sensitive ecological nature of the area; however as mentioned above, the existing natural values of the area (wetlands, streams and remnant bush areas) would benefit through rehabilitation and enhancement that could result from land use change.

Consideration should be given to the effects of building site location, effluent disposal design and location, earthworks and road construction on existing vegetation and waterways will be required to ensure impacts are not adverse, visually or ecologically.

### LANDSCAPE CHARACTER

The Moutoa-Opiki Plains landscape domain is situated in the northern portion of the Horowhenua, east and south of the Foxton Dunefields domain, west of the Tararua Terraces landscape domain and includes the Manawatu River and its plains to the south.

The domain's proximity to the river provides a character that results from the intense activity of the hydrological system – both above and under ground. Related to this is the imposition of flood management processes – the stop banks, canals and sluice gates provide an 'engineered' topography that, in its purpose, conflicts both visually and physically with the natural hydrological processes.

### Landform

The landscape is comprised of extensive open plains with alluvial, clay-rich and relatively fertile soils and high water tables

Wetland areas exist in remnant river locations; the shapes of which reveal past oxbows and meandering patterns. The southern part of the domain forms part of the Manawatu flood plain where the peaty wet soils exist through which deep drainage canals have been cut to allow the land to be used for agricultural purposes.

### Landcover

Intense land use has resulted in the loss of indigenous vegetation cover and there are fewer shelter belts and exotic trees than in other domains.

Prior to clearance the indigenous vegetation would have consisted of kahikatea and flax in the wetter area, with podocarp forest in the area further away from the river and in the slightly more elevated areas to the east.

The soils within this area are predominantly highly versatile, having a Land Use Capability (LUC) classification of Class 1 or 2 and as a result the scale of the primary production activities is generally large and intensive with dairying, market gardening and cropping occurring throughout the domain.



**MOUTOA-OPIKI PLAINS**

## Landuse

The fertile soils in this area support primary production at a range of scales. The 'patchwork' effect from this land use is a strong visual element; the grid patterning distorted by the river courses and flood plains.

The pattern of human settlement also reflects the productive character of the area; large utilitarian buildings and farm worker dwellings, as well as the established rural dwellings associated with the properties are found either as individual isolated structures or small clusters.

## VISUAL QUALITY

### Natural Science Factors

Within the plains area, very little of the original indigenous vegetation remains and the modification of the hydrological system has meant that a large proportion of the original habitat for fauna has been lost, so natural values are low, generally speaking.

Where the topography remains unmodified, such as the meandering streams, their interesting formation contributes positively to the landscape values, despite the significance of these elements being heightened through the removal of vegetation.

### Aesthetic Values

While much of the factors mentioned above are the product of the reduction of natural values through deforestation and modification to landform and hydrology, the level of the perceived aesthetic values of this landscape type is an indication of the resilient nature of the 'picturesque' model of landscape appreciation.

The expansive plains that characterise this domain would have not been of such visual significance when covered in their original vegetation. Similarly, the organic forms of the stream courses would have been in less contrast to these landforms when hidden within riparian vegetation.

Even in a dry state, the streams that run through the area have created oxbows and hollows in an otherwise quite ordered landscape.

## Sensitivity

The presence of highly versatile soils and long-established horticultural activities contributes to this domain's high level of sensitivity to change. The parcels are generally large and reflect the dominant land use, which is an essential component of the domain's character. Therefore, subdivision and close-density development is not appropriate in this domain.

In visual terms, this landscape requires careful consideration of the location of buildings and roading, as these elements will be quite distinct within the open expanse of the plains.

Where possible and appropriate to land use, re-vegetation in indigenous species would reduce the sensitivity somewhat and raise the level of natural character, as would riparian management and rehabilitation.

### Visual Absorption Capability

Similarly, the insertion of constructed elements into the landscape could result in adverse effects on the Tararua Range - which forms a significant backdrop to the area and is currently designated as an Outstanding Landscape in the District Plan.

This further reduces the VAC for the plains area in particular; however utilisation of existing shelterbelts for screening will allow an increase in VAC.

### Opportunities & Constraints

A significant constraint on development is the extent of high class soils within this domain. As a result of this, issues of reverse sensitivity and connectivity are also apparent; primary production is the dominant activity and the large parcel size has restricted the need for secondary or connecting roads.

Further, the existing limited amount of development, or indeed the number of built structures, and the wide open areas that surround them are significant influences on this domain's character. More intensity of development or a significant increase in the density or number of buildings could result in adverse effects on the strongly rural character of this domain.



## 6.5 TARARUA TERRACES

### LANDSCAPE CHARACTER

This domain extends from the north-eastern boundary of the District and acts as a transition zone between the northern plains and the Hill Country. The varied landscape character is mainly that of the lowland terrace and is described in more detail below.

#### Landform

Generally, this area is a combination of elevated plateau dissected by gullies, some areas of steep erosion-prone faces to the east and flatter or gently sloping/undulating land towards the west.

Within this domain are some discrete areas sheltered from the prevailing winds by individual ridges that extend further to the east. These areas present a slightly different character because the climatic factors tend to be humid frost-free air, and significant cloud cover.

#### Landcover

The mainly pastoral nature of this area also contains a number of significant natural habitats, including remnant areas of indigenous vegetation of both forest and wetland types.

Vegetation in the sheltered 'alcove'-type areas also includes nikau palms and other vigorous species suited to the gentler environment. Volcanic soils found within the area also contribute to growth rates and vegetation types.

#### Landuse

Low intensity pastoral farming is the dominant land use in this area. The presence of market gardening reflects the high class soils that extend in some areas to the 100m contour of the foothills. Associated dwellings and buildings reflect this dominant usage, however there are some smaller parcels that are either rural residential or niche primary production activities.

### VISUAL QUALITY

#### Natural Science Factors

The variation within this domain results in a range of indigenous species in a range of micro-environments. This results in bio-diversity having the potential to be of a high level, despite the extensive modification and clearance through farming activities on the lower terrace areas.

#### Aesthetic Values

Varied landscapes have their own particular attractiveness, with the presence of streams, dense vegetation, lush grass and undulating landform usually appealing to most people.

Additionally, the nearby ranges and the steep elevation of some terraces is exaggerated by the contrast to the plains areas to the west, providing further aesthetic interest

#### Sensitivity

The variation within this domain calls for recognition that 'one size will *not* fit all' despite the elements all being components of a particular landscape character. Development needs to respond directly to the types of landform and acknowledge the high or potentially high biodiversity and ecological value.

The domain's proximity to the outstanding landscape of the Tararua Range also affects the level of sensitivity; and requires care as to the location, height and visibility of structures to avoid adverse visual or landscape effects on the landscape.

#### Visual Absorption Capability

The variable landscape provides a range of site-types that differ in their ability to absorb built structures and roads. The same issue as noted with the open plains areas previously apply here, as does the need to protect the visual qualities of the Tararua Range.

#### Opportunities & constraints

Close to the Shannon and Tokomaru townships, this domain's location presents some opportunities for development in response to this connectivity. However, the presence of high class soils places constraints on both the type and location of development.

Land instability on the terraces also presents constraints, and the high visibility of these areas could pose problems with adverse visual effects should building sites be located on the elevated sites.

However, the variation of the domain's topography, particularly to the west, does provide opportunities for sites that do not have the same constraints as those discussed above – however where these areas also contain high natural values or the potential for ecological enhancement, development should respond to this.

## 6.6 LEVIN - KOPUTAROA

### LANDSCAPE CHARACTER

The landscape character of the Levin-Koputaroa domain is a direct result of flooding processes. Situated between the Coastal Lakes, the Moutua-Opiki Plains and the Tararua Terrace domains, the domain displays the range of variation in topography contained in this dynamic geomorphological intersection.

#### Landform

The domain's mid-catchment location results in the topography that is a product of both flood processes and loess, including fertile alluvial plains, low lying peat swamps, elevated areas and deeply incised gullies.

The low lying peat areas also are affected by rises in the water table which results in ponding at various times. The presence of dynamic streams within this domain and the influences of fluvial processes mean that areas within the domain are under threat from flooding.

#### Landcover

As with much of the district, the original landcover has been reduced to remnant patches; primary production has resulted in deforestation and drainage, with pasture grasses, agricultural plant species and exotic shelterbelts becoming the dominant vegetation.

The remnant bush areas, as well as the remaining significant wetland areas provide habitat for a range of indigenous flora and fauna.

### Landuse

The land use in the area is a product of the varied topography, with soil fertility, climate, aspect and proximity to water (above and underground) promoting a range of activities. In general, the high class soils result in primary production as being the most dominant, with smaller-scale production also featuring.

The location and density of dwellings tends to be that associated with primary production and rural lifestyle settlement. Both State Highway 1 and 57 cross this domain, resulting in the rural areas being less isolated than in some domains.

### VISUAL QUALITY

#### Natural Science Factors

The variation in topography and the proliferation of gullies and streams reveals the remnant natural textures of the complex environmental processes of this area. The added overlay of the regular geometry of pastures, shelterbelts and drains results in a multi-patterned and visually dynamic landscape.

#### Aesthetic Values

The sense of this area being an intermediate zone is heightened by the ability to obtain views of both the beginning and conclusion of the catchment process. These views tend to be either framed by landforms and vegetation, or unobstructed and expansive when obtained across open pasture.

Alternatively, the undulating landscape can also result in a sense of enclosure within localised areas – particularly toward the elevated terrace and foothill areas.

Together with the strong sense of rural amenity, these factors make the area an appealing one in which to live.

#### Sensitivity

The level of sensitivity depends largely on the part of the domain in question. In terms of ecological sensitivity, the areas in which the hydrological system dominates require consideration of any impacts on this – particularly where it is unmodified.



LEVIN - KOPUTAROA

## 6.7 LEVIN-OHAU

Maintaining view shafts across the plains is also important; the ability to capture a view extending from the ranges to the sea is an important characteristic of the domain – and also in other domains within this relatively short and intense catchment that provides this opportunity.

### Visual Absorption Capability

Because of the reasons above, the open expansive areas maintain a lower level of VAC, although the existence of mature shelter belts will provide a level of absorption for appropriate development. The more complex, undulating areas containing the gullies provides a higher level of VAC; however these also tend to be within or close to the more elevated areas so a clustered approach to development would be more appropriate than large lots containing isolated large dwellings.

### Opportunities & constraints

This domain has extensive areas of high class soil but the mixed nature of the landform provides the potential to enhance natural values. The roading network in this domain provides a better level of connectivity compared other domains such as the Coastal Environment, Moutua-Opiki and Foxton Dunefields.

The extensive areas of pine forestry also provide visual integration of potential development within this area.

Constraints to development include the sensitive ecological nature of the area; however as mentioned above, the existing natural values of the area (wetlands, streams and remnant bush areas) would benefit through rehabilitation and enhancement that could result from land use change.

Assessment of the effects of building site location, effluent disposal design and location, earthworks and road construction on existing vegetation and waterways will be required to ensure impacts are not adverse, visually or ecologically.

### LANDSCAPE CHARACTER

This domain's rather varied character is influenced by its location in the volcanic lowland terrace area of the district and by the hydrological system.

#### Landform

Terracing is a dominant landscape element in the eastern part of this domain; the impact of the Ohau River is clear. Flood and loess action has created the terracing but also the wide expanses of river-plain in the central part of the domain.

#### Landcover

The original vegetation cover in this domain has been heavily modified or destroyed through farming activities; the dominant cover is now pasture grasses, crops, exotic shelter belts and some areas of pine forest. The volcanic and alluvial soils provide a high level of fertility, so market gardening and more recently small scale horticultural enterprises are also contributing to the dominance of cultivated species in the area.

Remnant areas of indigenous vegetation occur – usually in close proximity to the river. Some of these have been designated as reserves, the largest being the Kimberley Scenic Reserve.

#### Land Use

The existence of high class soils in this domain results in farming and horticulture being the dominant land uses. The exception to the wide distribution of high quality soils is an elevated band of sandstone just north of Muhunua East and West Roads. The land parcels within this band are correspondingly smaller, and reflect the change in land use towards Levin itself, where it becomes progressively more rural-residential in nature.

### VISUAL QUALITY

#### Natural Science Factors

The hydrological system is the main contributing element to natural landscape values in the area; the land form's distinctive shape is a result of the paths of the river and streams, the high class soils a result of alluvial matter and the remnant wetlands a result of high water tables and/or uncontrolled streams and springs.



**LEVIN - OHAU**

## Aesthetic Values

The most influential factor in terms of aesthetic values is probably the rural amenity created by the existing land uses. The reserves in the area also contribute examples of 'naturalness' to the area, as do views of the Tararua Ranges (located outside this domain) however, naturalness is not a dominant element.

## Sensitivity

The high level of modification to this area lowers its sensitivity to activities, except as mentioned above, where it may impact on rural character/amenity.

Further modification to the hydrological system is to be avoided, however – as the formation created through river and stream movement is a strong characteristic of the area. Development that enhances and rehabilitates waterways is recommended in this area.

## Visual Absorption Capability

Despite the modification, the overall topography of this domain and lack of extensive or densely vegetated areas is not particularly high. However, the elevated nature of the terraces reduces the VAC of those particular areas.

The relatively high density of the area of the domain located near Levin itself (north of Muhunua East Road) does present a higher level of VAC, because there is already a visible level of activity in terms of built structures and landscape modification that could be increased without negative impact.

## Opportunities & Constraints

Proximity to both state highways and a fairly comprehensive roading network and a mix of parcel sizes presents opportunities for effective development in this domain. However, the varied landscape character and strong hydrological presence present constraints on how this should be approached.

The geomorphological processes of this domain result in areas of high class soils separated by bands of uplifted sandstone, rock outcrops, waterways and peaty swamps<sup>8</sup>. These areas would be more appropriate for future development that encourages environmental enhancement and riparian rehabilitation, with the areas of good soil retained for primary production.

Development in this domain could involve the inclusion on environmental or conservation lots and should be located so as to avoid issues of reverse sensitivity. Consideration of adverse visual effects resulting from prominent sites on elevated terraces or uplands will also be required.

## 6.8 KUKU

### LANDSCAPE CHARACTER

While this domain has many of the same components that make up the character found in the Levin-Ohau domain, is sufficiently different to warrant its own domain, as explained below.

#### Landform

The flat fertile plains are the dominant topographical element, and the domain also includes a series of former river terraces from the Ohau River, Waikawa Stream and Manakau Stream. The active hydrological system in this area results in flood risks from these waterways, and this is exacerbated by the elevated water table in the area which are subject to ponding in prolonged wet weather.

#### Landcover

The presence of the fertile soil has resulted in a predominantly pastoral and market gardening environment. The original land cover of flax, kahikatea and other forest species found in areas of inundation has almost completely been cleared; however some isolated remnant areas of indigenous vegetation remain, which together with a number of significant wetlands support a wide range of indigenous flora and fauna.

#### Landuse

As mentioned above, land uses in this domain are a mix of dairying, pastoral farming and market gardening, at a range of scales – including some smaller and more intensive than in the other domains of similar character. There is also rural living associated with these activities, including farm worker accommodation.

<sup>8</sup> Adkin, G.L. *Horowhenua: Its maori place-names & their topographic & historical background*. Dept of Internal Affairs, Wellington 1948



**KUKU**

## VISUAL QUALITY

### Natural Science Factors

The hydrology of the area is important to the character in visual terms as well as ecological. It underpins the land form, land use and land cover; the combination of which provides a particular visual quality, albeit different from that existing prior to the cultivation of the area.

The remnant bush and functioning wetlands are of high quality and the Ohau River functions as a valuable ecological corridor despite the scale of primary productive land use which commonly impacts negatively on waterways. Rehabilitation projects are progressing well, however, mainly as a result of the reasonably healthy ecological networks in place.

### Aesthetic Values

The productive landscape has its own aesthetic, as discussed previously. The market garden element adds to this, and to the sense that the land is fertile, giving and well-tended – all qualities which are appreciated by human beings.

Also present but no less important is the appreciation of naturalness gained from the high quality remnant bush stands and the wetlands.

### Sensitivity

The waterways and remnant bush require protection, but so too does the productive/rural amenity of the area which is so important to the landscape character of this domain.

### Visual Absorption Capability

The flat expansive plains reduce the VAC of this domain, as do the elevated terraces. Given that the insertion of structures or groups of structures will have highly visibility, it is important that the location and design of these is carefully considered, and that parcel size remains similar to that existing, in appearance at least.

### Opportunities & Constraints

In this domain there is a strong sense of an established culture of local productivity which requires protection and encouragement, but does not necessarily preclude complementary residential development.

Alongside this is an intensification of ecological processes, driven by the narrowing of the catchment between the Tararua Range and the coastal edge, which provides both constraints in terms of the presence of high natural values but also the potential to use development as a means to enhance and rehabilitate those in some areas.

This would particularly involve the streams, swamps and 'engineered' or modified waterways running through the catchment, which are at risk through stock activity and nitrification.

Visually, care is required that development is located to avoid prominent sites on the terraces to the east, and that existing vegetation and shelterbelts are utilised to screen and/or integrate structures in the more open areas to the west.

## 6.9 MANAKAU DOWNLANDS

### LANDSCAPE CHARACTER

Varied landform and particular aesthetic qualities make up this domain, which wraps wraps around the eastern side of Manakau village. The village of Manakau has its own distinct character which is different from any other settlement in the district and it seems as if this character has permeated through into the environment beyond the village boundaries.

#### Landform

The landform is a mix of types with discrete areas of more varied topography, particularly on the eastern side of the domain. Here, where the catchment is at its narrowest, the proximity of the foothills provides small enclosed areas, similar but more distinct to those found in the southern part of the Tararua Terrace domain.

#### Landcover

Within the eastern area of the foothills, the vegetation is mainly pine forest except in some areas where indigenous forest is regenerating. Otherwise, cover is predominantly pastoral grass and exotic trees, including shelter belts, although there are some small isolated remnant bush stands within the pastoral areas.



**MANAKAU DOWNLANDS**

## Landuse

Pastoral farming is the most dominant of the land uses, ranging from small to large scale farms. Small-scale horticultural activities also occur in this domain, reflecting the presence of fringe areas of high class soil from the adjoining domain. More recently, lifestyle development has been occurring, in addition to the small settlements or isolated buildings associated with the rural activities.

## VISUAL QUALITY

The Manakau area has a high level of rural amenity. This is in part contributed to by the sheltered and enclosed areas which do not bear the full force of the predominant winds and appear lush and gentle, and as discussed below, has a distinctive aesthetic.

## Natural Science Factors

Natural values in the area are restricted to the remnant bush and wetland areas, as well as the regenerating bush on the foothills, but are important to the domain's overall character. Modification of the hydrological system through farm drains has also reduced the visual quality of the waterways.

## Aesthetic Value

The high level of rural character provides a 'picturesque' aesthetic that, although more realistically at home on the other side of the world, is still appreciated here.

This also results in there being a vulnerability to development that is not in keeping with the current character.

## Sensitivity

As mentioned, the distinct character of this domain requires consideration of location, design and size of any development.

Care should also be taken that no negative effects of development impact on the backdrop and views of the Tararua Range. The areas of indigenous bush require protection and enhancement where possible.

## Visual Absorption Capability

The varied topography, and in particular the enclosed areas, provide a reasonably high level of VAC, as does the backdrop of dense forestry. Building on top of the elevated inland areas should be avoided so views of the Tararua Range are not compromised.

## Opportunities & Constraints

The particular character of this domain presents both opportunities and constraints in terms of development. So far, subdivision of parcels has been executed in a way that this domain retains its scale, which reflects that of the village itself. It is important that this character is maintained, as the domain is small and the particular characteristics could easily be affected by inappropriate development.

While the presence of high class soil is not a constraint, as with the Kuku domain, the narrowing of the catchment in the southern part of the district means that the existing ecological and hydrological systems are intense and distinct and require protection and enhancement where possible.

The topography and existing vegetation allows integration and screening of future development where these are located in such a way that this is achievable. Adverse impacts from locating structures in prominent sites, or in such a way that the integrity of the Tararua Range is affected are possible if inappropriate development occurs.

## 6.10 HILL COUNTRY

### LANDSCAPE CHARACTER

This domain extends the full length of the western side of the district and is characterised by its consistent elevated nature. The character is also influenced by the climate of the area; the range and its proximity to the Cook Strait produce a very high rainfall and north westerly winds up to gale force sweep up over the lower parts of the area.

### Landform

The domain contains all land above the 100m contour line where the gradient of the hills becomes noticeably steeper and includes the taller of the foothills as well as the highest peaks of the Tararua mountain range at some 1570 metres above sea level (msl).



The range consists of parallel ranges interspersed with deep river valleys. It covers some 3,168 square kilometres, stretching from the Manawatu Gorge approximately 100 kilometres to the south.

### **Landcover**

On the western side of the ranges themselves, the vegetation is predominantly conifers, ferns, shrubs and vines, largely due to the approximate 5,000 millimetres of rain received.

On the lower levels of the ranges and on the foothills, the vegetation is largely scrub species resulting from areas reverting to bush after being farmed. Species include manuka, kamahi, tauhinu and bracken.

### **Landuse**

Landuse in this domain very much depends on the elevation of the site. The highest levels form part of Tararua Forest Park, and the foothills contain large scale forestry, pastoral farming as well as remnant and regenerating areas of indigenous bush and scrub.

This domain contains many of the the headwaters of the hydrological catchments in the district and therefore influences, to some degree, all of the other landscape domains. The significant natural habitats found in this area are important for any future remediation work within these catchments, often forming one 'end' of the ecological corridors.

Exotic vegetation and fauna are also dominant features in this area, however – and the parcels on which these occur are generally of a large scale.

Residential, or indeed rural, living is not a strong feature of this domain however this area does afford a range of recreation opportunities which, in their limited number, are not inappropriate to this landscape. Larger-scale activities of this nature would not be appropriate.

## **VISUAL QUALITY**

### **Natural Science Factors**

The natural unmodified landscape of the Tararua Range is a dominant factor in the level of quality in this domain. Additionally, the areas that are reverting to indigenous bush cover are adding to the level of

biodiversity in the area. The restriction of modification of indigenous vegetation above the 100m contour line (as provided by the District Plan 1999 provisions) has also assisted.

### **Aesthetic Values**

The range has 'iconic' qualities and is recognised as an outstanding landscape feature in the current District Plan (1999). The foothills have a different aesthetic quality that contributes to the amenity factor with the gentle undulating form and rural character they possess through farming activities.

### **Sensitivity**

For all the reasons discussed above and below, this domain has a high level of sensitivity, and in general, development should be discouraged.

### **Visual Absorption Capability**

The range provides limitations on the ability of this landscape to absorb change. It is important that views of this element are not affected by the insertion of structures above a certain level.

Lower down in the foothill area, there is a greater ability, through the undulating topography and the presence of forestry; however care still needs to be taken that visual effects of any development in this area do not adversely impact on the outstanding landscape area and maintain the rural amenity values.

### **Opportunities & Constraints**

As discussed above, this domain is highly sensitive and has the current status of an outstanding landscape area. It is important that this status be upheld, and that the amenity, landscape and natural values that are inherent in that level of sensitivity and the character that results in the domain's iconic value be enhanced, or at the very least, maintained.

Residential or other inappropriate development should be severely restricted because of issues of high visibility and the level of landscape values.

## 7. CONCLUSION

Through the identification and analysis of the different landscape domains, areas where rural subdivision can be more readily integrated into the existing landscape, or where the effects of subdivision and development are likely to bring about beneficial or adverse change, can be identified.

Additionally, while the scope of this project has been to consider the impacts of subdivision, the process has identified that the effects of landuse activities could also be addressed through a domain-based approach.

Each domain presents particular characteristics, or combinations of characteristics, that result in specific sensitivities that require consideration in terms of the level and density of development proposed.

Certain features within individual domains require attention to particular details in the early stages, such as scheme plan layout (including building site locations), the siting of roads, accessways and right-of-ways, and the shape and location of boundaries, while other issues (such as planting and building style) can be addressed later in the development process.

Given the large-scale deforestation and the level of modification to the hydrological systems that has occurred in the district, future development has an important role to play in the restoration of natural landscape values. Sustainable practices involving water use and disposal, effluent disposal and building and roading design are required as a basic approach to development.

The re-introduction of indigenous species of vegetation, including those in riparian areas, is also an important factor in every domain. The unique characteristics of the district's narrow catchments and intensely varied landscapes require careful attention to allow the ongoing natural processes to continue without further degradation and be enhanced wherever possible to raise the level of natural values of the area.

However, the importance that has historically been placed on the retention of highly versatile soils also needs to be maintained; the approach to future primary production at the local level is now being

seen as an integral part of sustainability in this country.

Therefore, a balanced approach to both development and environmental management is necessary to sustain not only the environment and its processes, but also to the social and economic needs of the future inhabitants of the Horowhenua District.

The strongest message that has emerged during the process involved in this assessment is that the 'one-size-fits-all' approach is not appropriate and does not efficiently manage the effects on the environment. The individual domains require individual responses in terms of land use and development, with this approach underpinned by the provisions of the District Plan.

Objectives, policies and methods (including design guidelines and criteria for the assessment of effects) should be applied across the whole rural environment but also specifically to each domain, resulting in development that is sensitive to the variations of the landscape. This approach would be timely and helpful for all those involved in the future use and development of the rural environment of the district, allowing developers and their agents clear parameters and recommendations as to how they should plan and proceed with proposals. Similarly, those involved in assessing the benefits or otherwise of development proposals can maintain a consistent and informed approach that is appropriate to the particular landscape domain.

Council's awareness of the importance of re-thinking development and land use in the Horowhenua District is opportune and fundamental to the sustainable development of the district. The manner in which subdivision and land use of the rural environment is planned and conducted now and in the near future will have permanent effects on the social, economic and environmental future of the district; It is crucial therefore, that this process be supported and maintained by all stakeholders in the development and use of the rural environment.

OCTOBER 2008

Nicola Treadwell BLA

David McCorkindale BREP

Landlink Ltd

Horowhenua District Council

## Appendix 1: Landscape – Geomorphological Matrices

Although the two domains share many similar geomorphological characteristics, those isolated in the table above are significant enough to affect the landscape characteristics and result in the domains being separate landscape units or domains.

Comparing the Levin-Ohau and the Kuku domains, the differences appear more subtle partly as a result of the shared geomorphological characteristics.

However, both contain landscape characteristics from different geo-domains and together with the different proportional amount of characteristics from the shared geomorphological domains, are enough to distinguish between the two landscape domains.

The purpose of this matrix is to identify the distinctions between the landscape domains; in particular those occupying the central area of the District.

Most of these domains share certain geomorphological characteristics, but it is the combination of these that create the specific landscape characteristics that differentiate the domains from one another.

Example: The differences between the Levin-Koputaroa and the Levin-Ohau domains.

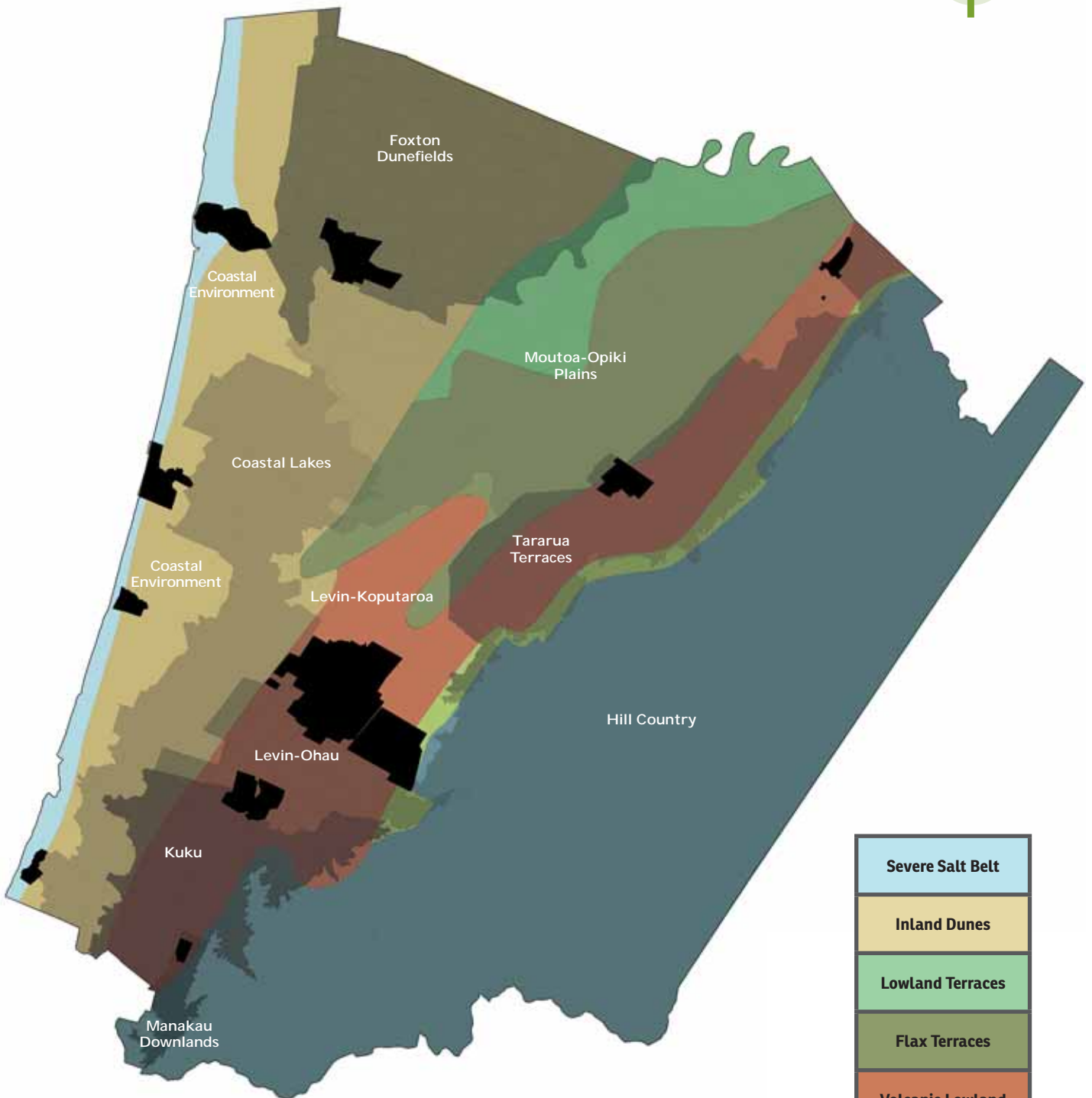
Levin-Koputaroa has a combination of the Inland Dunes and the Flax Terrace geomorphology while Levin-Ohau has combination of the Inland Dune and Volcanic Lowland Terrace geomorphology.

While both domains share most of the Inland Dune characteristics, the geomorphological differences between the Flax Terrace and Volcanic Lowland Terraces are such that each domain presents different characteristics from each other.

Using the matrix to isolate these characteristics, the Levin-Koputaroa and the Levin-Ohau domains are differentiated as shown on the following page.



## LANDSCAPE - GEOMORPHOLOGICAL DOMAIN MAP



Severe Salt Belt
Inland Dunes
Lowland Terraces
Flax Terraces
Volcanic Lowland Terrace
'Nikau Belt'
'Kamahi Country'

Coastal Environment	Foxton Dunefields	Moutoa-Opiki Plains	Tararua Terraces	Hill Country
Coastal Environment	Coastal Lakes	Levin-Koputaroa	Tararua Terraces	Hill Country
Coastal Environment	Coastal Lakes	Levin-Ohau	Hill Country	Hill Country
Coastal Environment	Coastal Lakes	Kuku	Hill Country	Hill Country
Coastal Environment	Coastal Lakes	Manakau Downlands	Hill Country	Hill Country
<b>Severe salt belt</b> <b>Inland dunes</b> <b>Lowland terraces</b> <b>Flax terraces</b> <b>Volcanic lowland terraces</b> <b>Nikau Belt</b> <b>Kamahi Country</b>				

Levin-Ohau: Inland Dunes/ Volcanic Lowland Terrace	Kuku: Inland Dunes/ Volcanic Lowland Terrace/ Nikau Belt Characteristics
Parabolic dunefields extend into domain	Less extent of dunefields into domain
Intense land use over all of domain	Landuse less intense towards foothills
Well-defined terraces/ dissected downlands	Areas of remnant and regenerating bush Foothills, softened landforms

Levin-Koputaroa: Flax Terrace Characteristics	Levin-Ohau: Volcanic Lowland Terrace Characteristics
Open landscape	Well-defined terraces/ dissected downlands down-cutting streams
Drainage canals/patterns prominent	Shaped by flood processes and loess
Peaty wet soils	Fertile volcanic ash

\* Adapted from *Environmental Guidelines for Rural Living: Kapiti & Horowhenua* Boffa Miskell November 2001

\* Geomorphological information adapted from *Environmental Guidelines for Rural Living: Kapiti & Horowhenua* Boffa Miskell November 2001

GEO-DOMAIN	TOPOGRAPHY/SOIL	VEGETATION	CHARACTER	SENSITIVITIES	LANDSCAPE DOMAIN
<b>Severe Salt Belt</b>	Low mobile young dunes Estuaries at stream mouths Deep meandering streams Bare hill/dune tops Low nutrient sand Acidic swamp soils	Large-scale forestry Pastoral farming	Dynamic Rarity Naturalness Coastal residential Forestry Primary production	Ecological value of dunes and estuaries Ecological values of wetlands and natural habitats Significant landscape features	Coastal Environment
<b>Inland Dunes</b>	Parabolic dunefields Dune lakes and hollows Thin, readily leached topsoils Peaty wet soils in the Manawatu floodplain	Large-scale forestry Pastoral farming Indigenous bush and wetlands	Highly diverse Lacustrian Forestry Primary production	Ecological value of dunes, dune lakes, wetlands, natural habitats and remnant bush Scenic value of dunes and lakes Outstanding Landscapes	Coastal Environment Foxton Dunefields Coastal Lakes Moutoa-Opiki Plains
<b>Lowland Terraces</b>	Alluvial and clay rich soils Open plains Flood control measures (stop banks, canals)	Large areas of deforestation Pastoral grasses Crops Shelter belts Streamside trees	Intense varied land use Rural amenity Naturalness	Riparian margins Wetlands/habitats Flooding High class soils	Moutoa-Opiki Plains Levin-Koputaroa Levin-Ohau
<b>Flax Terraces</b>	Peaty, wet soils Manawatu River flood plains Drainage canals	Pasture Large areas of deforestation Scattered exotic trees and shelterbelts Streamside trees	Open landscape Rural amenity Drainage patterns prominent Intense land use	Riparian margins Wetlands/habitats Flooding	Moutoa-Opiki Plains Levin-Koputaroa
<b>Volcanic Lowland Terrace</b>	Well-defined terraces/dissected downlands Volcanic ash, Relatively fertile Shaped by flood processes and loess down-cutting streams	Scattered exotic conifers and shelterbelts Deciduous exotic trees Willows by streams	Intense land use	Riparian margins Flooding High class soils	Levin-Koputaroa Levin-Ohau Kuku Manakau Downlands Tararua Teraaces
<b>'Nikau Belt'</b>	Lowland terraces Foothills Valley mouths Landforms softened by loess mantling and weathering	Vigorous, high nutrient-cycling regenerating species e.g. kohekohe Pockets of native forests and nikau palms	Kohekohe-dominant forests Smooth, compact canopies Soft bush edges Intensive land use	Ecological value of remnant and regenerating bush Earthworks conspicuous	Kuku Manakau Downlands Tararua Teraaces
<b>'Kamahi Country'</b>	Thin, leached soils Rocky, fast-flowing incised streams with steep banks High, steep terrain Foothills	Slower growth Tall regenerating native species e.g. rewarewa Reverting farmland e.g. tauhinu, bracken, manuka kamahi	Naturalness Regenerating cut-over forests Reverting farmland	Outstanding landscape Ecological value	Hill Country

\* NB: A landscape domain may cross two or more geomorphological domain boundaries.

## Appendix 2: Landscape Character Comparative Matrices

The following tables identify the elements that contribute to landscape character in the domains. Comparison of the elements within adjacent domains allows the main differences between the characters of the individual domains to become apparent. This is illustrated in the matrices that follow the tables.

### TABLES

#### 1. Land Cover

This refers to the visually dominant or otherwise significant vegetation of a domain. The information utilized is adapted from the Land Cover Data Base (LCDB) 2.

Categories include:

- Coastal sand and gravel
- Lake and pond
- Pine forests (open or closed canopy)
- Broadleaved indigenous hardwoods
- Deciduous hardwoods
- Manuka and/or kanuka
- Crop Land (short rotation)
- Herbaceous freshwater vegetation (wetland/swamp species)
- Grassland (High or Low producing exotic)

#### 2. Parcel Size

The measure for this category is taken from the following scale:

- < 0 – 5ha Very small
- >5 – 10ha Small
- <10 – 20ha Medium
- <20 – 40ha Large
- >40ha Very large

#### 3. Land Use:

This refers to the dominant land use of the domain.

The categories are:

- Farming (includes dairy, beef, sheep and other)
- Forestry (including pine and other exotic species)
- Horticulture (market gardens, orchards and other)
- Coastal residential (include bach settlements)
- Farm dwellings (on large parcels)
- Lifestyle (isolated, rural)
- Rural Residential (residential by nature and design)

### Modification/naturalness:

The levels of this are categorized as follows:

- Deforested (all indigenous vegetation removed)
- Drained wetlands (farm drains, canals)
- Modified landform (e.g. flattened dunes)
- Modified waterways (culverts, bridges, stopbanks)
- Remnant bush (small areas of indigenous vegetation)
- Regenerating bush (deforested area reverting to indigenous vegetation)
- Intact wetlands and waterways (no modification, indigenous vegetation)
- Indigenous bush

High Modification



High Naturalness

### Existing development

The level of visual density of existing development in a domain is scaled as follows:

- Extremely low (e.g. Hill Country)
- Low
- Medium-low
- Medium (e.g. Kuku)
- Medium-high
- High (e.g. Levin)

### Visual Context

This refers to the domain's 'sense of place' and is generated mainly by its location within the wider district catchment – e.g. proximity to range/river/coastal edge, and the perception this creates e.g. 'enclosed'/'exposed' etc).

- Enclosed
- Exposed
- Open
- Dynamic
- Natural
- Modified
- Rural
- Productive
- Remote
- Settled
- Distinctive characteristics

### Significant Landscape Features

- Historic sites
- DoC sites
- Sites of threatened indigenous species as identified in current planning maps
- Outstanding Landscape areas or features.
- Significant Reserves

### Sensitive land use features:

- Hydrological Catchment Area
- Landfill Site
- Sewerage Treatment Plant Sites

	Coastal Environment	Coastal Lakes
<b>Land Cover</b>	Pine forestry Pasture grasses Dune species Remnant wetland/bush	Pine forestry Pasture grasses Some dune species Remnant wetland/bush
<b>Parcel size</b>	Very large (except in settlements)	Medium/large to very large
<b>Land Use</b>	Farming Forestry Rural and holiday homes	Farming Forestry
<b>Modification/Naturalness</b>	Most dune systems intact but with forestry cover. Intact swamp areas but some drained Vegetation removed except for coastal edge. Estuaries and beaches largely intact	Modified and intact dunes Most swamps drained Deforested/reforested with exotic species Areas of high natural value
<b>Level of existing development</b>	Low - contained around coastal settlements	Low – isolated farm dwellings and buildings
<b>Visual Context</b>	Dynamic, exposed, generally modified, areas of high naturalness, distinct settlements, forest	Dynamic modified areas of high naturalness
<b>Sensitive landuse features</b>	Sewage Treatment Plants, Landfill	Sewage Treatment Plant
<b>Significant landscape features</b>	Estuarine/esplanade, foreshore, scenic and recreation reserves Designated heritage sites. Several identified sites of threatened plant species. Outstanding landscape features	Significant lacustrian areas, scenic and recreation reserves Designated heritage sites. Identified sites of threatened plant species, particularly around lakes Outstanding landscape features

	<b>Coastal Environment</b>	<b>Foxton Dunefields</b>
<b>Land Cover</b>	Pine forestry Pasture grasses Dune species Remnant wetland/bush	Pine forestry Pasture grasses Small remnant bush areas
<b>Parcel</b>	Very large (except in settlements)	Medium/large
<b>Land Use</b>	Farming Forestry Rural and Coastal residential dwellings	Farming Forestry Rural-residential
<b>Modification/Naturalness</b>	Most dune systems intact but with many with forestry cover Some drained swamp areas but many intact Vegetation removed except for coastal edge Estuaries and beaches largely intact	Mostly intact dunes with forestry cover Some modification to landform through levelling Little indigenous vegetation Modification to waterways
<b>Level of existing development</b>	Low - contained around coastal settlements	Medium-low, rural dwellings
<b>Visual Context</b>	Dynamic, exposed, generally modified, areas of high naturalness, distinct settlements, forested	Expansive, open, visually strong dunes, fewer natural areas, rural, forested
<b>Sensitive landuse features</b>	Sewage Treatment Plants, Landfill	Sewage Treatment Plant
<b>Significant landscape features</b>	Estuarine/esplanade, foreshore, scenic and recreation reserves Designated heritage structures and sites. Several identified sites of threatened plant species. Outstanding landscape features	Scenic and DoC reserves Designated heritage structures and sites Several identified sites of threatened plant species. Outstanding landscape features.

	<b>Coastal Lakes</b>	<b>Levin - Koputaroa</b>
<b>Land Cover</b>	Pine forestry Pasture grasses Remnant wetland/bush	Pasture grasses Horticultural crops
<b>Parcel</b>	Some medium-large dune species to very large	Small to medium-large
<b>Land Use</b>	Farming Forestry Rural Residential	Horticulture Farming Lifestyle
<b>Modification/Naturalness</b>	Modified and intact dunes. Most swamps drained. Deforested/reforested with exotic species. Areas of high natural value	Open deforested plains and terraces Exotic shelterbelts and riparian planting Modified and intact waterways
<b>Level of existing development</b>	Low - contained in coastal settlement areas. Isolated farm dwellings/buildings	Medium Isolated farm dwellings/buildings Dense near outskirts of Levin
<b>Visual Context</b>	Dynamic, generally modified, some areas of high naturalness	Open, expansive, rural/productive, more settled areas
<b>Sensitive landuse features</b>	Sewage Treatment Plant	
<b>Significant landscape features</b>	Significant lacustrian areas, scenic and recreation reserves Designated heritage sites. Identified threatened plant species, particularly around lakes Outstanding landscape features	Includes a portion of an outstanding landscape area

	<b>Coastal Lakes</b>	<b>Levin – Ohau</b>
<b>Land Cover</b>	Pine forestry Pasture grasses Remnant wetland/bush Some dune species	Pasture grasses Horticultural crops
<b>Parcel</b>	Medium/large and very large	Small to medium
<b>Land Use</b>	Farming Forestry	Farming Forestry Horticulture Rural residential
<b>Modification/Naturalness</b>	Modified and intact dunes. Most swamps drained. Deforested/reforested with exotic species. Areas of high natural value.	Open deforested plains Exotic shelterbelts and riparian planting Modified and intact waterways
<b>Level of existing development</b>	Low Isolated farm dwellings/buildings	Medium-high
<b>Visual Context</b>	Dynamic, generally modified, some areas of high naturalness	Varied topography, rural, productive, densely settled
<b>Sensitive landuse features</b>	Sewage Treatment Plant	
<b>Significant landscape features</b>	Significant lacustrian areas, scenic and recreation reserves Designated heritage sites. Identified threatened plant species, particularly around lakes Outstanding landscape features	Scenic reserves Designated heritage structures and sites.

	<b>Coastal Lakes</b>	<b>Kuku</b>
<b>Land Cover</b>	Pine forestry Pasture grasses Remnant wetland/bush Some dune species	Horticultural crops Pasture grasses
<b>Parcel</b>	Medium/large to few very large	Medium to medium-large
<b>Land Use</b>	Farming Forestry	Horticulture Farming Rural-Residential
<b>Modification/Naturalness</b>	Modified and intact dunes Most swamps drained. Deforested/reforested with exotic species. Areas of high natural value.	Modified and intact dunes and waterways Deforested/reforested with exotic species.
<b>Level of existing development</b>	Low Isolated farm dwellings/buildings	Medium
<b>Visual Context</b>	Dynamic, generally modified, some areas of high naturalness	Varied topography, productive, less suburban/more rural character
<b>Sensitive landuse features</b>	Sewage Treatment Plant	
<b>Significant landscape features</b>	Significant lacustrian areas, scenic and recreation reserves Designated heritage sites. Some identified threatened plant species, particularly around lakes Outstanding landscape features	Historic structures. One identified area of threatened plant species.

	<b>Kuku</b>	<b>Manakau Downlands</b>
<b>Land Cover</b>	Horticultural crops Pasture grasses	Horticultural crops Pasture grasses
<b>Parcel</b>	Medium to medium-large	Small to medium
<b>Land Use</b>	Horticulture Farming Rural Residential	Horticulture Farming Residential
<b>Modification/Naturalness</b>	Modified and intact dunes and waterways Deforested/reforested with exotic species	Deforested/reforested with exotic species
<b>Level of existing development</b>	Medium	Medium – high
<b>Visual Context</b>	Varied topography, productive, strong rural character,	Enclosed, productive, rural, strong settlement character
<b>Sensitive landuse features</b>		
<b>Significant landscape features</b>	Historic structures. One identified area of threatened plant species.	Historic structures. Outstanding landscape area

	<b>Kuku</b>	<b>Levin-Ohau</b>
<b>Land Cover</b>	Horticultural crops Pasture grasses	Horticultural crops Pasture grasses
<b>Parcel</b>	Medium to medium-large	Small to medium
<b>Land Use</b>	Horticulture Farming Rural Residential	Forestry Farming Horticulture Rural Residential
<b>Modification/Naturalness</b>	Modified and intact dunes and waterways Deforested/reforested with exotic species	Open deforested plains Exotic shelterbelts and riparian planting Modified and intact waterways
<b>Level of existing development</b>	Medium	Medium-high
<b>Visual Context</b>	Varied topography, productive, strong rural character	Varied topography, rural/productive, densely settled
<b>Sensitive landuse features</b>		
<b>Significant landscape features</b>	Historic structures. One identified area of threatened plant species	Scenic reserves, designated heritage structures and sites

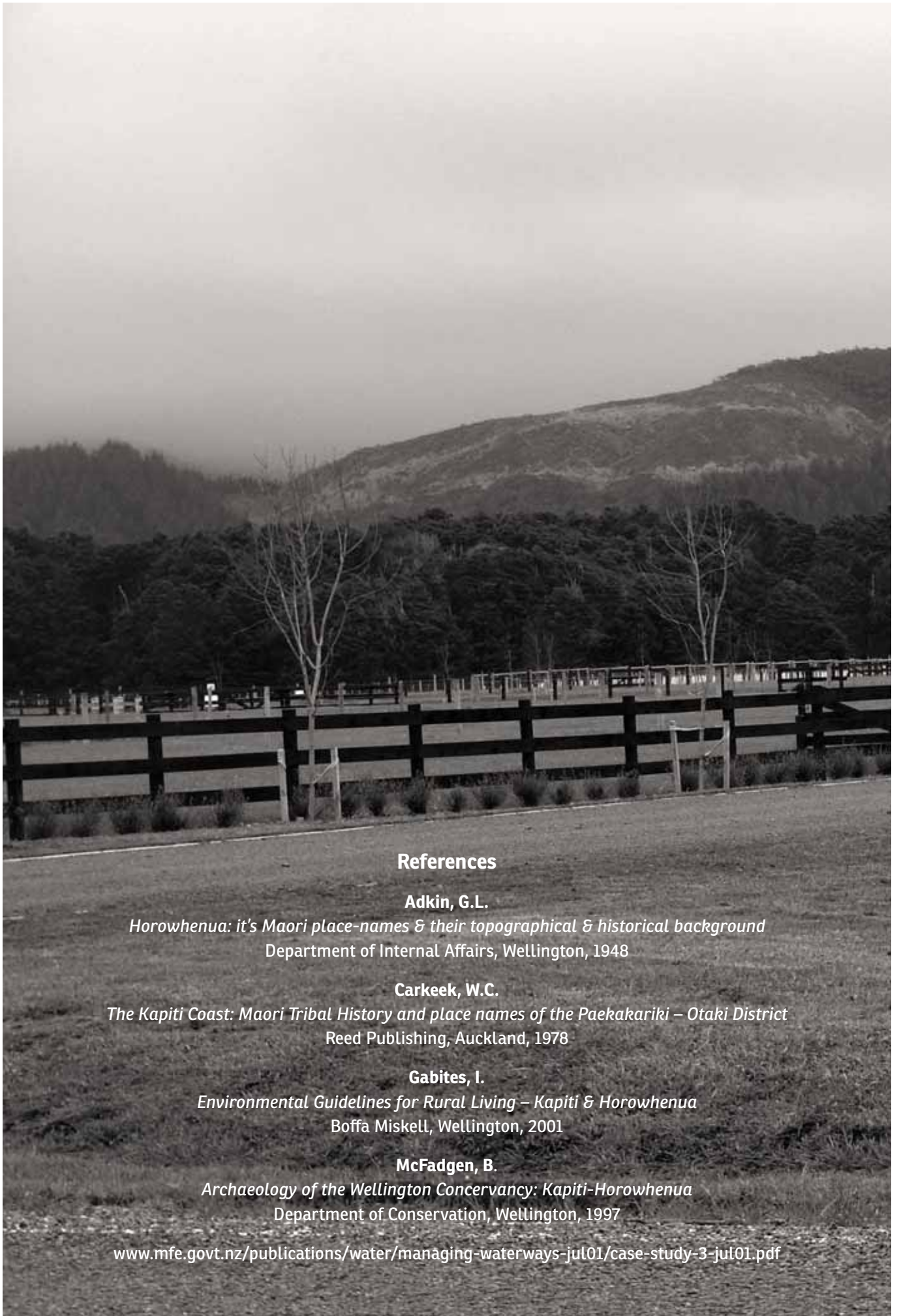
	<b>Levin-Koputaroa</b>	<b>Tararua Terraces</b>
<b>Land Cover</b>	Pasture grasses Horticultural crops	Pasture grasses Remnant bush and wetland areas
<b>Parcel</b>	Small to medium-large	Medium large to very large
<b>Land Use</b>	Horticulture Farming Lifestyle	Horticulture Large scale Farming Lifestyle
<b>Modification/Naturalness</b>	Open deforested plains and terraces Exotic shelterbelts and riparian planting Modified and intact waterways	Deforested terraces and flats Bush/scrub clad gullies Intact waterways
<b>Level of existing development</b>	Medium Isolated farm dwellings/buildings Dense near outskirts of Levin	Low Isolated farm dwellings/buildings
<b>Visual Context</b>	Open, expansive, rural/productive, more settled areas	Varied, dynamic, some enclosed areas, others elevated
<b>Sensitive landuse features</b>		
<b>Significant landscape features</b>	Includes a portion of an outstanding landscape area	Scenic and recreation reserves Historic structures

	Levin-Koputaroa	Moutua-Opiki
<b>Land Cover</b>	Horticultural crops Pasture grasses	Horticultural crops Pasture grasses
<b>Parcel</b>	Small to medium large	Medium to very large
<b>Land Use</b>	Horticulture Farming Lifestyle	Horticulture Farming
<b>Modification/Naturalness</b>	Open deforested plains and terraces Exotic shelterbelts and riparian planting Modified and intact waterways	Open deforested plains and terraces Exotic shelterbelts and riparian planting Modified and intact waterways
<b>Level of existing development</b>	Medium Isolated rural dwellings/buildings Dense near outskirts of Levin	Low Isolated farm dwellings/buildings Small areas of rural – residential
<b>Visual Context</b>	Open, expansive, rural/productive, more settled areas	Open, expansive, strongly productive, more rural, less settlement
<b>Sensitive landuse features</b>		Sewage Treatment Plants
<b>Significant landscape features</b>	Includes a portion of an outstanding landscape	Scenic reserves Soil conservation, river control and land drainage management sites Few identified areas of threatened plant species

	<b>Tararua Terraces</b>	<b>Moutua-Opiki</b>
<b>Land Cover</b>	Pine forestry Pasture grasses Remnant wetland/bush Some dune species	Pasture grasses Horticultural crops
<b>Parcel</b>	Medium/large and very large	Medium to very large
<b>Land Use</b>	Farming Forestry	Horticulture Farming
<b>Modification/Naturalness</b>	Modified and intact dunes. Most swamps drained. Deforested/reforested with exotic species. Areas of high natural value	Open deforested plains and terraces Exotic shelterbelts and riparian planting Modified and intact waterways
<b>Level of existing development</b>	Low Isolated farm dwellings/buildings	Low Isolated farm dwellings/buildings Small areas of rural – residential
<b>Visual Context</b>	Dynamic, generally modified, some areas of high naturalness	Open, expansive, strongly productive, more rural, less settlement
<b>Sensitive landuse features</b>	Sewage Treatment Plant	Sewage Treatment Plants
<b>Significant landscape features</b>	Significant lacustrian areas, scenic and recreation reserves Designated heritage sites. Identified threatened plant species, particularly around lakes Outstanding landscape features	Soil conservation, river control and land drainage management sites. Scenic reserves Few identified areas of threatened plant species

	<b>Moutua-Opiki</b>	<b>Foxton Dunefields</b>
<b>Land Cover</b>	Horticultural crops Pasture grasses	Pine forestry Pasture grasses Small remnant bush areas
<b>Parcel</b>	Medium to very large	Medium/large
<b>Land Use</b>	Horticulture Farming	Forestry Farming Rural residential
<b>Modification/Naturalness</b>	Open deforested plains and terraces Exotic shelterbelts and riparian planting Modified and intact waterways	Intact dunes with forestry cover Little indigenous vegetation Modified to waterways
<b>Level of existing development</b>	Low Isolated rural dwellings/ buildings Small areas of rural residential	Medium-low Rural dwellings
<b>Visual Context</b>	Open, expansive, strongly productive, more rural, low settlement	Expansive, less open, visually strong dunes, few natural areas rural, forested
<b>Sensitive landuse features</b>	Soil conservation, river control and land drainage management sites.	Sewage Treatment Plant
<b>Significant landscape features</b>	Scenic reserves Few identified areas of threatened plant species.	Outstanding landscape features Scenic and DoC reserves Designated heritage structures and sites. Several identified sites of threatened plant species.

	<b>Hill Country</b>
<b>Land Cover</b>	Forestry Indigenous bush
<b>Parcel</b>	Large to extremely large
<b>Land Use</b>	Forestry Reserve (recreation)
<b>Modification/Naturalness</b>	Some areas deforested and reforested with exotic species
<b>Level of existing development</b>	Extremely low
<b>Visual Context</b>	Remote, iconic, natural, highly scenic
<b>Sensitive landuse features</b>	Hydrological Catchment area
<b>Significant</b>	Identified outstanding landscape area



## References

**Adkin, G.L.**

*Horowhenua: it's Maori place-names & their topographical & historical background*  
Department of Internal Affairs, Wellington, 1948

**Carkeek, W.C.**

*The Kapiti Coast: Maori Tribal History and place names of the Paekakariki – Otaki District*  
Reed Publishing, Auckland, 1978

**Gabites, I.**

*Environmental Guidelines for Rural Living – Kapiti & Horowhenua*  
Boffa Miskell, Wellington, 2001

**McFadgen, B.**

*Archaeology of the Wellington Conservancy: Kapiti-Horowhenua*  
Department of Conservation, Wellington, 1997

[www.mfe.govt.nz/publications/water/managing-waterways-jul01/case-study-3-jul01.pdf](http://www.mfe.govt.nz/publications/water/managing-waterways-jul01/case-study-3-jul01.pdf)