

TRANSMISSION GULLY PROJECT

TECHNICAL REPORT #6

Terrestrial Vegetation & Habitats:
Description & Values
August 2011



Boffa Miskell

Front Cover Photo:

Beneath the canopy of a small fragment of kohekohe forest in the Te Puka valley (Site K229, Paekakariki bush I). This is one of areas of indigenous forest that will be partially lost beneath the project footprint within this catchment.

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EXECUTIVE SUMMARY

Introduction

This report presents the results of a survey of the flora, vegetation communities, and associated terrestrial habitats, in and around the Transmission Gully Alignment.

Methodology

The study has involved a desktop review of literature relevant to the botany of the study area with a focus on sites in, and adjacent to, the Transmission Gully Designation and including identification of all sites along the route that have been identified in earlier surveys.

Field investigations were then undertaken to map vegetation and confirm the presence or absence of rare plants. A small number of vegetation transects were carried out to better describe indigenous vegetation that is potentially affected. A rare plant survey was carried out in all habitats likely to contain rare species.

The significance of all terrestrial plant communities along the route was then assessed and the areas potentially affected by construction were quantified.

Resource description / desktop study

Base maps of the historical vegetation and current vegetation of the study area were produced from national data sets. This helped to identify vegetation communities now locally rare. The desktop study also identified a number of climatic, soil, and geological limitations to land use which can guide site selection and inform restoration activities. A range of rare plants that could potentially be found along the route was compiled to guide field investigation.

A total of 20 protected natural areas (PNA) and 17 significant natural areas (SNA) areas were identified that have historically been recorded either within the proposed Designation or immediately adjacent to it. These sites are listed and described.

Field Survey results

A detailed map of plant communities was prepared covering a corridor 500 m wide following the TG alignment. Several areas of vegetation with ecological value, that have not been previously described, were located and added to the list of sites for assessment. In total 6 ha of mature native forest and 11 ha of seral forest is affected by this project. A further 26 ha of mixed shrublands are affected. All remaining affected vegetation is farmed, rural residential, or in plantation pine.

Assessment of ecological value

It concludes with an assessment of the significance of the various plant communities along the route with recommendations for assessment of potential effects and mitigation. All areas of indigenous vegetation considered to have ecological value that were identified through the above processes were listed and assessed for significance. This process identified key plant communities and habitats that will be potentially affected, and a number that could be avoided during detail design.

Conclusion

The route lies within a highly modified landscape dominated by farming and rural lifestyle blocks. However, a number of areas of vegetation of significance have been identified that will be lost beneath the project Footprint and this effect will need to be mitigated. Other sites lie within the Designation but the potential exists through careful design to avoid or minimise effects. For other areas of value this process has confirmed that they will not be affected.

Recommendations

Recommendations are provided that relate to the development of a mitigation package, and the identification of sites where efforts should be made to avoid effects where practical.

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1. INTRODUCTION

1.1 BACKGROUND

This technical report is one of a series that report on ecological investigations being undertaken as part of the Transmission Gully Project (the “Project”), specifically in relation to NZTA 345PN Phase II Investigations, E&EA; work package “WS-08 Ecological Assessment, Survey, Modelling, and Management (BML, 2009). The purpose of Work Package 08 is to comprehensively map and describe the values of ecological systems that occur along this route, and associated link roads, and to describe the distribution and abundance of native flora and fauna within or in close proximity to the project Footprint. From this work the potential environmental effects of both the construction and ongoing operation of the proposed Transmission Gully highway will be assessed in a subsequent report (i.e. the Ecological Impact Assessment (EIA) report (Technical Report 11) and measures to mitigate potential or actual adverse effects will be developed.

The Transmission Gully Main Alignment is 27 km in length, running north between Wellington (Linden) and the Kapiti Coast (McKays Crossing). The main alignment and two link roads traverse a wide range of habitats from improved pasture, plantation forestry, shrublands, and scrub, to forest remnants. It ranges from sea level to 280 m in altitude and crosses 10 catchments, 6 of which discharge to Porirua Harbour, a nationally significant estuary.

The Transmission Gully Project (the Project) consists of three components:

- The “Transmission Gully Main Alignment” (*the Main Alignment*) involves construction and operation of a State Highway formed to expressway standard from Linden to McKays;
- The “Kenepuru Link Road” involves the construction and operation of a State Highway (limited access road) from the Kenepuru Interchange to Kenepuru Drive; and
- The “Porirua Link Roads” involves the construction and operation of two local roads connecting the Main Alignment to the existing eastern Porirua road network.

This report presents the results of the vegetation and habitat investigations undertaken along the Main Alignment from November 2009 to February 2010. The report also considers the habitat value of these plant communities as it is not logical to separate habitat value from species and community values when quoting historical studies of these sites, or when assessing the significance of plant communities. Note, however, that more detailed studies of terrestrial habitat are found in technical reports covering terrestrial fauna (Technical Report 6) and avifauna (Technical Report 7).

1.2 STUDY OBJECTIVES AND REPORT STRUCTURE

The Project covers a wide range of botanical environments, ranging from largely unmodified remnant forest through to large-scale exotic forestry operations and intensive pastoral farming. Within these varying vegetation types, there is a wide range of vegetation communities, largely reflecting historical and current land uses.

Across the wider study area, historical land clearance combined with over a century of stock and animal grazing has had significant effects on the current distribution of indigenous vegetation and species composition within almost all the vegetation communities present. Grazing and possum browsing was observed in almost all vegetation communities visited.

The objectives of the terrestrial vegetation assessment were to:

- Describe and map the terrestrial vegetation patterns and habitats in and immediately adjacent to the proposed Designation;

- Confirm the presence or absence of native flora species and, if present, determine their distribution in relation to habitat that will be affected by the activities associated with construction and operation of the highway;
- Assess the ecological and conservation values of these plant communities and habitats; and
- Provide sufficient survey and evaluation information to support the assessment of effects required for a resource consent application.

This report consists of six main parts:

1. A description of the study methodology;
2. A desktop review of the study area including climate, geology, soils, past and current vegetation, rare and threatened plants that may be present, and identification from records of all known sites of significance that could potentially be affected;
3. The results of field investigations, primarily the mapping and description of vegetation communities within the mapped corridor and the results of a rare plant survey;
4. An assessment of the ecological values and significance of all identified plant communities and habitats;
5. Concluding discussions and recommendations;
6. Appendices containing key reference material, species lists, transect results and site photographs.



The terrestrial vegetation and habitats described in this report also provide the basis of descriptions in the two Technical Reports addressing fauna:

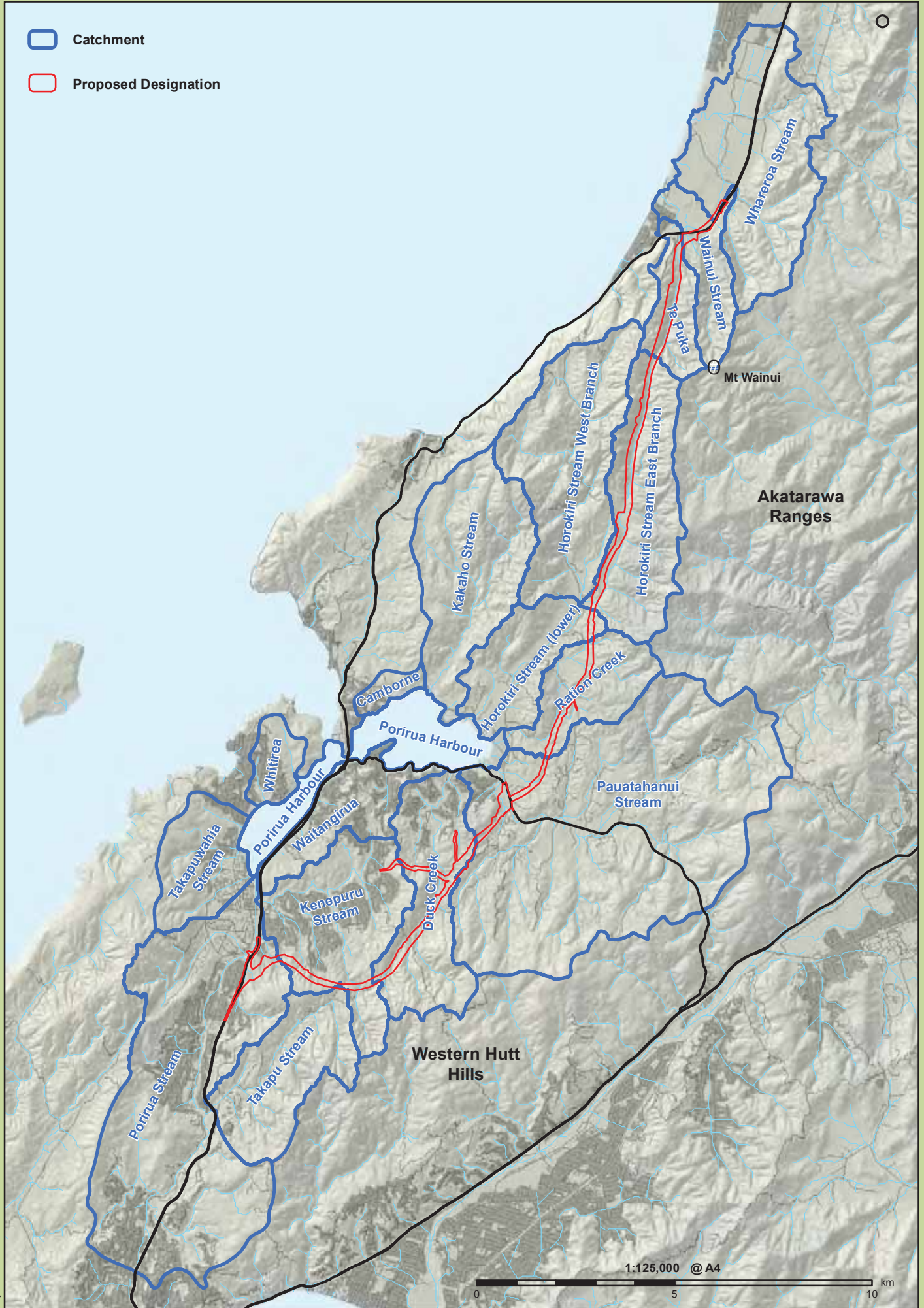
- TR 6: Herpetofauna & Terrestrial Macro-invertebrates: Description and Values;
- TR 7: Avifauna & Bats: Description and Values.

1.3 DEFINITIONS OF TERMS

In this assessment

- **“Footprint”** refers to the earthworks extent for the road including both the road surface and associated cuts and fills, but does not involve subsidiary works such as fill sites and sediment treatment devices which have not yet been designed. The Transmission Gully Footprint has an area of 172ha.
- **“Designation”** For the purpose of this assessment the Designation defines the maximum extent of direct effects on the sites ecology. This is on the understanding that, except where noted, the extent of the Designation has been determined to enclose all necessary construction activities, including the road and all subsidiary work such as sediment treatment and fill disposal. The Transmission Gully Designation has an area of 483ha.
- **“Corridor”** Vegetation was mapped for a corridor approximately 250 m wide and based on the centreline of the main alignment. This was done to provide a reasonable limit to the area that needed to be studied and mapped. Beyond this corridor, vegetation shown in maps is based on a national dataset (LCDBII). The area of the mapped corridor is 2,089ha.
- **“Study Area”** refers to all land, water bodies and receiving environments that could be potentially affected by the Project (also called **Zone of Influence**). To provide consistency between this and the other ecology technical reports (including Technical Report 9 Estuarine habitat and species) the study area includes all catchments that are crossed by the main Alignment or which feed into either arm of Porirua Harbour. It has a total area of 20,699ha
- Note that descriptions of the route are typically divided into catchments (See Figure 6.1).

-  Catchment
-  Proposed Designation



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2. PROJECT SCOPE

The Transmission Gully Main Alignment

The Main Alignment will provide an inland State Highway between Wellington (Linden) and the Kapiti Coast (McKays Crossing). Once completed, the Main Alignment will become part of State Highway 1 (SH1). The existing section of SH1 between Linden and McKays Crossing will likely become a local road.

The Main Alignment is part of the Wellington Northern Corridor (Wellington to Levin) road of national significance (RoNS). The Wellington Northern Corridor is one of the seven RoNS that were announced as part of the Government Policy Statement (GPS) on Land Transport Funding in May 2009. The focus of the RoNS is on improved route security, freight movement and tourism routes.

The Main Alignment will be approximately 27 km in length and will involve land under the administrative jurisdiction of four separate territorial authorities: Wellington City Council, Porirua City Council, Upper Hutt City Council, and Kapiti Coast District Council. The Main Alignment will be a motorway under section 71 of the Government Roothing Powers Act 1989 (GRPA).

The key design features of the Main Alignment are:

- Four lanes (two lanes in each direction with continuous median barrier separation);
- Rigid access control;
- Grade separated interchanges;
- Minimum horizontal and vertical design speeds of 100 km/h and 110 km/hr respectively; and
- Maximum gradient of 8%;
- Crawler lanes in some steep gradient sections to account for the significant speed differences between heavy and light vehicles.

Kenepuru Link Road

The Kenepuru Link Road will connect the Main Alignment to western Porirua, providing access from Kenepuru Drive to the Kenepuru Interchange. This road will be a State Highway (limited access road) designed to following standards:

- Two lanes (one in each direction);
- Design speeds of 50 km/h;
- Maximum gradient of 8%;
- Limited side access; and
- The Kenepuru Link Road will also be a limited access road under section 88 of the GRPA. Access to this road will be at the discretion of the NZTA.

Porirua Link Roads

The Porirua Link Roads will connect the Main Alignment to the eastern Porirua suburbs of Whitby (Whitby Link Road) and Waitangirua (Waitangirua Link Road). The Porirua Link Roads will be local roads designed to the following standards:

- Two lanes (one in each direction);
- Design speeds of 50 km/h;
- Maximum gradient of 10%; and
- Some side access will be permitted.

3. METHODOLOGY

3.1 INTRODUCTION

The following sections provide an overview of the field survey methods and desktop analysis used to describe and evaluate the terrestrial vegetation within the proposed Transmission Gully Designation.

The various methods described below form a systematic methodological structure, with desktop studies and mapping informing the selection of specifically located transect surveys (for the more 'important' forest communities), and botanical surveys of habitats most likely to contain rare and threatened plants.

3.2 DESKTOP ASSESSMENT

This study commenced with a review of published and unpublished information on the terrestrial flora of the proposed alignment, including PNA surveys, species lists, databases provided by District Councils and Greater Wellington Regional Council (GWRC), and national data sets produced by Landcare, Department of Conservation (DOC), NIWA and Ministry for the Environment (MfE). References to all these data sets are provided in the Bibliography, page 69.

Information on landforms, soils, and erosion was derived from the New Zealand Land Use Resource Inventory (Page 1990) and from Heine (1975).

Broad vegetation associations, past and present, were identified and described through a combination of LCDBII (MfE) and NZLRI (Landcare).

Protected Natural Area reports have been completed for the Foxton Ecological District (Ravine 1992), which extends into the northern corner of the study area, but have not been done for the remainder of the site.

The national threat classification of plant species was derived from de Lange *et al* (2009). The regional status of species was derived from the draft Conservation Management Strategy for the Wellington Conservancy (DoC 2010).

Botanical information was obtained from a large number of unpublished checklists of native vascular plant species undertaken by a number of authors and held by the Department of Conservation (Sawyer 2001).

Land Environments of New Zealand (LENZ) was used to determine the threat status of various "environments" within the corridor; based on comparison of predicted historical vegetation with the known current extent of remaining indigenous vegetation.

Details on the Footprint and Designation were provided by NZTA. Aerial photographs flown in late 2009 were provided by OPUS Consulting.

GIS information on significant natural areas surveys was provided by Kapiti Coast District Council (KCDC), Porirua City Council (PCC), Wellington City Council (WCC), the Queen Elizabeth II National Trust (QEII) and DOC

All published information about the study area was reviewed and base maps prepared prior to site inspections.

The common names used in the text and their Latin equivalents are listed in Appendix 6.A, page 73.

3.3 FIELDWORK

Field work was carried out over a number of weeks in November 2009, January 2010 and early February 2010. In addition data collected in 2008 as part of the Scheme Assessment was used.

During the survey particular attention was paid to vegetation communities known to be reduced from their former extent in the Wellington Ecological District and nationally (e.g. coastal and lowland forest, wetland areas). These vegetation communities were identified through the desktop review of maps and descriptions of historical and remnant vegetation. Where these sites fell within the project Designation they were visited to check for the presence of rare or threatened plant species, and in some instances vegetation transects were carried out to better describe them.

3.3.1 VEGETATION MAPPING

Vegetation patterns were mapped in the field onto high resolution colour aerial photographs overlaid with proposed Designation boundaries. For each mapped area notes were made on the canopy composition, species dominance and vegetation structure. The vegetation communities were described using the vegetation structural classes from Atkinson (1985).

To ensure all potentially affected vegetation communities were included within this assessment a corridor extending 250 m to either side of the centreline of the alignment was mapped. Vegetation shown on maps outside this 500 m wide corridor is based on the LDCBII national dataset.

The extent of vegetation mapped within this corridor is provided in Figure 6.2, page 8.

3.3.2 VEGETATION TRANSECTS

To support the description of the most important forest communities, rapid vegetation transects were conducted. The methods were based on those developed and modified by Atkinson (1985). This method provides a semi-quantitative assessment of canopy composition, together with descriptions of the landforms, the height and diameter of the canopy trees, regeneration, understory and floor cover.

The purpose of the transects was to assist in accurately describing the canopy composition of the forests including the contribution of lianes and epiphytes to the canopy, something that is not easily achieved from casual observation. The transects were also able to give us an impression of the age of the stands through measurements of stem size and density, and provided some information on the impact of browsing on regeneration and successions within these stands.

We sought to carry out transects in representative examples of each of the main native forest types; coastal kohekohe forest, sub-montane hardwood forest, and lowland tawa forest. In the Te Puka catchment the two largest of the eight potentially affected kohekohe fragments were surveyed. At the Wainui Saddle two sidling transects were placed within potentially affected sub-montane hardwood forest. The only potentially affected site containing lowland tawa forest is Porirua Park Bush and one transect was located here.

In addition, a large area of mahoe dominated scrub and low forest is potentially affected within and adjacent to Cannons Creek Bush, and two transects were located here to ensure our descriptions of this vegetation were accurate.

No transects were located in kanuka forest which, in the small areas affected, are essentially monocultures and are easily described. Similarly, transects were not placed in the extensive shrublands and scrub dominated by gorse and tauhinu, as the canopy composition and history of these communities is relatively easy to determine.

The locations of these transects are shown in Figure 6.2, page 8.

3.3.3 BOTANICAL SURVEY

Desktop studies determined the location of habitats where rare plants, known to occur locally, were most likely to occur. Botanical surveys and lists of vascular plants were compiled for six indigenous habitats within these locations, all within the Horokiri and Te Puka catchments.

Based on our desktop study, the distribution of all plant species of conservation concern that were potentially present within the designation, was limited to a small number of specific habitats which were: wetlands, mature or maturing native forest, secondary native forest abutting mature forest, and rock outcrops. These types of communities were the focus for botanical investigations. The locations are shown in Figure 6.2, page 8.

We did not carry out any botanical studies in: pasture; in young shrublands or scrub dominated by gorse and tauhinu regenerating in pasture; in kanuka scrub and forest; or in rural residential areas such as Ration where farmland has been recently subdivided.

Botanical survey work was undertaken between 10 and 12 March 2010 by Pat Enright and Matiu Park.

3.3.4 TIMING & EFFORT

Initial vegetation fieldwork was undertaken as part of a coordinated 'bio-blitz' from 21 through 25 January 2010. The 'bio-blitz' involved a team of ecologists undertaking an intensive site investigation together. For the vegetation study the entire alignment was either walked or driven to ensure all mapped vegetation was observed.

A second 'bio-blitz' was undertaken between 8 and 12 March 2010. On this series of visits the preliminary vegetation maps produced following the January visits were ground truthed. Also during this visit vegetation transects were completed and species lists compiled.

A final visit was carried out on 22 April 2010 to finalise maps and visit areas where further information was required.

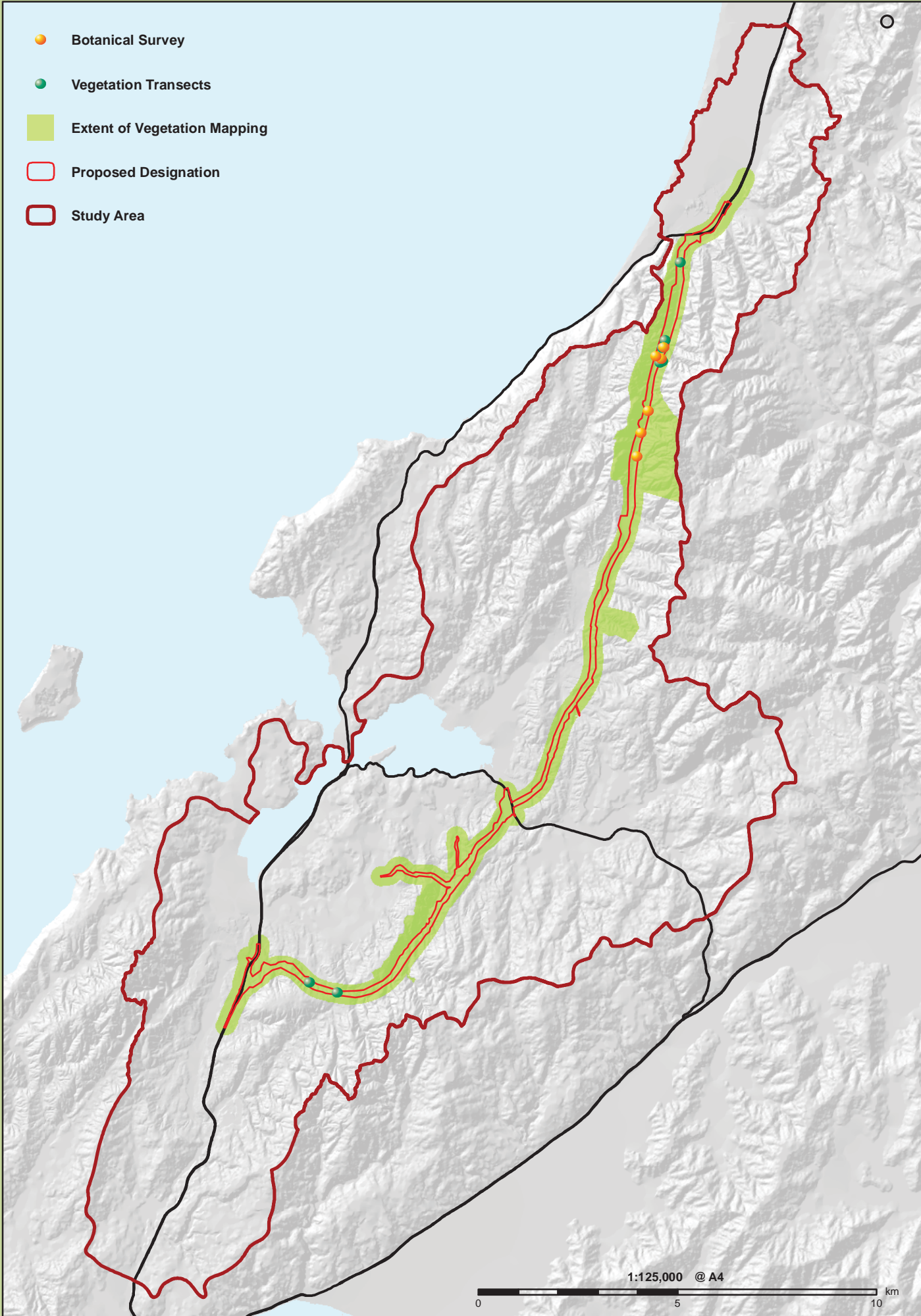
3.4 SURVEY CONSTRAINTS

Given the length of the alignment (27km) and the area of the Designation (483 ha) it is possible some small areas of vegetation have not been picked up in the vegetation mapping. Overall, however, we are confident we have mapped all indigenous plant communities and important habitats.

Also given the size of the study area, detailed botanical surveys were limited to specific locations identified through desktop studies and located during vegetation mapping. The focus was on areas of indigenous vegetation, naturally uncommon habitats, and habitats where rare plants may occur. The species list is therefore unlikely to be complete.

Botanical surveys were carried out during mid to late summer and may not have detected some species whose identification is limited to seasonal flowering.

- Botanical Survey
- Vegetation Transects
- Extent of Vegetation Mapping
- Proposed Designation
- Study Area



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0 5 10 km

3.5 ASSESSMENT OF ECOLOGICAL SIGNIFICANCE

3.5.1 INTRODUCTION

Assessment of significance is a necessary test under the Resource Management Act 1990. However, there is no nationally recognised assessment method. A range of methods have been developed by different agencies for different purposes, as can be seen from the three inventories of ecological sites that have previously been conducted across this project area (See section 4.9.2, page 35). This means that they are not comparable. The following sections describe the assessment methods used by other parties for parts of the route and how these have been accommodated to allow a consistent assessment of ecological value along the mapped corridor.

The study area extends across parts of five Districts. The mapped vegetation corridor within which the Designation lies, encounters four of these; Kapiti Coast, Upper Hutt City, Porirua, and Wellington. These are shown in Figure 6.3, page 14. These four councils have conducted inventories of sites of ecological significance, each of which is treated differently in their District Plan or associated documents, and each using different assessment criteria for significance.

3.5.2 KCDC SIGNIFICANCE CRITERIA

The Kapiti Coast District Council (KCDC) District Plan includes a schedule of sites of ecological significance (Part I; Section E: Heritage Register, Ecological Sites) which were identified by a study conducted in 2003 (Wildland Consultants 2003). This study used a method for assessing significance based on guidelines Wildlands developed for Environment Waikato (EW 2002). The assessment methodology is provided in Appendix 6.B, page 74. In summary, the classification rankings for KCDC sites are headed as follows:

<i>I</i>	<i>International</i>
<i>N</i>	<i>National</i>
<i>R</i>	<i>Regional</i>
<i>L</i>	<i>Local</i>

We note that the Wildlands study identified and described a number of sites which were not considered to have sufficient value at the District level to be included in the schedule, but which still have local values. These sites have also been considered in the following assessment.

3.5.3 PCC SIGNIFICANCE CRITERIA

The Porirua City Council (PCC) District Plan does not include a schedule of sites of ecological significance as is found in the KCDC plan. However, in 2000 Council commissioned an inventory of ecological sites (BML 2001) to aid in decision making. This inventory used a unique analysis tool for assessing significance. The reason for this is that so little original indigenous vegetation ("Old" sites) remains within this District that the value of shrublands and scrub ("New" sites) as habitat and refugia is elevated. The analysis tool took this into account. The criteria used are listed in Appendix 6.C, page 81. In summary the classification rankings for PCC sites are as follows:

- 1, 2 Highest ecological value. Priority for management action. Natural processes basically intact, minimum disturbance, good species diversity.*
- 3, 4 High ecological value*
- 5 Moderate ecological value. Low priority group for management action. Values reduced by disturbance and modification which is affecting natural processes and diversity.*
- 6 Not ecologically significant. Only of local value – amenity or other. May have a notable tree. Natural processes disrupted to the extent site unlikely to develop naturally.*

3.5.4 WCC SIGNIFICANCE CRITERIA

Unlike the other Districts, the Wellington City Council (WCC) District Plan includes a Conservation Sites Zone which covers the 32 sites of ecological significance identified during development of the Plan. The selection of these sites was guided by assessment criteria for ecological significance (Chapter 18.1.1. of the Plan) which are similar to Norton & Roper-Lindsay (2004) but have been broadened. In summary the assessment criteria headings are:

- *Rarity;*
- *Diversity;*
- *Distinctiveness;*
- *Continuity and linkage;*
- *National and regional importance;*
- *Size;*
- *Viability; and*
- *Other (Access, protection, pests, restoration potential).*

In addition to sites identified in the District Plan, WCC commissioned an inventory of ecological sites not included in the Conservation Sites listed in the plan (Park 1999). This inventory was intended to locate and describe the surviving traces of the “Primary Forests” that once covered Wellington before European settlement and does not include an assessment of significance. Whether a forest fragment was considered to be Primary Forest was determined by the presence of marker species in the canopy such as northern rata, any podocarp species, kohekohe, tawa, titoki, and hinau.

3.5.5 UHCC SIGNIFICANCE CRITERIA

The Upper Hutt City Council (UHCC) District Plan does not include a schedule of sites of ecological significance as is found in the KCDC plan. However it does include assessment criteria for identification of Significant Natural Areas (Chapter 12.7 of the Plan) for a future schedule. These criteria are similar to Norton & Roper-Lindsay (2004) but they have been broadened beyond ecological significance to include cultural and landscape values. In summary the assessment criteria headings are:

- *Representativeness;*
- *Rarity;*
- *Diversity;*
- *Distinctiveness;*
- *Continuity & Linkages;*
- *Cultural Values;*
- *Ecological Restoration;*
- *Landscape Integrity; and*
- *Sustainability.*

3.5.6 PROPOSED REGIONAL POLICY STATEMENT

As part of the proposed RPS, Greater Wellington Regional Council has developed a minimum set of criteria for the assessment of significance (Policy 22). The assessment criteria are provided in full in Appendix 6.D, page 83. In summary, the assessment criteria headings are:

- *Representativeness;*
- *Rarity;*
- *Diversity;*
- *Ecological Context*
- *Tangata Whenua values*

Historically representativeness was a measure of how closely community and species assemblages resembled an equivalent pre-human state (see O'Connor 1990). In these criteria the definition of representativeness means "ecosystems and habitats that were once typical and commonplace but which are now poorly represented in existing protected areas". It could be argued that this is a feature of rarity, not representativeness.

We note that Policy 22 has been appealed.

3.5.7 CASE LAW DEALING WITH ASSESSMENT OF ECOLOGICAL SIGNIFICANCE

Given the variability of approach in assessing significance of sites between Districts, another method was needed for this assessment that, while drawing on past assessments, provided a consistent approach for assessment of sites along the route and across District boundaries.

Many assessment criteria used by councils including UHCC and WCC are based on Norton & Roper-Lindsay (2004), although they are often modified. The core criteria are:

- *Rarity and distinctiveness;*
- *Representativeness;*
- *Ecological context; and*
- *Sustainability.*

These criteria have since been refined by a number of Environment Court decisions. Each has outlined a basic list of factors that should be assessed when making a determination. These decisions include:

- Minister of Conservation v Western Bay of Plenty District Council (A71/2001 at para 20);
- Royal Forest and Bird Protection Society v The Central Otago District Council (A128/2004 at para 31 and 32);
- Director-General of Conservation v The Wairoa District Council (W 081/2007); and
- Long Bay-Okura Great Park Society Incorporated v North Shore City Council (A078/2008).

Discussion over the outcomes of these decisions have centred on: 1) the definition of "representativeness" which has been used to both assess a communities' similarity to pre-human examples, and the remaining physical extent; and 2) whether sustainability or viability is a relevant criterion for the assessment of significance.

The most recent Court decision (interim) is from Shearer Swamp Incorporated v West Coast Regional Council (NZEnvC 345). While this decision relates predominantly to West Coast wetlands, it is notable that the experts caucusing on this case have moved physical extent from representativeness to rarity; and sustainability has been removed. The criteria are listed as:

Ecological Criteria

[137] A wetland is significant if it triggers any one of the following criteria:

- *ecological context;*
- *representativeness;*

- *rarity; and*
- *distinctiveness.*

Ecological context relates to the wetland's role in relation to the wider ecological area. Representativeness relates to how closely it resembles pre human communities. Rarity relates to species, communities or habitats as defined through a variety of systems. Distinctiveness relates to special or unique features. The criteria in full are to be found in Appendix 6.E, page 84.

We propose to apply these criteria to our assessments in this study, taking into account the work carried out by other authors for Councils, and the values identified in those studies.

3.5.8 OTHER ASSESSMENT CONSIDERATIONS

Other tools which assist in assessing significance include the LENZ threat class (Landcare); priorities set in the Wellington Conservancy Conservation Management Strategy (DOC 2010); and the National Priorities for protecting rare and threatened indigenous biodiversity (MfE 2007).

National Priorities for Protecting Rare and Threatened Indigenous Biodiversity

In 2007 the Ministry for the Environment developed a statement of National Priorities for Protecting Rare and Threatened Indigenous Biodiversity on private land (MfE 2007). This lists four national priorities. They are:

National Priority 1: *To protect indigenous vegetation associated with land environments (defined by Land Environments of New Zealand at Level IV), that have 20% or less remaining in indigenous cover.*

LENZ is a national environment-based classification of ecosystems mapped across New Zealand's landscape (Leathwick et al. 2003). Acutely threatened and chronically threatened level IV LENZ environments have < 20% cover of indigenous vegetation, and these areas have been specifically identified as a national priority (Priority #1) for protecting rare and threatened indigenous biodiversity on private land by the MFE (2007). Any reasonably sized and/or relatively un-modified areas of indigenous vegetation on this land environment should therefore be regarded as ecologically significant.

National Priority 2: *To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.*

National Priority 3: *To protect indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2.*

Seventy-two naturally rare ecosystems have been identified (Williams *et al.* 2007) defined as ecosystems having a total extent less than 0.5% of New Zealand's total area. Many of these ecosystems rely on specific rock and soil types which are not found locally. The ones of these that could potentially be found on the Transmission Gully route are:

<i>Cloud Forest</i>	<i>(high cloud cover (<1,500 sunshine hrs and >200 rain days p.a.) ;</i>
<i>Ephemeral wetlands</i>	<i>(seasonally high water table / depression. Herbfield);</i>
<i>Damp sand plains</i>	<i>(raw-recent / coastal/sand/depression/plains/permanently high water table. Open land, herbfield);</i>
<i>Dune slacks</i>	<i>(raw-recent / coastal/sand/depression/ permanently or seasonally high water table. Open land, herbfield); and</i>
<i>Estuaries:</i>	<i>Tidal and subtidal.</i>

National Priority 4: *To protect habitats of acutely and chronically threatened indigenous species.*

Wellington Conservation Management Strategy (CMS)

Within the Wellington Conservancy the ten highest priority ecosystems and habitats managed by the Department of Conservation in the Wellington CMS area (DOC 2010) are:

- indigenous forests;
- shrublands;
- freshwater wetlands;
- rivers and lakes;
- estuaries;
- dunes and dune wetlands;
- cliffs;
- herbfields and grasslands;
- islands; and
- marine environment.




Proposed National Policy Statement on Indigenous Biodiversity (NPSIB)

A set of assessment criteria have been included in the proposed NPSIB. Specifically Policy 2 requires that:

"In considering the effects of any matter, local authorities shall, in addition to any area of significant indigenous vegetation or a significant habitat of indigenous fauna identified in, or by, provisions of any relevant regional policy statement, or regional or district plan, regard the following as significant indigenous vegetation or significant habitat of indigenous fauna:

- a. the naturally uncommon ecosystem types listed in Schedule One*
- b. indigenous vegetation or habitats associated with sand dunes*
- c. indigenous vegetation or habitats associated with wetlands*
- d. land environments, defined by Land Environments of New Zealand at Level IV (2003), that have 20 per cent or less remaining in indigenous vegetation cover*
- e. habitats of threatened and at risk species."*

While the NPS has not yet been enacted and may change based on consideration of submissions, for completeness we have treated this as an "other matter". We have accordingly considered each of these criteria in this assessment.

-  TLA Boundaries
-  Proposed Designation
-  Study Area



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3.6 GLOSSARY OF ECOLOGICAL TERMS

Endemic: Species of plants and animals which are unique to an area or animals which may migrate but breed only in the area.

Ecological District: One of the major levels used for the ecological classification of land. New Zealand has been divided into 85 ecological regions and 269 ecological districts according to geological, topographical, climatic and biological features and processes. This reflects the small-scale variability of New Zealand's ecological patterns.

An ecological district is an area of land where topographic, climatic, soils and biological features and broad cultural patterns produce a characteristic landscape of biological communities. An ecological region comprises adjacent ecological districts with closely related characteristics; it may only include one ecological district with very distinctive features (McEwen, 1987).

Ecotone: A transitional zone between two habitats, which has distinct species or ecological characteristics of its own.

Habitat: The environment in which a particular species or group of species lives. It includes the physical and biotic characteristics that are relevant to the species concerned.

Seral Vegetation: A seral community (or sere) is an intermediate stage found in ecological succession in an ecosystem advancing towards its climax community. In many cases more than one seral stage evolves until climax conditions are attained.

Pioneer Vegetation: A plant or community that occurs early in a vegetation succession. Pioneer species possess characteristics that suit them to this ecological niche, notably: rapid growth; the production of copious, small, easily dispersed seed; and the ability to germinate and establish themselves on open sites.

Altitudinal Sequence of Vegetation: Vegetation of the hill country falls into a series of distinct altitudinal zones. Broadly in the central North Island these altitudinal zones are considered to be:

Lowland	sea level to 300m	
Montane	300 m to 600 m	
Subalpine	600 m to 1,200 m	
Alpine	1,200 m to 1,800 m	(Zotov et al, 1938)

Vegetation/Habitat Type Names:

<u>tawa</u>	over 50% cover of the double underlined species
<u>tawa</u>	between 25-49% cover of the underlined species
tawa	between 5-24% cover of non-underlined species
(tawa)	less than 5% cover. Generally used for emergent species.

Canopy structure is conveyed using the following approach:

- / Separates various tiers of the vegetation in the community description.
- links plants in the same tier.

Vegetation structural classes: are from Atkinson 1985. Ones relevant to this assessment are:

- **Forest:** Woody vegetation in which the cover of trees and shrubs in the canopy is >80% and in which tree cover exceeds that of shrubs. Trees are woody plants >10 cm diameter at breast height (dbh). Tree ferns >10 cm dbh are treated as trees.
- **Treeland:** Vegetation in which the cover of trees in the canopy is 20-80%, with tree cover exceeding that of any other growth form, and in which the trees form a discontinuous upper

canopy above either a lower canopy of predominantly non-woody vegetation or bare ground.

- **Scrub:** Woody vegetation in which the cover of shrubs and trees in the canopy is >80% and in which shrub cover exceeds that of trees (cf forest). Shrubs are woody plants <10 cm dbh.
- **Shrubland:** Vegetation in which the cover of shrubs in the canopy is 20-80% and in which the shrub cover exceeds that of any other growth form or bare ground. It is sometimes useful to separate tussock-shrublands as a subclass for areas where tussocks are >20% but less than shrubs. (Note: the term scrubland is not used in this classification.)
- **Herbfield:** Vegetation in which the cover of herbs in the canopy is 20-100% and in which the herb cover exceeds that of any other growth form or bare ground.
- **Boulderfield:** Land in which the area of unconsolidated bare boulders (>200 mm diam.) exceeds the area covered by any one class of plant growth-form. Boulderfields are named from the leading plant species when plant cover > 1%.

In addition to the terms listed above, Appendix 6.A provides a list of the common and scientific names of species listed in the text of this report.

4. DESKTOP STUDY RESULTS

4.1 ECOLOGICAL CONTEXT

The study area lies almost entirely within the Sounds-Wellington Ecological Region (39) and the Wellington Ecological District (39.01).

The Wellington Ecological District (ED) is characterised by steep, strongly faulted hills and ranges, and the Wellington and Porirua Harbours. The district is windy with frequent NW gales, warm summers, and mild winters. Rainfall is typically between 900 and 1400 mm p.a.

The ED includes a range of soils derived from greywacke and loess on slopes, and areas of peaty and stony alluvial soils in the valleys. Soils in the valleys range from sandy and silty well-drained soils of levees, through poorly drained heavier textured soils on the toe slopes and fans, to peaty soils in swamps. On the hilly rolling and flattish slopes, soils are moderately deep and formed from varying thicknesses of loess over greywacke. On the steep slopes there are shallow moderately leached steepland soils, mainly used for pastoral farming.

The ED was originally mostly forested but also included salt marsh communities around the inlets. The forests were rimu-rata/kohekohe forest nearer the coast; podocarp forests (kahikatea, totara, matai) on the hills; and miro-rimu/tawa forest at higher altitudes. The Porirua Basin was part of the Wellington beech gap. What little beech was present (black beech and hard beech) was confined to stands which extended over the ridgelines from the extensive beech forests of the Hutt Valley on the eastern fringes of the ED.

Today the ED is modified by farming and urbanisation, with pasture, gorse and regenerating shrublands throughout. Some small forest fragments occur. The vegetation includes a number of Cook Strait endemics typically along or near the coastal fringe (McEwen, 1987).

The far east of the study area along the ridgelines of the Horokiri and Te Puka valleys abuts the Tararua ED (38.01). The steep, high, dissected hills and mountains of this ecological district are apparent east of Wainui saddle. This ED is characterised by high winds, long periods of low cloud, and high rainfall ranging from 1,600 mm p.a. at low altitudes to 2,400 on the summit of the western summit of the Akatarawa Ranges above the Kapiti Coast, increasing to 8,000 mm in the Tararua Ranges. These high intensity rainfalls occasionally lead to flash flooding and small snowfalls. The steepland soils in the ED are derived from greywacke and are mainly shallow, stony and somewhat leached. In the lower altitude foothills, such as those seen around Wainui Saddle, are less leached and more fertile steepland soils. On these soils scrub reversion is rapid and often dominated by tauhinu.

The north of the study area extends a short distance into the Foxton Ecological District. This is an ED typified by coastal processes, dunes and wetlands as can be seen at Queen Elizabeth Park.

4.2 CLIMATE

4.2.1 General

Climate has a major influence on the vegetation patterns and implications for restoration and recovery of vegetation following works associated with this project.

The climate along the route can broadly be divided into: (1) the lowland valleys and basins in the southern part of the route (typically below 200 m a.s.l.), (2) the steeplands and mountainlands in the Upper Horokiri Valley (typically above 200 m a.s.l.) adjacent to the Akatarawa Ranges, and (3) the exposed coastal slopes of the Kapiti Coast and extending into the Te Puka valley.

The differences in climate across the route can be explained by differences in altitude, aspect and proximity to the coast. These result in substantial deviations from average values for wind, cloud, sunshine, and rainfall. This in turn is reflected in the variability of river flows (SKM Technical Report).

4.2.2 Rainfall

Average annual rainfall for Wellington and Porirua is 1,250 mm and rainfall is experienced on average for 123 days per annum (Table 6.1).

However, the mountainlands of the Akatarawa/Whakatiki catchments, that lie along the north eastern boundary of the study area, receive up to 2,390 mm on the western ridgeline above the Kapiti Coast and above the Horokiri Valley. The heaviest rainfall in these catchments occurs during north-westerly storms, reflecting their elevated position near the west coast. Rain falls on average 176 days a year in the headwaters of the Whakatiki catchment (WRC 1995).

4.2.3 Fogs and Orographic Cloud

Fog and orographic cloud (clouds that develop in response to the forced lifting of moist air by the earth's topography) is experienced in the higher hill country of the southern Tararuas, typically above 200 m. Fogs are usually associated with a weak southerly airflow or a clearing southerly change. Fogs are prevalent between November and May in Wellington.

Orographic cloud is perhaps the stronger influence in the higher portions of the route, occurring on the top ridges during prevailing northerlies and north-westerlies. In the headwaters of the Akatarawas, fog and low cloud occur on average 21 days a year and this is expected to also be experienced in the upper Horokiri Valley (GWRC 1995).

Fog and orographic cloud have three main ecological effects: reducing insolation; narrowing diurnal temperature range; and creating a more humid environment. Reduction of solar radiation by continuous cloud or mist has a large influence on daily temperature. Precipitation can be increased several-fold by condensation and leaf drip. At higher altitudes leaf drip leads to water logging, poor root development and to a susceptibility to drought. Water logging also results in slow mineralisation of organic materials and decreased availability of nutrients (Fuller 1986). All of these occur in and around the Mt Wainui summit.

4.2.4 Wind

Wind in the Wellington area is predominantly from the northwest, although strong salt laden southerly winds occur frequently. Reid (1981) states "Apart from Wharite Peak the highest measured mean speeds in New Zealand are found on the hills around Wellington. These high winds are associated with a more continuously windy regime near Cook Strait than is found in other parts of New Zealand".

The main western ridge of the Akatarawa Block lies only a short distance from the Kapiti Coast and north westerly gales have a marked effect on the ridge and upper slope vegetation. The effects of wind on vegetation in the Te Puka valley and the upper slopes of the Horokiri valley can be seen in windthrow, windshorn canopies, flag formed trees, poor growth, and protracted recovery of vegetation following disturbance.

Persistent dry north-westerlies have a strong desiccating effect on vegetation, and gales carry salt spray into the atmosphere which also influences vegetation and soils on exposed western slopes. Salt spray and associated desiccation is a major influence on the extent of coastal kohekohe dominated forest such as those found in the Te Puka Valley.

4.2.5 Temperature and Sunshine

The mean annual temperature in Wellington is 12.8°C. Coldest mean temperatures are experienced in July with a mean winter temperature of 8.8°C and mean maximum and minimums of 11°C and 6°C respectively. Warmest temperatures are experienced in February with the mean summer temperature of 17°C and mean maximum and minimums of 20°C and 13°C respectively (Table 6.1).

Temperature decreases with increasing altitude at a rate of approximately 0.5° Celsius per 100 metres. Temperature is also affected by wind duration and strength. At higher altitudes total sunshine hours are expected to be less, due to orographic cloud and fog. Mean annual temperatures at the higher altitudes around Wainui Saddle can be expected to be significantly lower (GWRC 1995).

Frosts can occur at any time of the year but are more common in winter. In Wellington they typically occur at lower altitudes in valleys and basins sheltered from the dominant warm north-westerlies, and where cold air is able to pond.

4.2.6 Implications for land use and management

The climate of the higher altitude sections of the route is typified by high rainfall, extreme winds, low temperatures compounded by frosts and occasional snow, and variable sunshine hours. These extremes can be expected year round and from both the north and south. Combined, these factors have a significant impact on vegetation growth, with altitudinal zonation of vegetation being a feature of the upper Horokiri and Te Puka catchments.

These climatic extremes also have an impact on soil formation and stability which will have an influence on plant growth rates and vegetation recovery.

The southern section of the route (south of Battle Hill Regional Farm Park) has less extreme weather patterns, with generally warmer temperatures, less extreme winds and less extreme rainfalls. This section, in contrast, is more likely to suffer from summer drought with associated impacts on plant growth and survival. Basins in the southern section of the route may also be susceptible to frost and a number of species of native tree are susceptible to frost damage. Revegetation in some areas such as Battle Hill, Ration Creek and Pauatahanui will need to take this into account.

Table 6.1. Weather Summaries for Wellington (Source NIWA Website)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean temp (°C)	16.9	17.1	15.8	13.8	11.5	9.5	8.8	9.2	10.6	12.0	13.4	15.3	12.8
Average high (°C)	20.3	20.6	19	16.7	14.2	12	11.4	12	13.5	15	16.6	18.5	15.8
Average low (°C)	13.4	13.6	12.6	10.9	8.8	6.9	6.3	6.5	7.7	9	10.3	12.2	9.9
Precipitation (mm)	72	62	92	100	117	147	136	123	100	115	99	86	1,249
Sunshine hours	246	209	191	155	128	98	117	136	156	193	210	226	2,065
Wet Days	7	7	8	9	11	14	13	13	12	12	10	8	123

4.3 GEOLOGY & TOPOGRAPHY

From Mckays Crossing the TG alignment climbs steeply to its maximum altitude of 275 m a.s.l. at Wainui Saddle. It then descends gradually down Horokiri Stream to 75 m a.s.l. at Battle Hill. From here it climbs slightly to the ridge separating Horokiri Stream from Ration Stream at 105 m a.s.l., then descends gradually to Pauatahanui Stream which is near sea level. From Pauatahanui Stream it climbs to Duck Creek, sidling along the eastern slopes to the saddle with Cannons Creek at 160 m a.s.l. From Cannons Creek it sidles across steep slopes above Porirua East at approximately 130 m to 160 m a.s.l., then descends steeply to SH1 at Linden at 50 m a.s.l.

The NZLRI identifies seven distinct geological zones within the study area (not including Town/Urban and Harbours). These zones are summarised in Table 6.2 which shows both their total extent within the wider study area and the proportion contained within the project Designation. These landforms are shown in Figure 6.4. Within these seven zones there is a finer gradation of 32 landforms. These are presented in detail in Appendix 6.F, page 87. The zones are:

Table 6.2. Geology of the Study Area (Derived from NZLRI, Page 1995)

Description	Study Area (ha)	% of Study Area	Designation (ha)	% of Total Designation
Sand country				
– Kapiti Coast and in proximity to Pauatahanui inlet	306	1%	2	0%
Peat bogs, swamps and basins				
– Associated with dune depressions and in some of the valley floors near Pauatahanui inlet	404	2%	5	1%
Low alluvial plains and terraces				
– River mouths and associated lowlands surrounding Porirua Harbour	400	2%	32	7%
Medium height stony alluvial terraces				
– Within Pauatahanui catchment and parts of Horokiri valley	343	2%	48	10%
High dissected loess covered terraceland				
– Upper Porirua and Pauatahanui catchments.	1,935	9%	80	16%
Greywacke hill country				
– The dominant landform of the study area.	11,572	56%	288	60%
Greywacke mountainlands and associated foothills				
– On the boundary of the Akatarawa-Whakatikei and the eastern margins of the Pauatahanui, Horokiri and Te Puka catchments.	2,026	10%	12	3%
Town / Urban	3,003	15%	16	3%
Harbour	710	3%	0	0%
TOTALS	20,699	100%	483	100%

In summary, the great majority (60% or 288ha) of the alignment lies in Greywacke hill country the strongly rolling to steep greywacke hill country of the Te Puka, upper Horokiri, Duck, and Kenepuru/Porirua catchments. The next largest proportion of the alignment (33% or 160ha) lies on rolling to strongly rolling alluvial plains and terraceland within the lower Horokiri, Ration, and Pauatahanui catchments. Small areas of the alignment (1.5% or 7ha) lie on sand country and associated swamp lands (around McKays crossing), or on excessively steep and erosion prone mountainlands (3% or 16ha) in the upper Horokiri and Te Puka catchments.

4.4 SOILS

Table 6.3 provides additional detail on the soils found within each of the geological zones described above. There is a close relationship between soil, climate and vegetation communities, both in terms of pathways and timeframes for regeneration and the final vegetation patterns that form. Because of this it is possible to map with some accuracy historical vegetation from a soil map combined with an understanding of other local influences.

The NZLRI identifies 24 different soil types within the study area. These are grouped and summarised in Table 6.3 which shows both their total extent within the study area and the proportion contained within the TG Designation. More detail of these soils is provided in Appendix 6.F, page 87.

Table 6.3. Soils of the Study Area

		Study Area (ha)	% of Study Area	Designatio n (ha)	% of Total Designatio n
Sand country					
7e3, 6e5, 6s6	Waitere sands & Foxton Black Sands	266	1%	2	0%
4e3	Pukerua loamy sand	39	0%	0	0%
6s2	Titahi hill soils	2	0%	0	0%
Peat bogs, swamps and basins					
3w2, 4w3	Paraparaumu & Omanuka peat soils	404	2%	5	1%
Low alluvial plains & terraces					
4s1	Waikanae gravelly sands	35	0%	10	2%
2w1, 3w1	Waiwhetu sandy loam & silt loams	309	1%	22	5%
7w2	Pauatahanui shelly sands	56	0%	0	0%
Medium height stony alluvial terraces					
2s3, 3s2, 4s2	Heretaunga silt loams & silty clay loams	343	2%	48	10%
High dissected loess covered terraceland					
3s3,4e1, 6s1	Judgeford hill soils	1,935	9%	80	16%
Greywacke hill country					
6c2, 6s6	Korokoro hill soils	6,745	33%	194	40%
6e3	Porirua & Paremata hill soils	692	3%	2	0%
6e6, 7e1	Makara steepland soils	4,095	20%	92	19%
7e4, 8e2	Terawhiti steepland soils.	40	0%	0	0%
Greywacke mountainlands and foothills					
6c1	Belmont hill soils	1,085	5%	0	0%
6e8	Akatarawa hill soils	104	1%	0	0%
6e10, 7c1	Renata hill soils	49	0%	0	0%
7e2,	Ruahine steepland soils.	788	4%	12	3%
7e5, 8e3	Rimutaka steepland soils.	124	0%	0	0%
Town / Urban (including Porirua Harbour)		3,713	3,713	18%	16
TOTALS		20,699	100%	483	100%

In summary, the majority of the route (over 90%) lies on five soil groups: Makara steepland soils (19%) mostly in the upper Horokiri and Te Puka catchments; Korokoro hill soils (40%) and Judgeford hill soils (16%) around the Duck and Porirua catchments; and Heretaunga silt and clay loams (10%) and Waiwhetu sandy and silty loams (5%) on the terraces and basins of the lower Horokiri, Ration, Pauatahanui catchments. A variety of other soils have small representations, but no others exceed 5% or 12 ha of the total Designation area.

Each of these soils has a range of limitations which are described in detail in section 6.6.

4.5 SLOPE

The study area varies from flat ground to very steep slopes (Table 6.4). A large proportion of the study area is flat to rolling (52%), 24% is hilly and the remaining 26% is steep to very steep.

The Wellington Regional Soil Plan identifies any slope exceeding 28° within this part of the Region as Erosion Prone, with specific rules in the plan relating to this. Slopes over 28° are shown in Figure 6.5, page 26.

Table 6.4. Slopes of the Study Area

Description	Code	Study Area ha	% of Study Area	Designation (ha)	% of Total Designation
Flat to Undulating	0-3°	5,117	25%	71	15%
Undulating	3-7°	1,911	9%	57	12%
Rolling	7-15°	3,837	19%	106	22%
Hilly	15-25°	4,968	24%	122	25%
Steep	25-34°	3,190	15%	76	16%
Very Steep	>34°	1,676	8%	50	10%
TOTALS		20,699	100%	483.3	100%

4.6 IMPLICATIONS OF CLIMATE, GEOLOGY, SOIL, AND SLOPE FOR LAND USE

NZLRI provides an assessment of the suitability of land for production. Generally classes 1, 2, 3 & 4 are suitable for arable uses, classes 5 and 6 are suitable for non-arable uses, and classes 7 and 8 land is not suitable for production and should be left in forest for protection. These categories are then further subdivided based on the major limitation to their use whether it is climate (c), erosion (e), soil (s), or wetness (w).

Table 6.5 identifies the structure, limitations, past vegetation, and general locations of soils and landforms found within the Designation.

Table 6.5. Erosion Potential

LUC Unit	LUC Description
Sand Country	
6s5	<ul style="list-style-type: none"> – Foxton Black Sands. Recent, unconsolidated excessively drained sand dunes near the coast. – Potential for very severe to extreme wind erosion. Maintenance of complete vegetation cover necessary. – Pre European vegetation would have been coastal shrublands and low coastal forest. – Locations: QE Park to Paekakariki township (1.7 ha, 0.4% of Designation)
Peat bogs, swamps and basins	
3w 2	<ul style="list-style-type: none"> – Paraparaumu peaty loams with peat overlying sand. – Potential erosion is negligible. – Pre European vegetation a rush / sedgeland and manuka scrub mosaic with areas of semi swamp forest. – Locations: Adjacent SH1 from TG exit to McKay's crossing (4.9 ha, 1.0% of Designation).
Low alluvial plains and terraces	
4s 1	<ul style="list-style-type: none"> – Waikanae gravelly sand - fine grained alluviums. – Potential for flooding and moderate stream bank erosion & deposition. Streambank protection. – Pre European forests would have been a podocarp (totara) / tawa forest. – Locations: South of 2w1 at SH1 south (10.3ha, 2.1% of Designation).

2w1 & 3w1	<ul style="list-style-type: none"> – Waiwhetu sandy loam and silt loams. Recent soils on imperfectly to poorly drained alluvial valley floors – Potential for occasional flooding & slight to moderate streambank erosion. Streambank protection. – Pre European vegetation would have been podocarp forest (kahikatea-rimu-totara). – Locations: 2W1 Gravel terraces at confluence of Te Puka and Waiuni Stream west of SH1 (Kapiti Coast). 3W1 in wide valley floors in the lower reaches of Kakaho Stream, Lower Horokiri Stream, Ration Stream, Pauatahanui Stream (Lanes Flats) immediately upstream of tidal influence (21.9ha, 4.6% of Designation).
Medium height stony alluvial terraces	
2s3 & 3s2	<ul style="list-style-type: none"> – Heretaunga Silt loams and stony silt loams. Well to somewhat excessively drained shallow stony soils subject to seasonal soil moisture deficits on alluvial terraces. – Potential erosion is negligible. Soil conservation = nil – Pre European vegetation would have been a podocarp – broadleaved forest possible with some silver or hard beech. – Locations: Terraces in Horokiri East and Battle Hill, terraces in Pauatahanui Stream headwaters (48.4ha, 10% of Designation).
High dissected loess covered terraceland	
3s3, 4e1, & 6s1	<ul style="list-style-type: none"> – Judgeford & Ngaio hill soils. Moderately drained high terraces and fans and low stable hills of consolidated weathered gravels mantled with loess. – Potential erosion is slight sheet and rill when exposed or cultivated. Soil conservation = contour cultivation – Pre European vegetation would have been a rimu-rata/hinau-tawa forest. – Locations: High terraces in upper Ration, lower Te Puka valley, above McKay's, and between Horokiri and Kakaho, rolling low hills across site, Cannons Creek, Pauatahanui, Horokiri, Whareroa, valley floor and lower slopes of Pauatahanui, Ration, Lower Duck, Kakaho, upper Porirua streams (79.7ha, 16.5% of Designation).
Greywacke hill country	
6c2, 6e6, &6s6	<ul style="list-style-type: none"> – Korokoro hill soils from patchy loess over weathered greywacke on exposed greywacke ridgetops and hill country. Soils are shallow, well to excessively drained, and subject to seasonal soil moisture deficits. – Potential for moderate soil slip, scree and sheet erosion where forest cover is removed. Maintenance of complete vegetation cover is recommended. Pastures prone to scrub reversion. – Pre European vegetation would have been rimu-rata/tawa/kohekohe forest. – Locations: Ridgeline and Short spurs predominantly on the eastern side of the study area descending from the rolling ridgetops, in Porirua Catchment, and low ridges in Horokiri and Kakaho. Basin and lower slopes on western side of the study area in Duck Creek and Takapu Stream (195.8ha, 40.5% of Designation).
7e 1	<ul style="list-style-type: none"> – Makara steepland soils formed from greywacke and related slope deposits on steep to very steep hill country with seasonal soil moisture deficiencies. The hill country occurs between 50 and 400 m a.s.l. – Potential for moderate scree, sheet and soil slip erosion. Maintenance of complete vegetation cover is necessary. Strict management guidelines needed for; logging, road construction, drain and culvert construction, and scrub clearance, to minimise soil erosion and maintain water quality, – Pre European vegetation would have been rimu-rata/tawa/kohekohe forest. – Locations: Gullies and steep headwaters predominantly found in Coastal hills, Horokiri East, upper Pauatahanui and parts of Takapu Valley (92ha, 19% of Designation).
Greywacke mountainlands and associated foothills	
7e 2	<ul style="list-style-type: none"> – Ruahine steepland soils on steep to very steep greywacke hill country in the foothills of mountain ranges. Soils are shallow and of low fertility. – Potential for severe soil slip, scree and sheet erosion. Maintenance of complete vegetation cover is necessary. – Pre human vegetation dominated by either hard beech, or mixtures of hard beech, kamahi, mahoe and mamaku. – Locations: Escarpments on the eastern slopes Horokiri and north east Pauatahanui catchments (12.4ha, 2.6% of Designation).

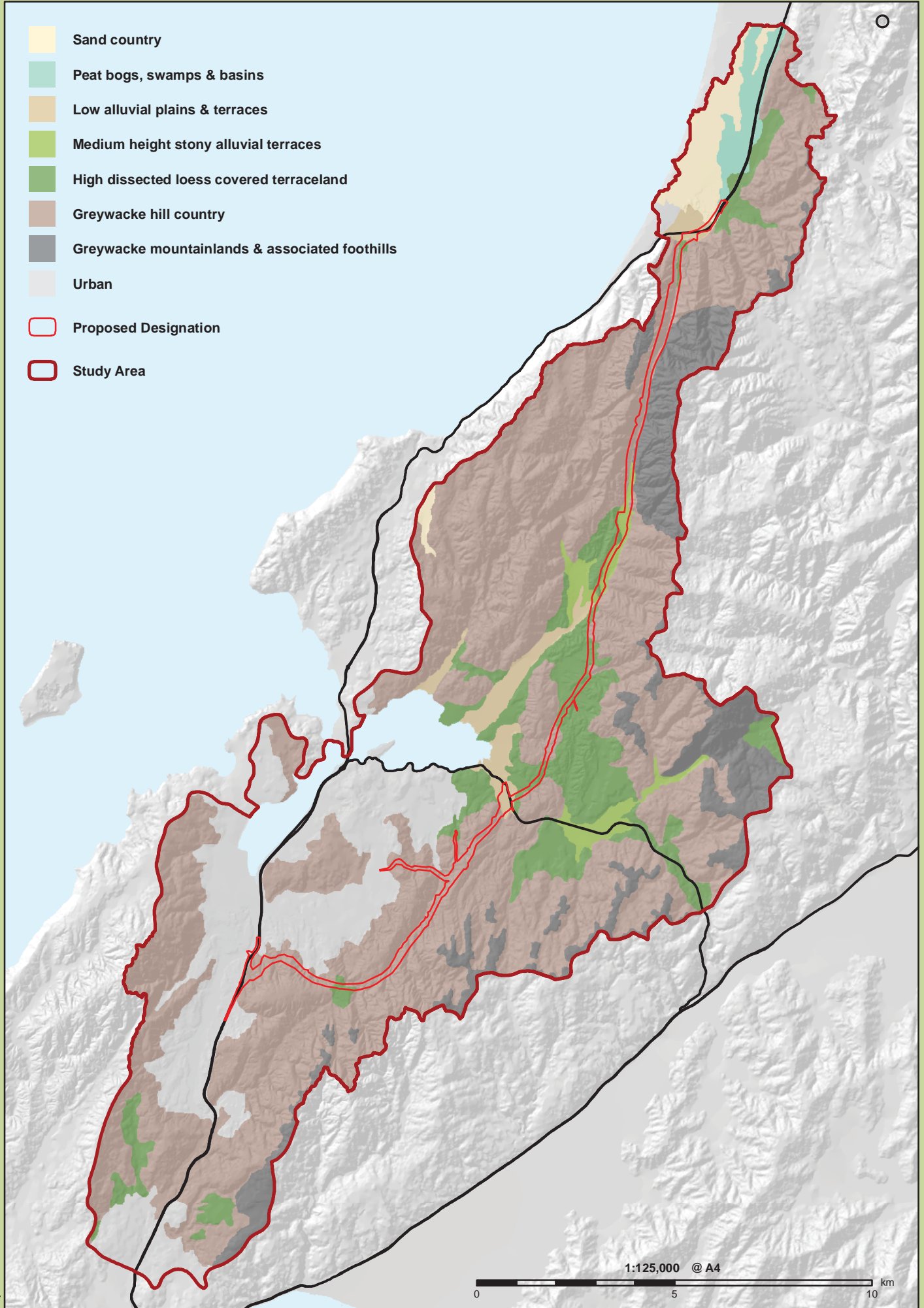
As can be seen in the preceding tables, a significant proportion (104ha, 23%) of the TG Designation lies in Class 7 and 8 land, with steep to very steep slopes and soils derived from slope deposits and colluvium. They are not considered appropriate for farming. In these areas erosion and climate are the two dominant limitations on land use. The maintenance of a complete vegetation cover is recommended and strict management guidelines are recommended for logging, road construction, drain and culvert construction, and scrub clearance, to minimise soil erosion and maintain water quality. These areas are typically found under the reverting unproductive pasture such as those seen in the upper Horokiri and Te Puka valleys where they are the dominant land classification.

A further 240 ha (50%) of the Designation lies on class 5 and 6 land, strongly rolling to steep hill country often with soils formed from loess deposits over weathered greywacke. These are appropriate for non-arable farming but still have major limitations for land use, typically relating to soil moisture deficits and potential erosion.

The remaining 135 ha (27%) for the route lies on class 1, 2 and 3 land, terraces and downlands with soils typically formed from alluvium and loess. These have fewer limitations, typically relating to either soil fertility or soil moisture. Soil moisture limitations usually relate to seasonal water-logging.

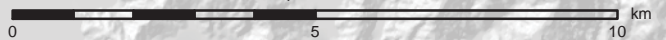
These factors should be considered as part of any future mitigation package.





- Sand country
- Peat bogs, swamps & basins
- Low alluvial plains & terraces
- Medium height stony alluvial terraces
- High dissected loess covered terraceland
- Greywacke hill country
- Greywacke mountainlands & associated foothills
- Urban
- Proposed Designation
- Study Area

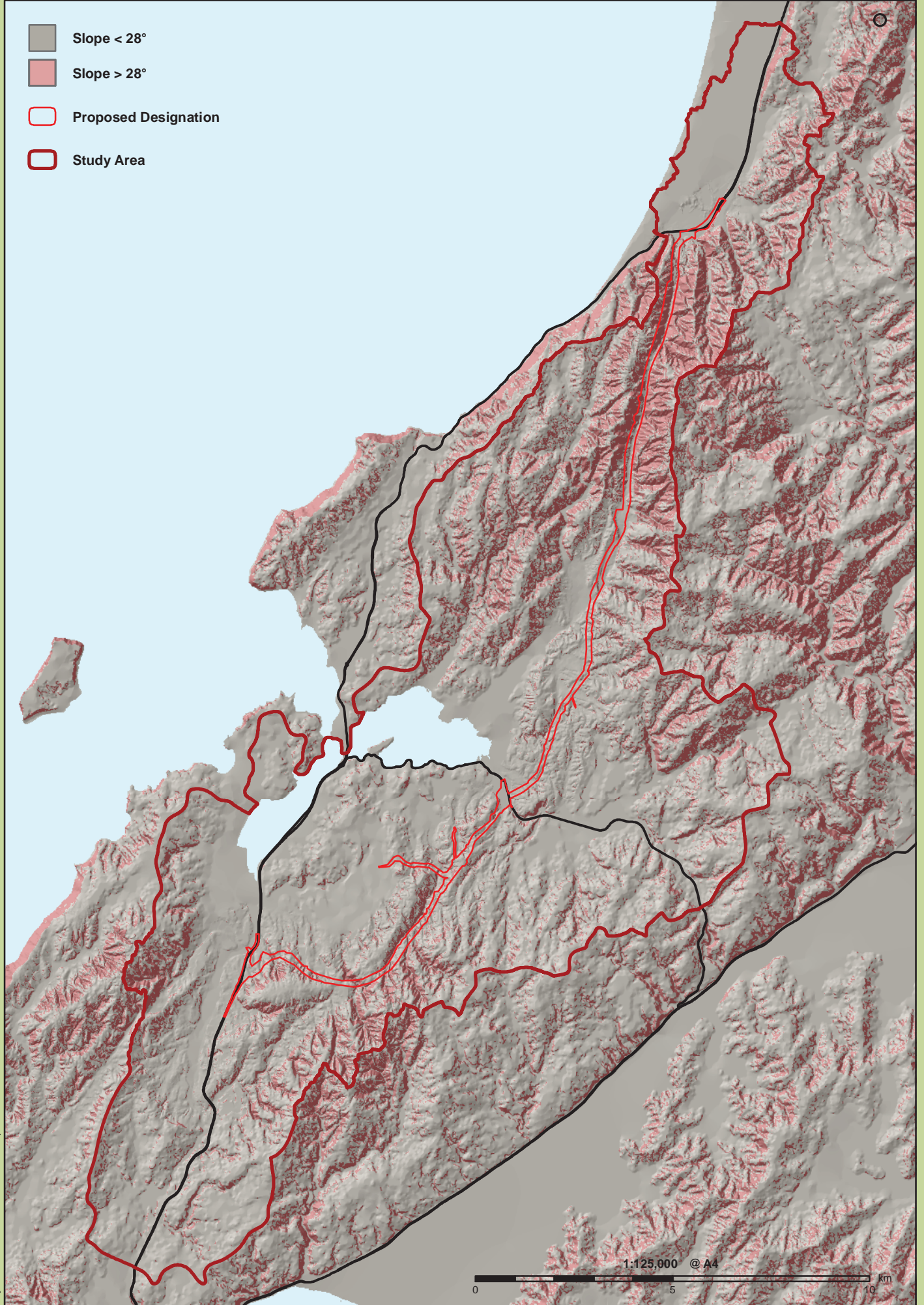


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-  Slope < 28°
-  Slope > 28°
-  Proposed Designation
-  Study Area



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4.7 VEGETATION OF THE STUDY AREA

4.7.1 Pre Human Vegetation

The extent of historical (pre-human) vegetation can be defined with varying degrees of accuracy from a number of sources. New Zealand's "Potential Vegetation" has been mapped using the LENZ model (Leathwick & et.al, 2002). However, this model does not take adequate account of coastal influences, typically underestimates shrubland communities, and at this site overestimates the extent of beech forest in what is part of the Wellington beech gap (see Table 6.6).

A more accurate picture of pre-human vegetation can be developed from Wellington soil maps (Heine, 1975) in combination with NZLRI (Page, 1995), see Table 6.7. However, these two sources are also limited in that they do not extend beneath urban areas and so do not describe the likely vegetation on the valley floors and hillsides of approximately 18% of the study area. Despite this limitation Figure 6.6 has been produced from these two data sets. Vegetation is sorted from low stature grasslands, through shrubland and scrub, to forest.

Table 6.6. Potential Vegetation (Derived from LENZ)

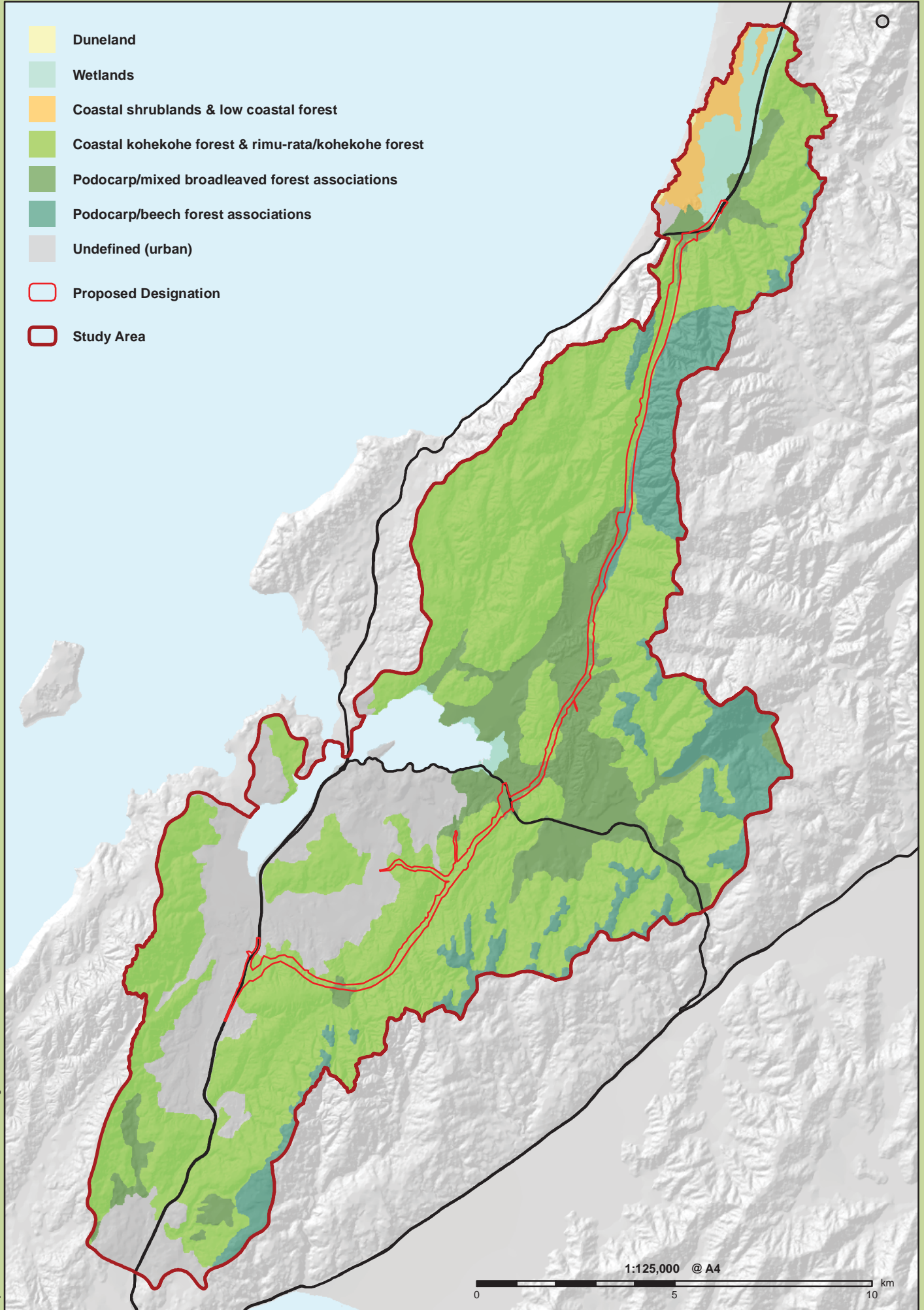
Sort	Description	Study Area ha	% of Study Area
1	Dunelands	352	2%
1	Wetland	366	2%
2	Coastal shrublands & low coastal forest.	na	na
4	Rimu-rata/tawa-kohekohe forest.	na	na
5	Podocarp - broadleaf forest associations	15,899	77%
6	Podocarp - beech forest associations	3,348	16%
7	Unclassified (Porirua Harbour)	734	4%
TOTALS		20,699	100%

Table 6.7. Pre-Human Vegetation (Derived from NZLRI)

Sort	Description	Study Area ha	% of Study Area
1	Dunelands	8	0%
1	Wetland	460	2%
2	Coastal shrublands & low coastal forest.	1,030	5%
4	Rimu-rata/tawa-kohekohe forest.	11,925	58%
5	Podocarp - broadleaf forest associations	2,517	12%
6	Podocarp - beech forest associations	1,046	5%
7	Unclassified (Urban – Porirua Harbour))	3,713	18%
TOTALS		20,699	100%

Furthermore, neither of these systems picks up the smaller scale variations that would have occurred. For example, within these forest associations there would have been additional diversity of dominant species depending on whether the site was north or south-facing, subject to frost or drought, or had impeded drainage. In the coastal sites, ngaio and nikau would also have been abundant. Tawa, hinau and titoki would have increased in abundance on moister and south-facing lowland sites. Pukatea, kahikatea and tree ferns would have dominated moist gullies throughout. Kamahi, miro, and hinau would have increased in abundance with altitude. Additional discussion of the ecotones that formed within these larger vegetation communities can be found in the inventory of ecological sites of Porirua City (Boffa Miskell Ltd, 2001).

- Duneland
- Wetlands
- Coastal shrublands & low coastal forest
- Coastal kohekohe forest & rimu-rata/kohekohe forest
- Podocarp/mixed broadleaved forest associations
- Podocarp/beech forest associations
- Undefined (urban)
- Proposed Designation
- Study Area



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4.7.2 Current Vegetation

All of the study area has been historically farmed with repeated fires and land clearance removing all but three small fragments of the original vegetation cover.

Table 6.8 presents a summary of the current vegetation of the study area based on LCDBI. The LCDBI vegetation categories have been aggregated and sorted to match the vegetation types mapped and presented later in this study. The complete LCDBI vegetation breakdown is provided in Appendix 6.G, page 91.

Table 6.8. Present Vegetation based on Land Cover Database (Derived from LCDBI)

Sort	Description	Study Area ha	% of Study Area
1	Pasture, cropland, open ground	9,287	45%
1	Wetlands	813	4%
2	Gorse, broom and fernlands	1,631	8%
3	Manuka or kanuka scrub and forest	747	4%
4	Regenerating broadleaved scrub & forest	2,006	10%
5	Mature or maturing indigenous forest	340	2%
6	Exotic vegetation / plantation Pine	3,017	15%
7	Urban	2,859	14%
TOTALS		20,699	100%

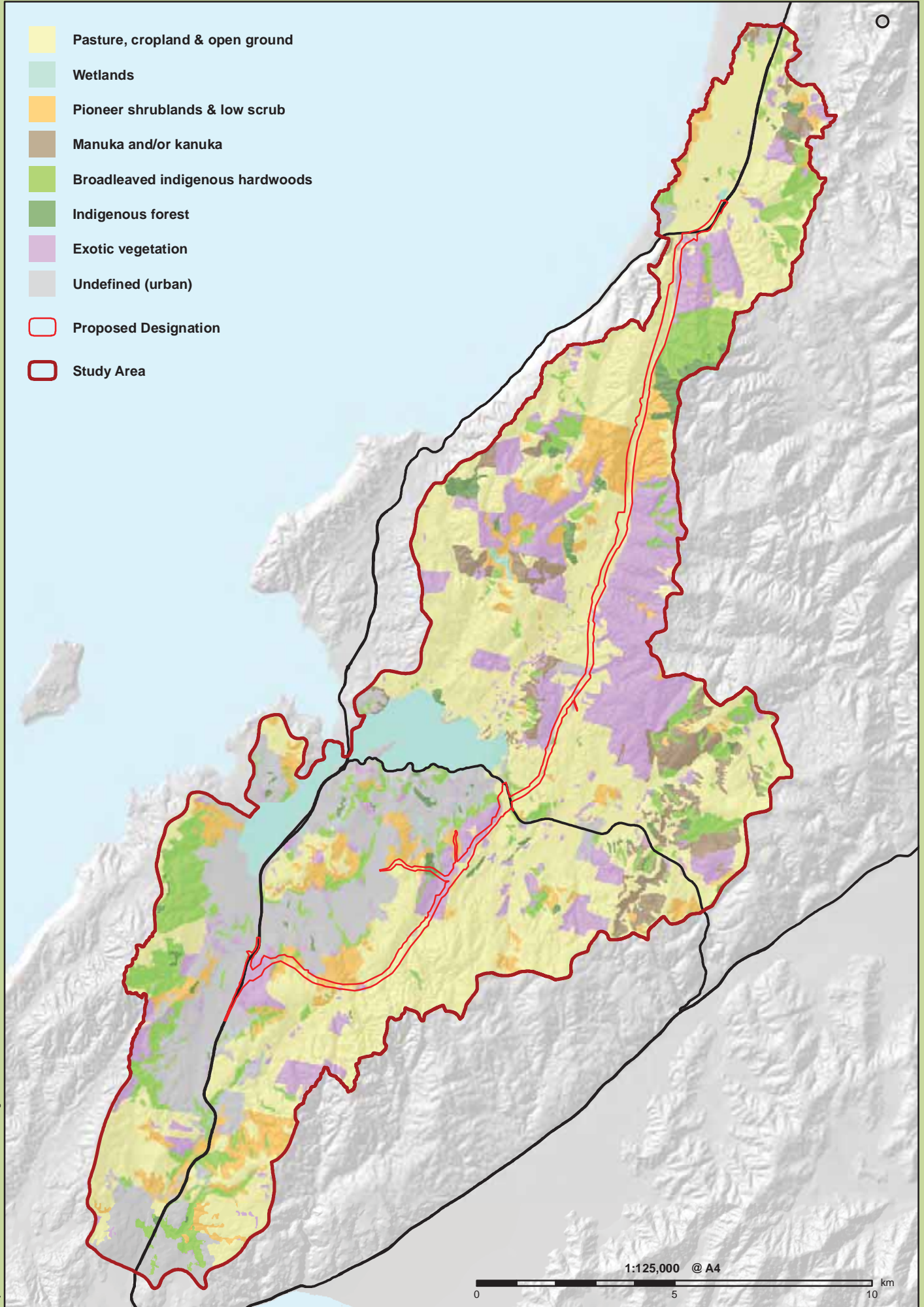
Table 6.9 shows changes in vegetation cover in the 30 years since it was last mapped (Healy, 1980). Note that the mapping methods and scales between Healy and LCDBI are different and only broad trends can be determined with any confidence. We have used the categories in Healy for this comparison.

The table suggests that arable and pastoral farming has diminished to be replaced by forestry or other exotic forest types associated with the subdivision of larger farms into lifestyle blocks. The table also suggests there has been a reduction in indigenous forest within the Pauatahanui watershed over the last 30 years.

Table 6.9. Changes in vegetation cover of the Pauatahanui Watershed (Healy 1980 & LCDBI 2003)

Sort	Description	Healy (%)	LCDB II (%)
1	Pasture, cropland, open ground	67%	57%
2	Shrublands and Scrub	24%	25%
5	Indigenous Forest	6%	2%
6	Exotic vegetation / Plantation Pine	3%	17%
TOTALS		100%	100%

- Pasture, cropland & open ground
- Wetlands
- Pioneer shrublands & low scrub
- Manuka and/or kanuka
- Broadleaved indigenous hardwoods
- Indigenous forest
- Exotic vegetation
- Undefined (urban)
- Proposed Designation
- Study Area



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4.8 RARE, THREATENED, NATURALLY UNCOMMON, OR DISTINCTIVE PLANTS

A large number of site specific species lists and vegetation descriptions exist for sites along this route. A list of these references is included in the bibliography. These sources were checked for the presence of rare or threatened plants to provide context for the botanical surveys and vegetation mapping, and to assist in prioritising sites that required more detailed investigation. The national threat status of plants was derived from de Lange et.al. (2009).

Overall, it was concluded that due to the high degree of modification of the vegetation within the designation, and the lack of naturally uncommon habitats such as wetlands, very few species of plant with a national threat status were likely to be found. Those few that could be present are identified below.

However, the various sources identified a number of plant species that, while not nationally threatened, are locally uncommon or unusual, for instance occurring at their southern limit or in unusual plant associations (See DOC 2010 and Appendix 6.H).

The habitats in which these rare, threatened, or locally uncommon species might be found were identified from these references and similar habitats within the designation were then investigated during field investigations.

The species and habitats considered were:

Species of note, Te Puka & Upper Horokiri Valleys (Ogle et al 1980):

In the wetter 'mist forest' of Mt Wainui the following locally uncommon plants have been previously recorded:

- *Cotula membranacea*
- *Carex inversa*
- *Nertera setulosa*
- *Adiantum fulvum*
- *Adiantum viridescens*
- *Grammitis magellanica*
- *Hymenophyllum armstrongii*
- *Hymenophyllum pulcherrimum*

In Wainui Stream the following have been previously recorded:

- *Mazus pumilio*
- *Adiantum diaphanum*
- *Nestegis montana* (narrow-leaved maire) single specimen.

Species of note, Paekakariki Hill Road Bush Remnants:

Battle Hill Bush, Paekakariki Hill Road:

- *Rhabdothamnus solandri* (taurepo) is at its southern limit around Wellington. Apart from an isolated plant or two near Makara, Pauatahanui is the only other location where this plant is found in the Wellington conservancy. Battle Hill Bush has a substantial population of this plant.

Collyn's QEII blocks, off upper Paekakariki Hill Road:

- *Large areas of Rhabdothamnus solandri* (taurepo) fringing the banks and bush edges.

Species of note, Battle Hill Regional Farm Park:

- *Adiantum viridescens*. A maidenhair fern that has a very restricted distribution in the Wellington Conservancy.
- *Adiantum diaphanum*. Another maidenhair fern that is not common around Wellington. There is a small patch near the northern boundary growing in what seems a favoured situation at the base of a rock outcrop in the loose dirt and detritus.
- *Arthropteris tenella*. This fern is somewhat local around Wellington.
- *Cyathea cunninghamii*. This species has a patchy distribution around Wellington. Its occurrence here probably reflects the past forest conditions of a much more heavily forested valley than presently exists.
- *Pittosporum cornifolium*. This species is now rather restricted. Two specimens were seen as epiphytes protruding from *Collospermum hastatum* clumps.
- *Syzygium maire* (Swamp maire). Uncommon around Wellington due to habitat loss.

Species of note, Porirua Park Bush:

- *Streblus banksii* (large-leaved milk-tree) (Relict). There is a single record in Porirua Park Bush Reserve.
- *Streblus heterophyllus* (small-leaved milk tree) locally uncommon. Present in forest remnants adjacent to Pauatahanui Inlet. Seedlings have been seen in other remnants nearby.

OTHER

Orchids:

- *Linguella puberula* (dwarf greenhood orchid). Nationally Critical. May be present despite not being recorded historically (recorded in Eastbourne in 1950).
- *Plumatochilus tasmanica* (bearded greenhood orchid). Nationally Endangered. May be present despite not being recorded historically (recorded in Eastbourne in 1950).
- *Adelopetalum (Bulbophyllum) tuberculatum* (Bulb leaf orchid) – Naturally uncommon.
- *Drymoanthus flavus* (little spotted moa orchid). Naturally Uncommon.
- *Bulbophyllum pygmaeum* (Bulb leaf orchid). Rarely recorded in Wellington region
- *Drymoanthus adversus*. Uncommon in Wellington.

Ferns

- *Adiantum diaphanum* (Small maidenhair). Locally rare in Wellington
- *Schizaea bifida* (Forked comb fern). Regionally Critical. Found in Eastbourne
- *Hypolepis dicksonioides* (Giant hypolepis). Naturally Uncommon.

Other:

- *Metrosideros robusta* (Northern rata) is a notable, but relatively uncommon, feature of Mt Wainui and similar un-logged remnant forest areas in the Wellington region.
- *Nestegis montana* (Narrow leaved maire) is rare in Wellington City.
- *Pittosporum divaricatum* is widespread throughout the Wellington region but never found in abundance. This is classified as Medium priority conservancy status in the Wellington CMS.
- *Mida salicifolia* (Willow-leaved Maire). Gradual decline. Known from a nearby forest remnant on Moonshine Road – approximately 2 km away from the route.
- *Ranunculus macropus* (Swamp buttercup) data deficient, is known from the Eastbourne hills. (Not threatened).

4.9 SIGNIFICANT NATURAL AREAS & HABITATS

4.9.1 PROTECTED NATURAL AREAS (PNA's)¹

Table 6.10 lists eighteen sites along the project alignment that have either been protected for their ecological values or which have been protected for other purposes, but contain smaller areas of identified ecological value. These sites are shown generally in Figure 6.8, and in more detail in Figure 6.12 a to e.

The sites listed all lie in close proximity to the Designation (within 100m) or are intersected by the Designation. Of the latter, a number extend beneath the Footprint of the proposed highway.

The second column of the table (Rel²) identifies the relationship of the PNA's to alignment. The categories used are:

- A** = adjacent to Designation;
- D** = all or part within Designation;
- F** = falls beneath road Footprint; and
- DS** = downstream of route.

Within the Porirua and Kapiti Districts', RMA-based ecological surveys of significant natural areas have been undertaken and relevant information from these surveys is included.

Table 6.10. Protected Natural Areas beneath or in close proximity to the Transmission Gully Designation.

Name (Sorted by Catchment and listed from North to South)	Rel ²	Description and size
Whareroa Catchment		
Queen Elizabeth Regional Park Bush and Wetlands	A	Much of this park is open space and farmland. There are a number of small wetland and bush fragments that lie within it that are considered to have ecological value. KCDC Ecosite K108 lies near the TG route but is separated from it by the North Island Main Trunk Railway. (16.81 ha). Outside proposed Designation.
McKays Crossing Wildlife Reserve	D	Moderately sized area of raupo reedland wetland which lies in part beneath the Designation. Considered to be regionally significant due to wetland habitat being nationally under-represented, a high diversity of wetland plant communities, the presence of rare plants, and as habitat for a variety of uncommon or threatened fish and birds. DOC Wildlife Management Reserve (Conservation Unit R26050). KCDC Ecosite 106 (9.68ha).
Whareroa Recreation Reserve	A	DoC Recreation Reserve and farm park (436 ha). KCDC Ecosites K104 & K105 indigenous (kohekohe-tawa-titoki) forest on low hills uncommon in Tararua Ecological District. Two of a series of fragments that provide links (for bird movement) between Kapiti Island and the Tararua Ranges. DOC Conservation Unit R26040. Regionally significant (3.22 ha). Outside proposed Designation.
Wainui Catchment		
Wainui Stream Bush	A	DOC (711) Protected. Kohekohe forest. Good example of kohekohe forest in gully. Some sheep grazing and feral goats. Provides habitat for kereru. KCDC Ecosite K111, Regionally significant (15.13ha). Outside proposed Designation.
Rowans Bush	D	Partially protected by QEII covenant (QE11 5/07/363). Kohekohe-titoki forest on lowland hill country. Part of a series of fragments that provides links (for birds) between Kapiti Island and the Tararua Ranges. Eastern half of site is protected in part under QEII

¹ Protected means either; a scenic reserve or conservation land protected under the Reserves Act (1977) including local purpose reserves and stewardship areas, a private or QEII National Trust Open Space Covenant registered to the title of the property, or public land which has a management plan (Regional Park).

		covenant. KCDC Ecosite K139. Regionally significant (2.8ha).
Te Puka Catchment		
Akatarawa / Whakatikei Forest Park	D	GWRC water collection area and regional forest park. Identified in BRWR ² as site 3l, 17a & 19b. Regionally representative plant communities including lowland to montane miro-rimu-rata/tawa-kamahi forest. Contains rare plants and uncommon plant communities. Provides habitat for high bird populations, densities and diversity. Has large wildlife corridor benefits and wider ecological habitat benefits (15,439ha).
Horokiri East Catchment		
Battle Hill Regional Park	F	Much of this park is open space and farmland. There are a number of small wetland and bush fragments that lie within it that are considered to have ecological value, however there are no indigenous plant communities within the Designation. (502ha)
Horokiri Wildlife Reserve	DS	Wildlife Management Reserve under Reserves Act 1977 (DoC Conservation Unit R26007). Coastal wetlands and saltmarsh communities which are regionally rare and which provide habitat for a range of common and threatened fish and birds. PCC Ecosite 30, SES ranking 3 (6.25 ha).
Ration Catchment		
Abbots Bush	A	Private Covenant. A small forest remnant within farmland. BRWR site 3k(B), tawa forest remnant with potential value as seedling nursery. PCC Ecosite 1, SES ranking 4. (7.16 ha). Outside proposed Designation.
Pauatahanui Catchment		
Pauatahanui Inlet Wildlife Refuge	DS	The eastern half of Pauatahanui Inlet. Estuary, open water & tidal flats. A Wildlife Refuge under the Wildlife Act (DOC Conservation Unit R26053, 506 ha). BRWR site 5a, nationally significant coastal estuary with intertidal sand flats and regionally rare salt marsh and saline herbfield, rushland and shrubland communities. Provides rich habitat for a variety of common and threatened fish and bird species. Also a link in the chain of stop-overs for internal north – south migrant waders. Moderate to high SSWI value. Values described in detail in DoC 2010. Intertidal sandflats, mudflats, shellbeds, and associated intertidal (wetland) habitat cover an area of 173 ha (Stevens et al, 2208). Within this are 50.6 ha of saltmarsh vegetation (9.6% of the area of the inlet). Note that these areas are inclusive of Horokiri Wildlife Management Reserve, Pauatahanui Inlet Wildlife Refuge, Pauatahanui Wildlife Management Reserve and Duck Creek Scenic Reserve.
Pauatahanui Wildlife Reserve	DS	Wildlife Management Reserve under Reserves Act (DoC Conservation Unit R27056). BRWR site 4h, low to mid-tidal sea rush, tidal meadow, coastal scrub communities which are regionally rare and which provide habitat for a range of common and threatened plants, fish and birds. Mixed private and public ownership. PCC Ecosite 65. SES Ranking 1 (47.4 ha)
Scoresby Grove Kanuka Forest	F	Private land with covenant. Small forest fragments within built up areas. PCC Ecosite 70a. SES ranking 4 (4.70 ha). Part of BRWR site 4g, small area of forest in an area with little remaining forest. May provide some limited habitat value.
Bradey's Road Gully	A	Private land with covenant. Small forest fragments within farmland and other open spaces. PCC Ecosite 223SES ranking 2 (1.97 ha). Part of BRWR site 4k, small area of forest in an area with little remaining forest. May provide some limited habitat value. Outside proposed Designation.
Duck Creek Catchment		
Duck Creek Scenic Reserve	DS	Coastal wetland and saltmarsh. Scenic Reserve under the Reserves Act (DOC Conservation Unit R27001). Considered an important refuge for waterfowl and contains saltmarsh plant communities uncommon in the region. PCC Ecosite 22, SES ranking 2 (1.18ha).
Tairangi Scrub	A	Local authority reserve. Small forest fragments within built-up area. PCC Ecosite 157a. SES ranking 4 (3.13 ha). Outside proposed Designation.
Whitby West Bush	D	Small forest fragments within built-up area. Mixed private/public land. PCC Ecosite

² Biological Resources of the Wellington Region. Wellington Regional Council 1984.

		155b. SES ranking 4 (9.16 ha)
Belmont Regional Park	F	Much of this park is open space and farmland. There are a number of small wetland and bush fragments that lie within it that are considered to have ecological value including: Wellington City Council Prime Bush Remnants (3,446 ha). Part of BRWR 14B
Kenepuru Catchment		
Cannons Creek Bush (Waitangirua Covenant)	F	Seral Forest with maturing tawa podocarp. BRWR site 13c. Lowland tawa-kohekohe-mahoe forest remnant and gorse shrubland, high diversity of ferns and regenerating podocarps. Sizeable areas of forest. PCC Ecosite 12. SES ranking 1 (41.66 ha). Conservation covenant under the Reserves Act 1977 (DOC Conservation Unit R27064) 82.55 ha.
Porirua Catchment		
Porirua Park Bush	F	Porirua Park Bush is well fenced and surrounded by a combination of farmland, residential areas and school facilities. BRWR site 13d & 13e. Regionally representative example of lowland tawa-kohekohe forest remnant with potential value as an SSWI site. PCC Ecosite 76. SES ranking 1 (16.4 ha).

One of these sites, the Akatarawa / Whakatiki Water Collection area is identified in the Regional Policy Statement for the Wellington Region as being regionally significant. The Waitangirua Covenant is managed by the DOC and is listed in the Wellington Conservation Management Strategy (DOC 1996). The values of the Akatarawa/Whakatiki Forest / Wainui Summit are generally described in Forest Lands and Water Collection Areas Management Plan (WRC 1995).

4.9.2 SIGNIFICANT NATURAL AREAS (SNAs)

In addition to PNAs listed above, Table 6.11 lists 21 sites along the route that have been identified through district wide or regional survey as having ecological value, and which do not have formal protection such as covenant or reserve status. A number may be protected through rules and schedules in the District or Regional Plans.

These sites have been derived from a number of sources, the three key ones being BML (2001) for Porirua District, Wildland Consultants (2003) for Kapiti Coast District, and Park (1999) for Wellington District. These sites are shown generally in Figure 6.8, and in more detail in Figure 6.12 a to e. It should be noted that each of the surveys has used a different set of criteria for establishing the significance of these sites. This is discussed in more detail in section 3.5, page 9.

The sites listed here are intersected by the Designation or lie in close proximity to the Designation (within 100m). Some sites are known to fall beneath the Footprint of the current road design. The second column of the table (Rel²) identifies the relationship of the SNA's to the route as described above.

Within the Porirua and Kapiti Districts RMA-based ecological surveys of significant natural areas have been undertaken and relevant information from these surveys is included. The evaluation/ranking system for these surveys was outlined in Section 3.5, page 9.

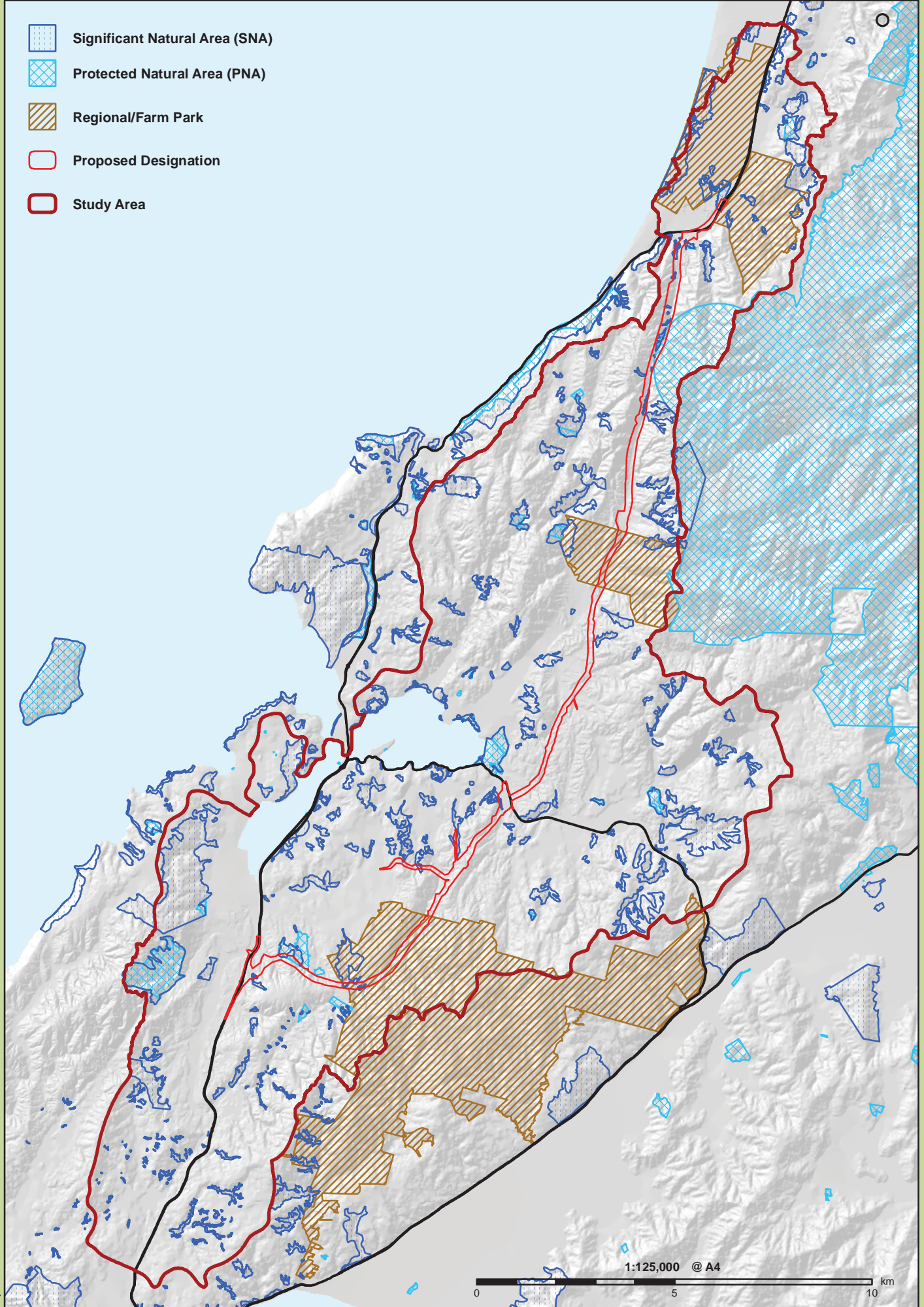
Table 6.11. Unprotected sites of ecological value beneath or in close proximity to the Transmission Gully Designation.

DESCRIPTION (listed North to South)	Rel ²	Description
Whareroa Catchment		
No sites	-	-
Wainui Catchment		
No sites	-	-
Te Puka Catchment		
Paekakariki bush B – I	F	KCDC Ecosite K222 – 229. Eight small fragments of kohekohe forest of varying sizes and conditions. All are unfenced and heavily browsed by stock. They are also typically

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		too small to contain a healthy core. For these reasons the KCDC survey did not recommend them for protection.
	F	KCDC Ecosite K230. A small area of boggy pasture with some sphagnum. Not recommended for protection.
Horokiri East Catchment		
Horokiri Stream & tributaries	F	Regionally significant stream (Regional Freshwater Plan).
Transmission Gully Saddle	D	Small forest fragment within farmland, PCC Ecosite 172 – SES ranking 6 (0.287 ha)
TG West Bush	A	Small forest fragments within farmland, PCC Ecosite 202 – SES ranking (1.688ha). Outside proposed Designation.
TG Riparian Area	D	Riparian areas within farmland, PCC Ecosite 199 – SES ranking 5 (1.877 ha)
Akatarawa Ranges Outlier	A	Reverting bush areas, PCC Ecosite 200 – SES ranking 3 (21.066 ha). Outside proposed Designation.
Puketiro Forest Remnant	A	Small natural areas (usually riparian) within forest plantations. PCC Ecosite 207b – SES ranking 4 (9.22 ha). Outside proposed Designation.
Ration Catchment		
Ration Stream & tributaries	F	Regionally significant stream (Regional Freshwater Plan).
Abbots Gully Bush	A	Small natural areas (usually riparian) within forest plantations, PCC Ecosite 196 – SES ranking 5 (10.43 ha)
Flighty's west remnant	A	Unprotected seral forest, PCC Ecosite 219 – SES ranking 4. Outside proposed Designation.
Pauatahanui Catchment		
Pauatahanui Stream & tributaries	F	Regionally significant stream (Regional Freshwater Plan).
Duck Creek Catchment		
Duck Creek & tributaries	F	Regionally significant stream (Regional Freshwater Plan).
James Cook Drive Bush	F	Small forest remnants within built-up areas, PCC Ecosite 33 – SES ranking 3,4 (12.84 ha)
Exploration Drive Kanuka	F	Small forest fragment within built-up areas. PCC Ecosite 190 – SES ranking 4 (5.67 ha)
Kenepuru Catchment		
Head of Cannons Creek	F	Tawa, mahoe, mapou, porokaiwhiri, mamaku and cabbage tree. WCC 0702.15 (1.06 ha)
Head of Cannons Creek	D	Primary forest of tawa, nikau, porokaiwhiri, mamaku, wineberry, mapou and mahoe. Secondary forest of mahoe, porokaiwhiri, lancewood, mamaku and mapou intermixing with primary forest remnant. WCC 0702.16 (1.28 ha)
Porirua Catchment		
Onepoto Arm of Porirua Harbour	DS	BRWR Site 5c, estuarine mudflats that provide feeding sites for birds. Moderate value SSWI site. Values described in detail in DoC 2010. Not protected. Intertidal sandflats, mudflats and associated habitat, cover an area of 61.5 ha (Stevens et al, 2208), and within this is 0.8 ha of saltmarsh vegetation.
Roberts Bush	D	Gullies of mahoe forest including small areas of maturing tawa forest within pines adjacent to SH1. PCC Ecosite 88 – SES ranking 4. (3.68 ha)

-  Significant Natural Area (SNA)
-  Protected Natural Area (PNA)
-  Regional/Farm Park
-  Proposed Designation
-  Study Area



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5. SURVEY RESULTS

5.1 VEGETATION MAPPING

This survey mapped 21 plant communities within the 500 m corridor which are summarised in Table 6.12. More detailed descriptions are provided in Table 6.13. The vegetation is further analysed by catchment in Table 6.14. To assist in descriptions of the key vegetation communities, species lists were prepared at seven sites (Appendix 6.J), and vegetation transects were carried out in six communities (Appendix 6.I).

Maps of the broad vegetation patterns are found in Figure 6.9 a - e. Generic photos of each vegetation type are provided at the end of this report, Figure 6.13 a - e, page 109, and more detailed vegetation maps are provided in Figure 6.14, page 116.

This analysis presents both vegetation communities within the Designation (an area of 483 ha), and communities beneath the Footprint (an area of 172 ha including cut and fill batters). It is assumed that most vegetation that lies outside the Footprint but within the Designation is at risk through associated construction activities. However while vegetation beneath the road Footprint will be lost, in some cases it will be possible to avoid and protect identified areas of value within the Designation.

Table 6.12. Summary of vegetation communities within the Designation of the proposed Transmission Gully.

Description	Design Footprint		Designation		
	Area (ha)	% of Total Designation	Area (ha)	% of Plant Community	
Grassland, shrublands, rushland and wetlands					
1.01	Improved pasture	62	36%	182	38%
1.02	Rough pasture and shrublands	10	6%	30	6%
1.03	Cropland	3	2%	4	1%
1.04	Stony streambed in pasture	3	2%	10	2%
1.05	Riparian margins in rushland	2	1%	4	1%
1.06	Indigenous wetland	0	0%	2	0%
Pioneer shrublands and low scrub					
2.01	Gorse dominated scrub (closed canopy)	9	5%	31	6%
2.02	Tauhinu dominated scrub (closed canopy)	6	3%	16	3%
2.03	Riparian margins beneath scrub	1	1%	3	1%
Seral manuka/kanuka forest					
3.01	Secondary native forest (kanuka)	4	2%	10	2%
Seral broadleaved forest					
4.01	Transmission Gully restoration planting	6	3%	16	3%
4.02	Secondary native forest (mahoe)	5	3%	15	3%
4.03	Riparian margins with 2° native forest	2	1%	6	1%
Mature or maturing indigenous forest					
5.01	Lowland tawa forest	0	0%	4	1%
5.02	Coastal kohekohe forest	5	3%	12	2%
5.03	Remnant sub-montane hardwood forest	0	0%	1	0%
5.04	Riparian margins with indigenous forest	1	0%	3	1%
Exotic vegetation					
6.01	Plantation pine	14	8%	47	10%
6.02	Plantation pine – harvested	17	10%	43	9%
6.03	Exotic trees (shelterbelts, gardens)	5	3%	12	2%
6.04	Riparian margins with exotic trees	1	0%	2	0%
Undefined					
7.01	Built-up area	17	10%	29	6%
TOTALS		172	100%	483	100%

The vegetation communities along the Route are highly varied and range from largely unmodified montane podocarp broadleaf forests, small fragmented forests in rural landscapes, regenerating shrubland communities to large areas of exotic forestry and croplands.

Because four regionally significant streams (Horokiri, Ration, Pauatahanui and Duck) lie within this route it was decided that riparian habitat has a value requiring recognition and so stream beds and obvious riparian vegetation were mapped separately.

A description of the mapped communities follows.

Table 6.13. Descriptions of vegetation communities within the Mapped Corridor.

Grassland, shrub-grasslands, rushland and wetlands	
A range of communities dominated by exotic pastures grasses and crops, with areas of rushes, sedges and herbaceous species in damper soils and wetland areas.	
1.01	Improved pasture: The dominant plant community within the mapped corridor (See Photo 6.1).
1.02	Rough pasture and shrublands: These are typically less productive pastures found on shallow, often stony, and less fertile soils. Three species of pioneer shrubs rapidly appear where regeneration is allowed to occur; gorse, tauhinu, and coastal shrub daisy. In some areas, particularly rocky ground, bracken and ring fern also occur. These communities vary from open shrub-grasslands described here, through a variety of ecotones, to closed canopy scrub (2.01 & 2.02). See Photo 6.2, Photo 6.3, Photo 6.4, Photo 6.5 & Photo 6.7.
1.03	Cropland: Various crops and market gardening, areas around Paekakariki and McKays Crossing.
1.04	Stony streambed in pasture: These open gravel streambeds with grassland margins are commonly found in Te Puka Stream, Horokiri Stream and Duck Creek. Occasional shrubs and small trees can be found including tauhinu, mingimingi, ongaonga, coastal tree daisy, kaikomako, putaputaweta, and mahoe. Toetoe and scattered rushes and sedges occur in some areas. Bush lawyer is a common vine (see Photo 6.4). None of these streams are fenced and there is unrestricted stock access.
1.05	Riparian margins in rushland: <u>Juncus</u> rushlands with introduced pasture grasses are typically found in upper Duck Creek and parts of the lower Horokiri Stream and Ration Creek (see Photo 6.5). Rushland species are both native and exotic.
1.06	Wetlands: The <u>raupo</u> wetland of McKays Crossing is the only largely indigenous wetland within the mapped corridor. It is described in detail in BML 2007. Within the upper Horokiri Stream a low terrace with impeded drainage has allowed the formation of a large area of <u>Juncus/Sphagnum</u> wetland in pasture. This is heavily grazed, cattle pugged and occasionally turned over by pig rooting (See Photo 6.7 & Photo 6.10). Refer Appendix 6.J, Species List 1. There are numerous small ephemeral wetlands that have formed in pasture, particularly in the upper Horokiri catchment, where hill-side springs maintain areas of wet pasture allowing a variety of native and exotic grasses and herbaceous species to persist. Refer Appendix 6.J; Species Lists 5 & 6 (See Photo 6.7).
Pioneer shrublands and scrub	
These plant communities occur where pioneer shrubs have been able to regenerate through pasture to the point that they eventually form a closed canopy 1.5 m to 3 m tall. These communities tend to be dominated by short-lived small-leaved shrubs of low stature that are tolerant of drought, exposure, and browsing. Broadleaved shrubs are also present, typically in gullies which are sheltered, have moist soils, and where steep slopes provide some protection from browsing.	
2.01	Gorse dominated scrub: <u>Gorse</u> dominates with varying quantities of tauhinu and coastal shrub daisy at lower altitudes and less exposed sites. As this community matures, broadleaved species, usually dominated by mahoe, enter the canopy in gullies and south facing slopes eventually developing into communities 4.02 & 4.03. Other regenerating broadleaved species include rangiora, karamu, kaikomako, and kohuhu. Where the canopy is broken, pasture grasses dominate the floor with occasional ferns (See Photo 6.8 & Photo 6.16).
2.02	Tauhinu scrub: <u>Tauhinu</u> and coastal shrub daisy dominate gorse at higher altitudes in the Horokiri Valley and on the driest and most exposed slopes in the Te Puka and Duck Creek catchments. There are occasional mingimingi and kaikomako, with areas of bracken. As this community ages, broadleaved species enter as described in 2.01. On lower slopes kanuka often occurs.

	Pasture grasses and ferns dominate the understorey while the canopy is broken (See Photo 6.9 & Photo 6.10).
2.03	Streambed with low scrub: Where gorse-dominated scrub and tauhinu scrub form a canopy over moist gullies a wider range of broadleaved species are found as saplings or emerging through the canopy. They include mahoe, ongaonga, karamu, rangiora, fivefinger, mamaku, putaputaweta, and fuchsia. Ferns are abundant on the floor and stream banks. This community eventually develops into 4.03 (See Photo 6.10).
Seral forest – Dominated by manuka / kanuka	
These forests are typically monocultures of kanuka that have regenerated beneath pioneer shrublands and have over-topped them to form a new canopy varying from 10 m to 30 m in height. Kanuka forest starts with a simple structure, often just canopy, understorey and floor but has an open canopy that encourages the recruitment of potential canopy species into the understorey. As kanuka naturally senesces these potential canopy species, tawa, hinau, kohekohe, titoki, rimu, kahikatea, emerge eventually forming a new mature forest.	
3.01	Seral forest dominated by kanuka: <u>Kanuka</u> forest is one of two main seral forests that occur at lower altitudes on sunny, dry sites. Closed canopy of kanuka with other regenerating species present including mahoe, hangehange, karamu, rangiora and occasional rewarewa. The understorey typically dominated by hangehange, karamu, rangiora and fern species (See Photo 6.11).
Seral forest – Dominated by mahoe	
These forests are typically monocultures of mahoe that have regenerated beneath pioneer shrublands, typically gorse, and have over-topped them to form a new canopy varying from 3 m to 10 m in height. They have a simple structure, often just a canopy, a sparse understorey of stems, and floor, without emergents or epiphytes. Mahoe forest can persist for a century or more through coppicing. It has a dense canopy that can limit regeneration of potential canopy species. These communities are not considered representative of historical communities. Mahoe dominates in these landscapes due to its tolerance to grazing, and because it is not reliant on native birds for the distribution of its abundant small seeds. Note we have included TG Restoration Planting in this community group.	
4.01	Transmission Gully Restoration Planting: Recent restoration planting including varying densities of kanuka, koromiko, five-finger, karamu, ribbonwood, hoheria, kowhai, ngaio, toetoe, kohuhu, cabbage tree, and flax (See Photo 6.15, Photo 6.16 & Photo 6.17).
Seral broadleaved forest dominated by mahoe: <u>Mahoe</u> forest is the second of two seral forests described within the corridor. It occurs at lower and mid altitudes, typically regenerating through gorse on moister sites.	
4.02	At lower altitudes on hillsides and terraces it often forms a near mono-culture with a limited number of other broadleaved species (kanono, rangiora, hangehange) entering the canopy and tree ferns occurring as an emergent on sheltered slopes and gullies. At higher elevations and in wet gullies it tends to have a more diverse canopy with pate, putaputaweta, pigeonwood, and kaikomako with occasional rewarewa and supplejack. The understorey is dominated by kawakawa, ongaonga, hangehange, rangiora, karamu and fuchsia, and a variety of ferns. (See Photo 6.12 & Photo 6.13).
4.03	Riparian margins with seral forest: Riparian vegetation under seral native forest (broadleaf). Dominated by mahoe but with a wider variety of species in the canopy including emergent mamaku, young rewarewa, and occasionally with young tawa and podocarps (See Photo 6.14).
Mature or maturing indigenous forest:	
These forests are a mix of maturing forest that has developed following settlement and clearance, and small remnant components that may be individual trees or small groups of trees. They differ from seral forests in that a multi tiered structure representative of the original forests has re-established, lianes and epiphytes are present in the canopy, and emergent podocarps are beginning to reappear.	
5.01	Lowland forest dominated by tawa: <u>Tawa</u> forest with <u>titoki</u> , mahoe, kohekohe and occasional emergent pukatea, rewarewa, northern rata, totara and rimu. This forest type was once one of the most common plant communities in the wider study area, but is now confined to a small number of isolated fragments, typically in sheltered gullies. Typically forests that have regenerated following historical land clearance, but still sometimes containing remnant emergents as relics of those past forests. Within the upper understorey and along the forests margins are trees of mahoe, pigeonwood, lancewood, pate, tree daisy, puka, putaputaweta, nikau, supplejack and tree fern. The lower understorey consists of shrubs of kanono, karamu, kawakawa, rangiora, hangehange, ramarama, mingimingi and koromiko. A variety of ferns, native grasses and seedlings are present on the floor which typically has a deep litter. Refer

	Appendix 6.J for full species list 3 (See Photo 6.18 & Photo 6.21).
5.02	<p>Coastal broadleaved forest dominated by kohekohe: <u>Kohekohe</u> / mahoe forest with titoki, tawa and emergent rewarewa, rimu, pukatea and kahikatea. The second most common forest type within the study area but now restricted to small fragments, predominantly in the Te Puka catchment.</p> <p>Also within the canopy are wharangi, nikau, mapou, ngaio and kaikomako. Kieke and supplejack are found in the understorey. Refer Appendix 6.J for full species list 4 (See Photo 6.19 & Photo 6.20).</p>
5.03	<p>Sub-montane hardwood forest: (rewarewa) / <u>mahoe</u> – <u>pigeonwood</u> - (supplejack) forest that has regenerated on very steep slopes following fire. Some remnant elements remain including scattered old stems of miro and rimu. Kieke, supplejack and emergent rewarewa and coastal tree daisy are present in the canopy with some tawa present. There are abundant canopy gaps beneath which dense vines occur.</p> <p>The understorey dominated by supplejack, kiekie, and saplings of a wide range of species. The floor has a dense cover of <i>Polystichum</i> fern and <i>Microlaena</i> grasses. Refer Appendix 6.J for full species list (See Photo 6.22 & Photo 6.23).</p>
5.04	<p>Riparian margins with indigenous forest: Riparian sections of streambed under indigenous forest. In addition to the species described above is an increase in pukatea, kahikatea and tree fern (See Photo 6.24).</p>
<p>Exotic vegetation and built-up areas A variety of exotic tree-lands, shelterbelts, residential gardens, and plantation forests, typically pine.</p>	
6.01	<p>Plantation pine: <u>Radiata pine</u> plantations of various ages across the study area and in every catchment. In some of the larger stands, especially in the Horokiri catchment, regenerating seral forest (mahoe dominant) occasionally forms stands in steep riparian areas which were cleared but where pine was not planted. Other exotic <i>Pinus</i> species and <i>Macrocarpa</i> are also present (See Photo 6.25).</p>
6.02	<p>Plantation pine – harvested: Areas of recent (within 2 years) harvest, now with a variety of plant communities including rank pasture, and weedlands dominated by gorse, blackberry, and broom. Within these weedlands a variety of native shrubs which were once present in the pine understorey have persisted following harvest and in some places these form mixed shrub-grasslands. Native species include mahoe, rangiora, poroporo, karamu, kanono, hangehange, fivefinger, lancewood, toetoe, and kanuka (See Photo 6.27).</p>
6.03	<p>Exotic trees: Predominantly old growth exotic trees or plantings. Includes <i>Macrocarpa</i>, <i>Pinus radiata</i>, <i>Eucalyptus</i> sp, willow etc. and areas of exotic landscape and amenity planting. Excludes Transmission Gully-associated restoration planting (See Photo 6.28).</p>
6.04	<p>Streambed with exotic trees: Riparian vegetation under plantation pine canopy or old growth exotic trees. Often includes large numbers of regenerating broadleaved species (See Photo 6.26 & Photo 6.29).</p>
<p>Built Up Areas – Urban</p>	
7.01	<p>Built-up area: Residential areas, schools, playing fields, roading and infrastructure.</p>

Table 6.14 presents the vegetation communities separated into catchments (areas are rounded up to the nearest ha). Things to note from this table are:

- Indigenous wetlands (1.06) are only present in two catchments: Whareroa (McKays Crossing wetland) and Horokiri Stream (a small area of sphagnum wetland in pasture identified in this study).
- The largest areas of seral kanuka forest (3.01) and scrub that will be affected are in the Pauatahanui (3ha) and Duck (5ha) catchments. The total area of affected kanuka forest is 10 ha.
- The largest affected areas of regenerating broadleaved scrub (4.01) are the early retirement plantings in the Duck, Pauatahanui, and Ration catchments (16ha).
- The largest area of unplanted regenerating broadleaved scrub and forest (4.02) is 10 ha of mahoe dominated low forest regenerating through gorse in the Kenepuru catchment (see Photo 6.12 & Photo 6.13).

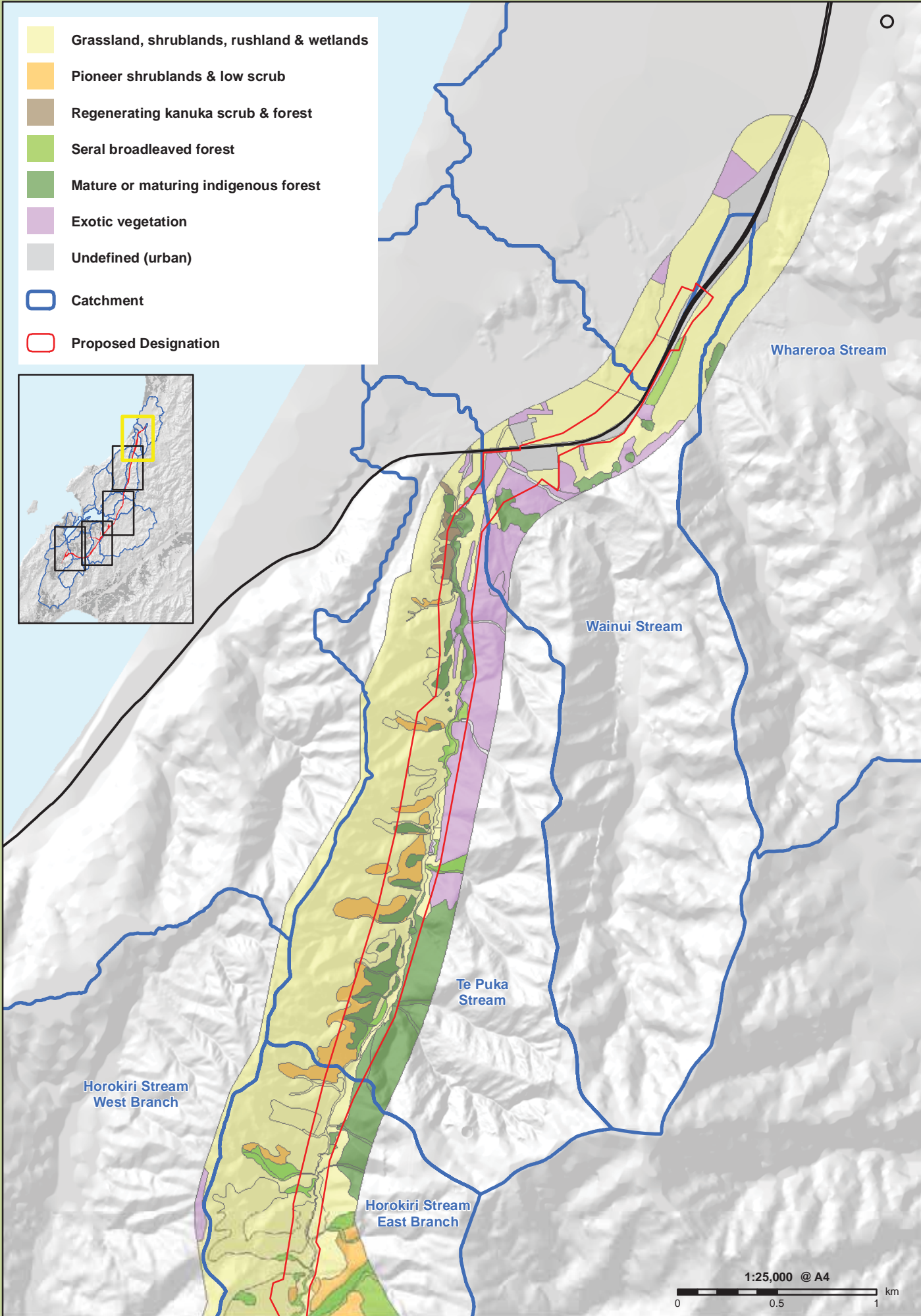
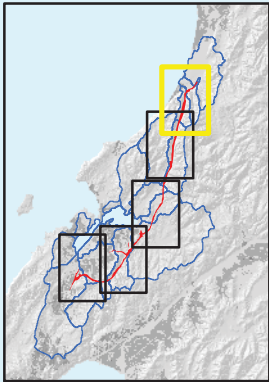
- Small areas of lowland tawa forest (5.01) lie within the Designation in three catchments: SNA site K222 (1ha), Te Puka catchment; a small fragment (1 ha) located as part of this study in the Kenepuru catchment; and SNA site PCC88 (1ha) in the Porirua catchment.
- Coastal kohekohe forest (5.02) is only affected in one catchment, the Te Puka, where 11 ha of kohekohe remnants lie within the Designation (see Photo 6.19 & Photo 6.20).
- A small area (1ha) of sub-montane podocarp-broadleaved forest (5.02) lies within the Designation at Wainui saddle.

Table 6.14. Vegetation communities within the Designation, by catchment.










Description		Whareora Strm	Wainui Stream	Te Puka Stream	Horokiri Stream	Ration Creek	Pauatahanui Strm	Duck Creek	Kenepuru Stream	Porirua Stream	TOTAL
Grassland, shrublands, rushland and wetlands											
1.01	Improved pasture	2	5	22	73	21	14	34	10		182
1.02	Rough pasture and shrublands			4	13		9	2	3		30
1.03	Cropland		4								4
1.04	Stony streambed in pasture			2	5		1	1			10
1.05	Riparian margins in rushland					1	2	1			4
1.06	Indigenous wetland	1			1						2
Pioneer shrublands and low scrub											
2.01	Gorse dominated scrub (closed canopy)				10	3	3		13	3	31
2.02	Tauhinu scrub (closed canopy)			8	8						16
2.03	Riparian margins with low scrub				2	1					3
Regenerating kanuka scrub & forest											
3.01	Secondary native forest (kanuka)			1			3	5	1		10
Regenerating broadleaved scrub & forest											
4.01	Transmission Gully restoration planting					7	4	5			16
4.02	Secondary native forest (broadleaf)			1	2	1			10		15
4.03	Riparian margins with 2° native forest			1	3			1			6
Mature or maturing indigenous forest											
5.01	Lowland tawa forest			1					1	1	4
5.02	Coastal kohekohe forest		1	11							12
5.03	Remnant sub-montane hardwood forest			1							1
5.04	Riparian margins with indigenous forest			3							3
Exotic vegetation											
6.01	Plantation pine		3	8	3	7		5		19	47
6.02	Plantation pine - harvested						8	35			43
6.03	Exotic trees (shelterbelts, gardens)			1	1	1	3	2	4		12
6.04	Riparian margins with exotic trees				1						2
Undefined											
7.01	Built-up area	1	5				4	1	1	16	29
TOTAL		5	19	65	124	44	51	91	44	41	483

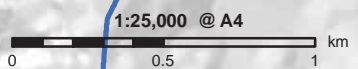
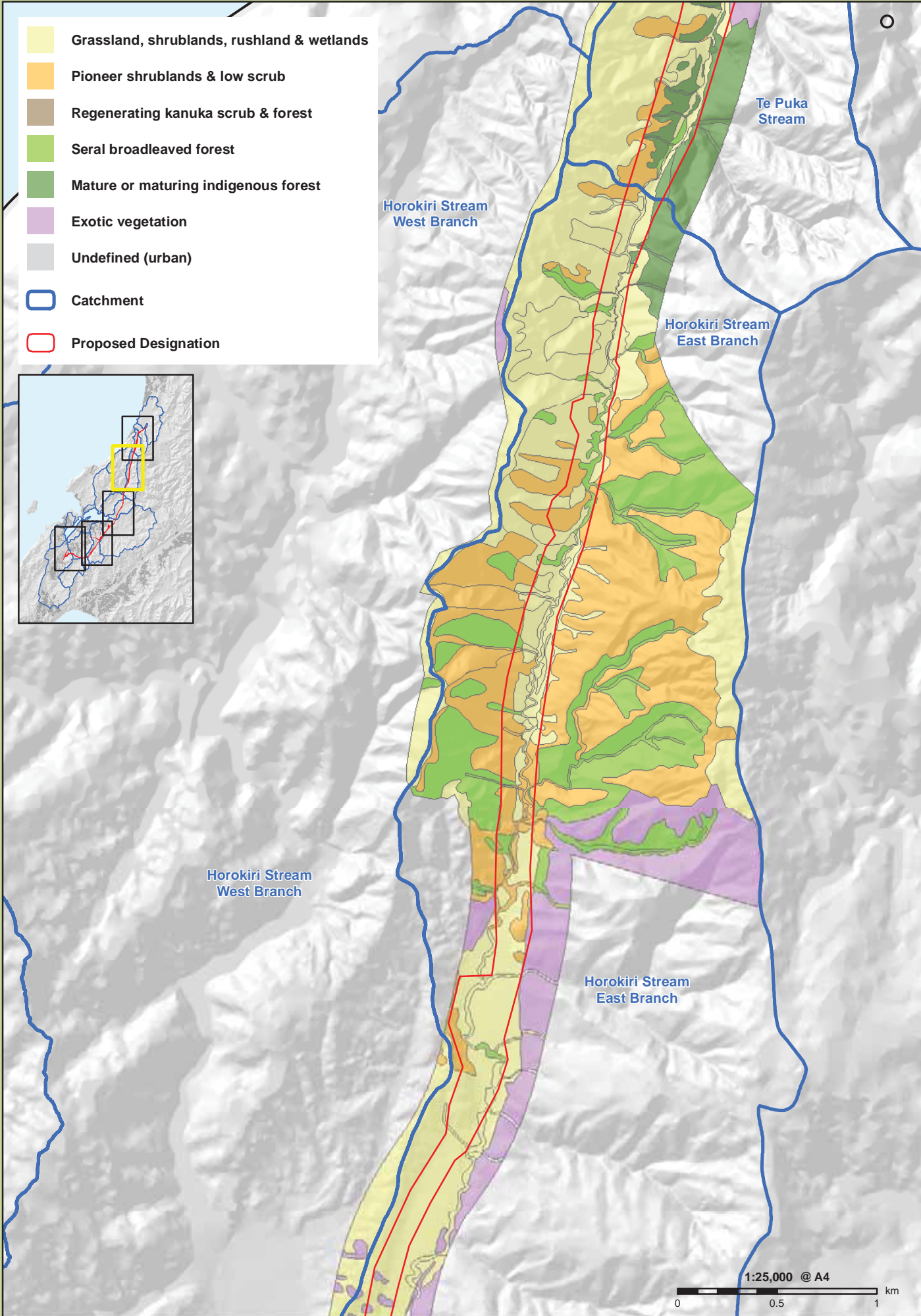
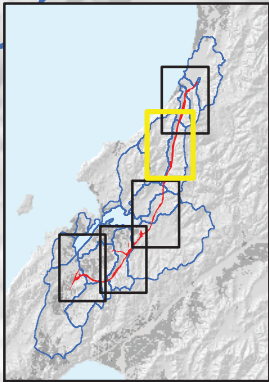
Note that the areas have been rounded up to the nearest whole number and so may not add exactly to the totals.

- Grassland, shrublands, rushland & wetlands
- Pioneer shrublands & low scrub
- Regenerating kanuka scrub & forest
- Seral broadleaved forest
- Mature or maturing indigenous forest
- Exotic vegetation
- Undefined (urban)
- Catchment
- Proposed Designation



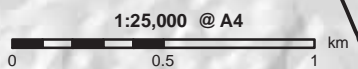
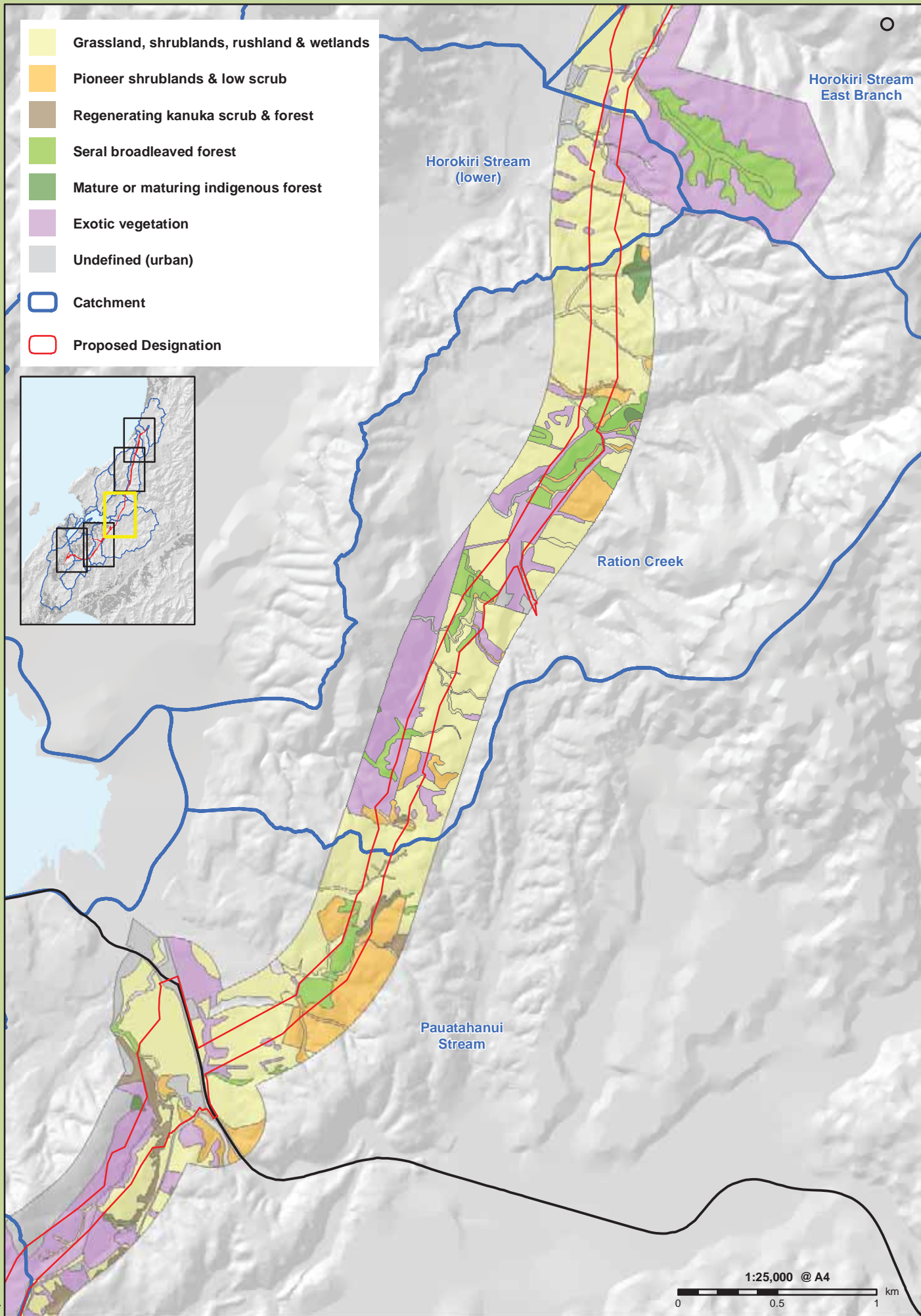
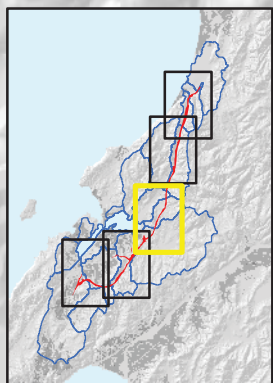
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-  Grassland, shrublands, rushland & wetlands
-  Pioneer shrublands & low scrub
-  Regenerating kanuka scrub & forest
-  Seral broadleaved forest
-  Mature or maturing indigenous forest
-  Exotic vegetation
-  Undefined (urban)
-  Catchment
-  Proposed Designation

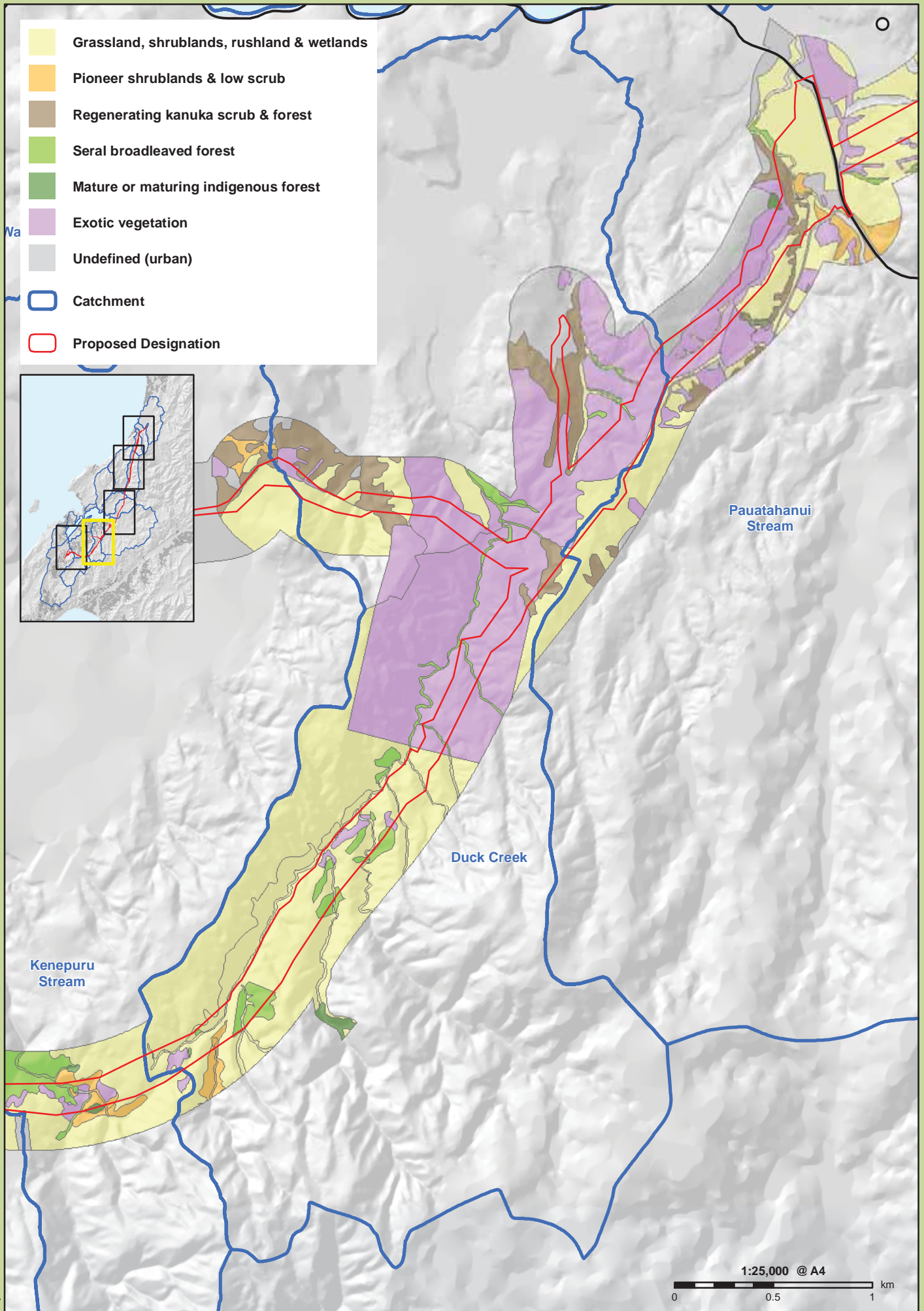


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- Grassland, shrublands, rushland & wetlands
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- Undefined (urban)
- Catchment
- Proposed Designation

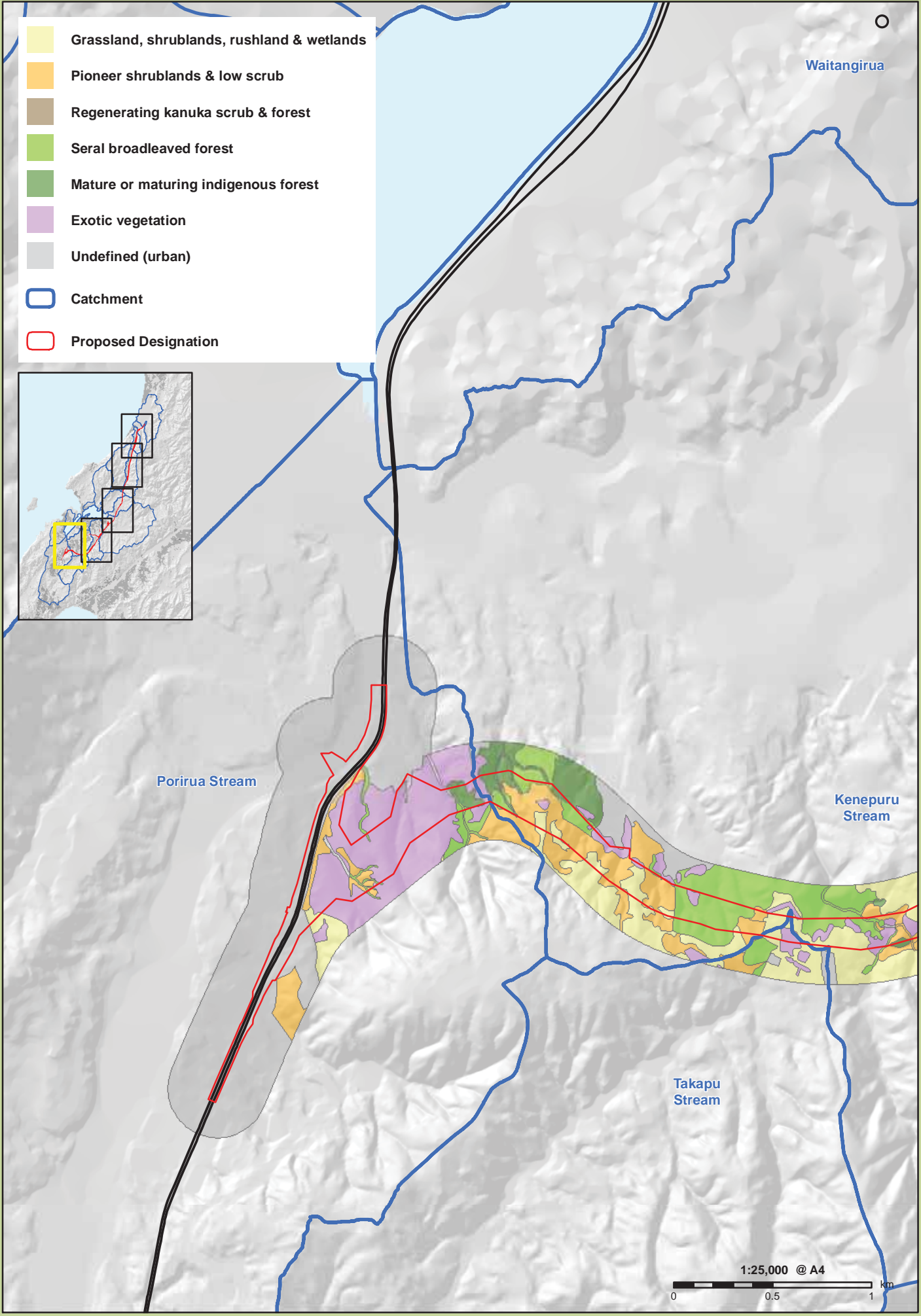
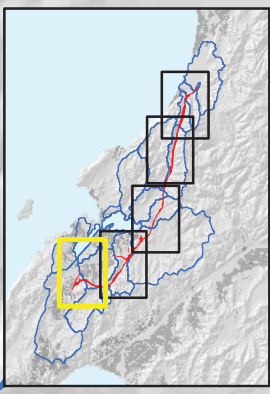


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- Grassland, shrublands, rushland & wetlands
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- Exotic vegetation
- Undefined (urban)
- Catchment
- Proposed Designation



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5.2 RARE PLANTS

In addition to vegetation mapping, and forest transects, botanical surveys were carried out to investigate six plant communities identified through the desktop study as being the most likely to contain rare or threatened plants.

These habitats were all located in the Horokiri and Te Puka valleys where the only extensive indigenous plant communities remain. The lists for each of these sites is provided in Appendix 6.J, page 102. These lists were combined and compared to other historical species lists prepared for areas located within or immediately adjacent to the mapped corridor. A master list was then prepared for the project corridor Appendix 6.K, page 105.

During this study only one species, *Leptinella tenella*, was found within the Designation that has a national threat classification. This species was ranked by de Lange *et al* (2009) as At Risk (Declining with the qualifiers of Data Poor, Range Restricted and Sparse). According to the New Zealand Plant Conservation Network (www.nzpcn.org.nz) *Leptinella tenella* is endemic to the North Island and northern South Island. Its distribution in the North Island is scattered from Mt Camel to Kawhia Harbour in the west and Matata in the east, thence absent until the Horowhenua and Wairarapa. *Leptinella tenella* is a lowland species, its habitat usually on stream margins where they enter estuaries, on lake margins, or on the margins of freshwater swamps and wetlands bordering saltmarsh.

This species is sometimes found on cattle pugged swampy ground bordering saltmarshes (as in the Transmission Gully location). It is intolerant of much shading and grass competition. It favours sites that are kept open through periodic disturbance from high tides and flooding. During this study it was located in an area of heavily grazed, sphagnum dominated wetland within the Horokiri Valley. This wetland is otherwise unremarkable; however, the presence of this species elevates its significance slightly.

The presence of this species contributes to our assessment of significance.

6. ASSESSMENT OF ECOLOGICAL VALUE

In this section the ecological value of identified vegetation and habitats are assessed drawing on historical studies and recent national policies and guidelines described in Sections 3.5, and the findings of this survey. In summary the assessment is informed by the following sources:

- The results of vegetation mapping carried out by this study;
- The results of rare plant surveys;
- Information provided by historical site inventories;
- LENZ threat classes for indigenous vegetation and habitats;
- Priority habitats described in the Wellington Conservancy CMS;
- National Priorities for protecting rare and threatened indigenous biodiversity; and
- Recent Case Law on criteria for assessing Significance.

6.1 VEGETATION COMMUNITIES

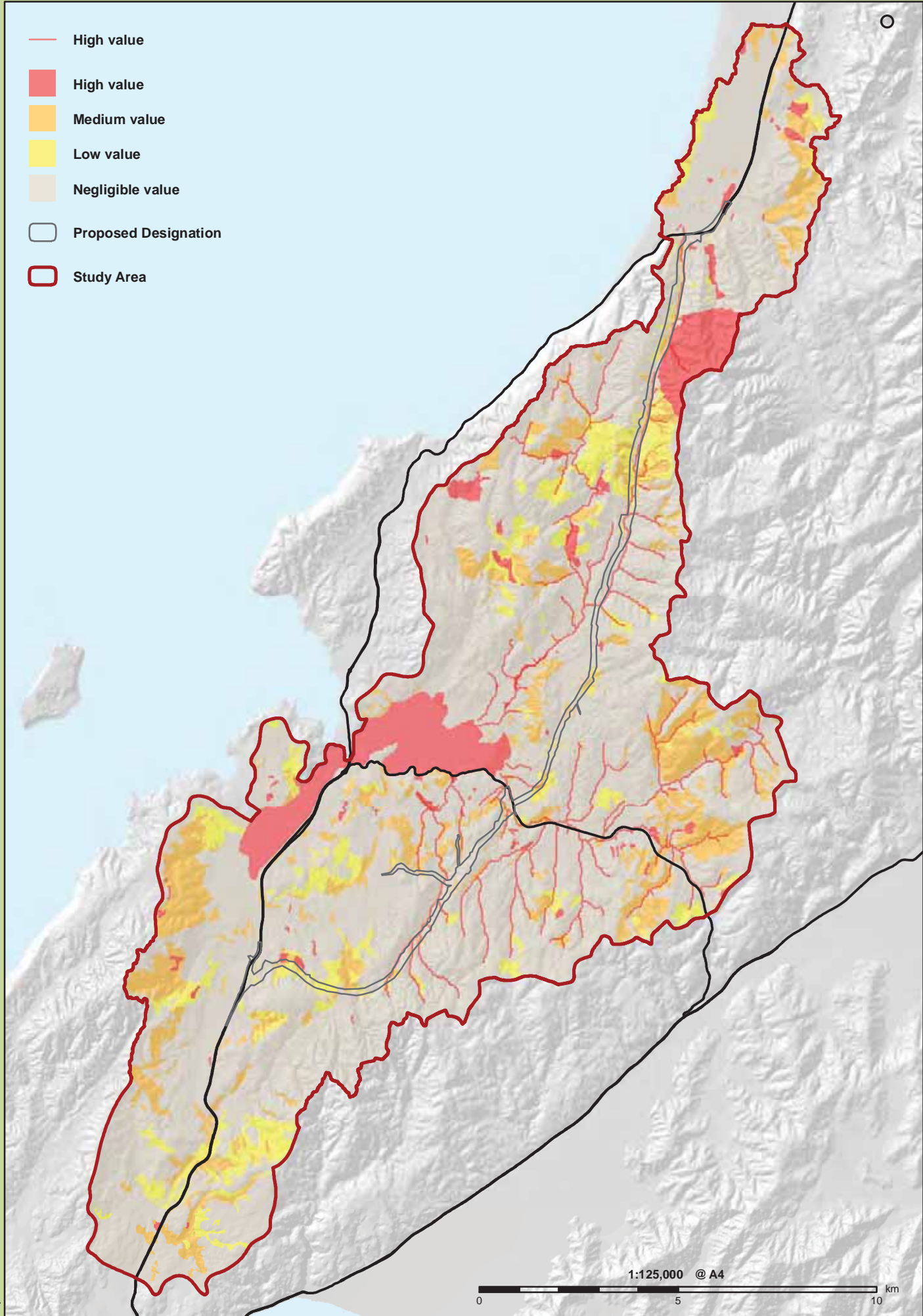
The assessment commenced with the development of a GIS layer that took the mapped vegetation communities and assigned each one a value (high, medium, low, and negligible) as follows.

Table 6.15. Value Classification of Plant Communities.

Grassland, shrublands, rushland and wetlands		RANK
1.01	Improved pasture	N
1.02	Rough pasture and shrublands	L
1.03	Cropland	N
1.04	Stony streambed in pasture	L
1.05	Riparian margins in rushland	M
1.06	Indigenous wetland	H
Pioneer shrublands and low scrub		
2.01	Gorse dominated scrub (closed canopy)	L
2.02	Tauhinu scrub (closed canopy)	L
2.03	Riparian margins with low scrub	M
Seral kanuka forest and scrub		
3.01	Secondary native forest	M
Seral broadleaved forest and scrub		
4.01	Transmission Gully restoration planting	M
4.02	Secondary native forest (mahoe)	M
4.03	Riparian margins with 2° native forest	H
Mature or maturing indigenous forest		
5.01	Lowland tawa forest	H
5.02	Coastal kohekohe forest	H
5.03	Remnant sub-montane hardwood forest	H
5.04	Riparian margins with indigenous forest	H
Exotic vegetation		
6.01	Plantation pine	L
6.02	Plantation pine - harvested	L
6.03	Exotic trees (shelterbelts, gardens)	L
6.04	Riparian margins with exotic trees	M

These were used to develop a base map, upon which all SNA's and PNA's were added (Figure 6.10, page 50).

- High value
- High value
- Medium value
- Low value
- Negligible value
- Proposed Designation
- Study Area



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Based upon the information contained with the SNA and PNA surveys, the value of each community was reviewed and the status of some were elevated or reduced. In addition, the presence of rare or locally uncommon indigenous plants was considered, for instance elevating the boggy pasture in Horokiri from low to medium based on the discovery of *Leptinella tenella* during the survey. The results of this analysis are shown in Figure 6.12, page 62 and summarised in Table 6.17

6.2 OTHER ASSESSMENT CONSIDERATIONS

6.2.1 National Priorities for Protecting Rare and Threatened Indigenous Biodiversity

National Priority 1: *To protect indigenous vegetation associated with land environments (defined by Land Environments of New Zealand at Level IV), that have 20% or less remaining in indigenous cover.*

- A LENZ level IV analysis was carried out and provides context to the following assessments. The results of this analysis are presented in Figure 6.11. The analysis is based on the following threat classes.

Table 6.16. LENZ Threat Classes

Category	1. Acutely threatened	2. Chronically threatened	3. At risk	4. Not at risk	A. Critically under protected	B. Under protected	C. Protected
	<10%	10–20%	20–30%	>30%	>30% indigenous cover remaining		
Criteria	<10% indigenous cover remaining	10–20% indigenous cover remaining	20–30% indigenous cover remaining	>30% indigenous cover remaining	<10% legally protected	10–20%	>20% protected

- The LENZ map confirms that within the study area the most threatened environments, and the environments that are critically under protected, are the lowlands, in particular the sand country of the Kapiti Coast, and the broad river valleys and terraces in the lower sections of the main streams. These are the areas that were first settled and which are now the most heavily urbanised and the most intensively farmed.
- The areas that are not at risk, and where there is adequate protection, are the higher steeper lands, typically class VII and VIII land (NZLRI) which is less suitable for land clearance and farming.
- These threat classes are taken into account in the assessment of significance in Table 6.17.

National Priority 2: *To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.*

- All dunelands and associated wetlands are considered in Table 6.17.

National Priority 3: *To protect indigenous vegetation associated with ‘originally rare’ terrestrial ecosystem types not already covered by priorities 1 and 2.*

Seventy two “Naturally rare ecosystems” have been identified (Williams *et.al.* 2007) and are defined as “ecosystems having a total extent less than 0.5% of New Zealand’s total area”. Many of these ecosystems rely on specific rock and soil types which are not found locally. The only ones of these

that have been identified within the mapped corridor and could potentially be affected by this project are:

- **Cloud Forest** (high cloud cover, <1,500 sunshine hrs and >200 rain days p.a.):
The forests on the slopes above Wainui Saddle fall into this category. This is acknowledged in Table 6.17.
- **Ephemeral wetlands** (seasonally high water table / depression. Herbfield).
We are satisfied that all ephemeral wetlands observed during this study are agricultural in origin (colluviation due to land clearance, over-sowing, grazing and trampling), are therefore not representative of historical communities and so have limited botanical value. Their dominance by exotic grasses and weed species also mean they have limited habitat value. These ephemeral wetlands are therefore not recognised unless another value is present (e.g. recognised habitat values or the present of rare flora or fauna).
- **Damp sand plains** (raw-recent/coastal/sand/depression/plains/permanently high water table. Open land, herbfield).
There are small areas at the McKays Crossing end of the Designation, all of which are currently in production farming. No original or unmodified sand plains are present.
- **Dune slacks** (raw-recent/coastal/sand/depression/permanently or seasonally high water table. Open land, herbfield).
There are small areas at the McKays Crossing end of the corridor including the McKays Crossing Wildlife Reserve. These are identified in Table 6.17.
- **Estuaries:**
These are identified in Table 6.17 to the extent that there is no distinct line between terrestrial vegetation, freshwater wetlands, and tidal saltmarsh vegetation.

National Priority 4: *To protect habitats of acutely and chronically threatened indigenous species.*

- This study did not identify any acutely or chronically threatened indigenous plants. It has identified one plant, *Leptinella tenella*, which is At Risk (Declining with qualifiers of Data Poor, Range Restricted and Sparse). The community this is found in is listed in Table 6.17.









6.2.2 WELLINGTON CONSERVATION MANAGEMENT STRATEGY

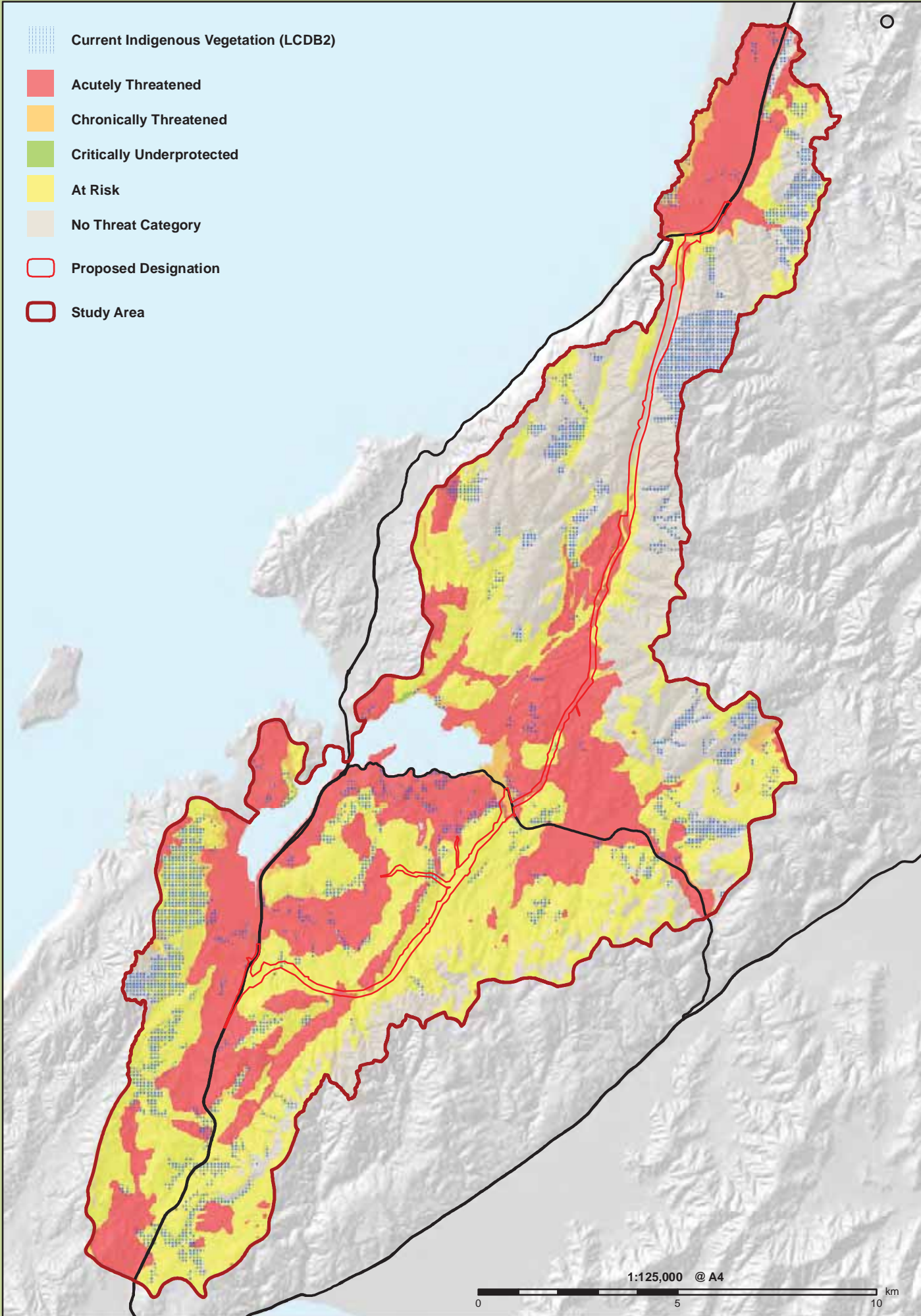
Within the Wellington Conservancy the 10 highest priority ecosystems and habitats managed by the Department in the Wellington CMS area (DOC 2010) are:

- **Indigenous forests:**
A small number of indigenous forest fragments are present within the Designation and a number are crossed by the project Footprint. In almost all instances these fragments have been identified and described in earlier PNA surveys and these descriptions have helped to inform the assessment of significance in Table 6.17.
- **Shrublands:**
We are satisfied that none of the shrublands contained within the Designation are persistent shrublands representative of historical communities. They therefore have limited botanical value. However, we have identified areas where regeneration has advanced to a stage where the shrublands are becoming increasingly important as habitat. These are identified in

Table 6.17.

- **Freshwater wetlands:**
These are identified in Table 6.17.
- **Rivers and lakes:**
There are no lakes within the mapped corridor. Listed rivers are identified in Table 6.17 to the extent that riparian vegetation is relevant to the values of these watercourses.
- **Estuaries:**
These are identified in Table 6.17.
- **Dunes and dune wetlands:**
See above.
- **Cliffs:**
No cliff habitat was identified within the mapped corridor.
- **Herbfields and grasslands:**
We are satisfied that all grasslands and herbfields are agricultural in origin, are dominated by exotic grasses and weed species and are therefore not representative of historical communities. Furthermore they have both limited botanical and habitat value.
- **Islands:**
Not relevant to this technical report.
- **Marine environment:**
Not relevant to this technical report.

-  Current Indigenous Vegetation (LCDB2)
-  Acutely Threatened
-  Chronically Threatened
-  Critically Underprotected
-  At Risk
-  No Threat Category
-  Proposed Designation
-  Study Area



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6.3 PLANT COMMUNITIES AND TERRESTRIAL HABITATS OF ECOLOGICAL VALUE

The previous sections of this report have led to the identification of 41 sites believed to have plant communities or species of ecological value (See Table 6.17). The list includes 19 sites historically identified, together with a number of other plant communities identified during this study which may not have sufficient value to warrant protection, but which still provide habitat values warranting consideration in an assessment of effects of the Project.

The table also provides an assessment of each site's significance (High, Moderate, Low, Negligible), using the following four criteria (Shearer Swamp vs West Coast Regional Council):

- ecological context;
- representativeness;
- rarity (species, communities, habitats); and
- distinctiveness.

In determining community and habitat significance, consideration was given to the findings of other studies and the LENZ threat class for each landform upon which the community was located.

Table 6.17. Assessment of Ecological Significance

DESCRIPTION (listed North to South)	Rel ¹ to TG route	Site Status	LENZ Threat	Significance Assessment					Overall Score
				Represent- ativeness	Context	Rarity	Distinctive - ness		
Whareroa Catchment									
Wetlands represented by									
1. K106 - McKays Crossing Wildlife Reserve	D	PNA	1	H	M	H	M	H	
Wainui Catchment									
Indigenous forest represented by									
2. K139 - Rowans Bush	D	PNA	4	M	H	Nil	L	H	
Te Puka Catchment									
Mature or maturing indigenous forest represented by									
3. Akatarawa/Whakatikei Forest Park	F	PNA	5	M	H	H	H	H	
4. K223 - Paekakariki bush C	F	NR	1	L	L	nil	nil	L	
5. K224 - Paekakariki bush D	F	NR	1	L	L	nil	nil	L	
6. K225 - Paekakariki bush E	F	NR	4	L	L	nil	nil	L	
7. K226 - Paekakariki bush F	F	NR	5	L	L	nil	nil	L	
8. K227 - Paekakariki bush G	F	NR	5	L	L	nil	nil	L	
9. K228 - Paekakariki bush H	F	NR	5	L	L	nil	nil	L	
10. K229 - Paekakariki bush I	F	NR	5	M	M	nil	nil	M	
11. K230 - Paekakariki bush J	F	NR	5	L	L	nil	nil	L	
Regenerating indigenous forest represented by									
12. Seral / regenerating forest (mahoe/kanuka)	F	-	5	L	M	nil	nil	L	
Shrublands and scrub represented by									
13. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	5	nil	L	nil	nil	L	
Horokiri East Catchment									
Wetlands represented by									
14. Horokiri Wildlife Management Reserve	DS	PNA	1	H	H	H	M	H	
15. Sphagnum / Juncus wetland on valley floor	D	-	4	nil	L	L	nil	L	
Mature or maturing indigenous forest represented by									
16. PCC172 – Transmission Gully Saddle	D	SNA	5	L	L	nil	nil	L	
Regenerating indigenous forest represented by									
17. PCC199 – TG Riparian Area	D	SNA	5	L	L	nil	nil	L	

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Shrublands and scrub represented by								
18. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	5	nil	L	nil	nil	L
Pasture								
19. Battle Hill Regional Park	F	PNA	1	nil	nil	nil	nil	Nil
Ration Catchment								
Wetlands represented by								
20. Ration Stream (Riparian Margins)	D	Listed	1	nil	L	nil	nil	L
Shrublands and scrub represented by								
21. Advanced Mitigation Planting - Sites 6 & 7	D	Mitigate	1	L	L	nil	nil	L
22. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	5	nil	L	nil	nil	Nil
Pauatahanui Catchment								
Wetlands represented by								
23. Pauatahanui Wildlife Management Reserve	DS	PNA	1	H	H	H	H	VH
24. Pauatahanui Inlet Wildlife Refuge	DS	PNA	1	H	H	H	H	VH
25. Pauatahanui Stream (Riparian Margins)	F	Listed	2	L	L	nil	Nil	L
Regenerating indigenous forest represented by								
26. PCC196 – Scoresby Grove Kanuka	F	PNA	1	L	M	nil	nil	M
Shrublands and scrub represented by								
27. Advanced Mitigation Planting - Sites 5	D	Mitigate	1	L	L	nil	nil	L
Duck Creek Catchment								
Wetlands represented by								
28. Duck Creek Scenic Reserve	DS	PNA	1	H	H	L	L	H
29. Duck Creek Riparian Margins	F	Listed	4	L	nil	L	nil	L
Mature or maturing indigenous forest represented by								
30. PCC155b – Whitby West Bush	F	PNA	4	M	L	nil	nil	M
31. PCC33 – James Cook Drive Bush	F	SNA	1	H	L	M	M	M
Regenerating indigenous forest represented by								
32. PCC190 – Exploration Drive Kanuka	F	SNA	4	M	L	nil	nil	M
Shrublands and scrub represented by								
33. Advanced Mitigation Planting - Sites 1, 2, 3, 4	F	Mitigate	4	L	L	nil	nil	L
34. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	5	nil	L	nil	nil	L
Pasture								
35. Belmont Regional Park	F	PNA	4-5	nil	nil	nil	nil	Nil
Kenepuru Catchment								
Mature or maturing indigenous forest represented by								
36. WCC 0702.15 - Head of Cannons Creek	D	SNA	1	M	L	nil	nil	M
37. WCC 0702.16 - Head of Cannons Creek	F	SNA	1	M	L	nil	nil	M
Regenerating indigenous forest represented by								
38. Porirua Park Bush	F	PNA	4	H	H	M	M	H
39. PCC12 – Cannons Creek Bush	F	PNA	4	H	H	M	L	H
40. Seral forest on slopes above Porirua East	F	-	4	L	L	nil	nil	L
Shrublands and scrub represented by								
41. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	5	nil	L	nil	nil	L
Porirua Catchment								
Wetlands represented by								
42. Onepoto Arm of Porirua Harbour	DS	-	1	L	H	H	M	H
Mature or maturing indigenous forest represented by								
43. PCC88 – Roberts Bush	D	SNA	4	L	L	nil	nil	L
44. Unnamed Site identified by BML surveys	F	-	4	L	L	nil	nil	L
Regenerating indigenous forest represented by								
45. Seral forest on slopes above Porirua East	F	-	4	L	L	nil	nil	L
Shrublands and scrub represented by								
46. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	5	nil	L	nil	nil	L

VH - very high,

H – high,

M – moderate

L – low

N - negligible

Ten sites are considered to have High ecological value:

- Three sites (Cannons Creek Bush - PCC12, Porirua Park Bush - PCC76, and Akatarawa Forest) lie beneath the Footprint and there will be some loss of habitat within each.
- A further five sites lie downstream of the Footprint (Duck Creek Scenic Reserve - PCC22, Pauatahanui Wildlife Management Reserve - PCC65 and Pauatahanui Wildlife Refuge, Horokiri Wildlife Management Reserve - PCC 30, and the Onepoto arm of Porirua Harbour). In these cases, any effects will be indirect and relate to potential contamination of streams that flow through them, either via sediment discharge during earthworks, or stormwater discharge during highway operation.
- The final two sites (Rowans Bush - QEII5/07/363, and McKays Crossing Wildlife Reserve - KCDC106) are crossed by the Designation but in each case there is the potential to avoid effects through careful management.

Seven sites are considered to have moderate value. All are affected by the footprint.

Twenty six sites or areas of vegetation are considered to have low ecological values but still provide some ecological benefits.

Table 6.18 quantifies the amount of each identified site that lies within the designation, or beneath the project footprint, as a percentage of the total area of that vegetation community within the catchment. This table is intended to inform the assessment of effects.

Table 6.18. Magnitude of Risk to Each Site

DESCRIPTION (listed North to South)	Rel ² to TG route	Site Status	Significance Score	Total Area vegetation by Catchment	Area (ha) Designation (% total)	Area (ha)/Footprint (% total)
Whareroa Catchment						
Wetlands represented by						
1. McKay's Crossing Wildlife Reserve (8.7ha)	D	PNA	H	12	1.4 (12%)	0.1 (<1%)
Wainui Catchment						
Indigenous forest represented by						
2. Rowans Bush (2.5ha)	D	PNA	H	17	0.5 (3%)	0 (0%)
Te Puka Catchment						
Mature or maturing indigenous forest represented by						
3. Akatarawa/Whakatikei Forest Park (15,423ha)	D	PNA	H	23	1.2 (5%)	0.2 (1%)
4. K223 - Paekakariki bush C (2.2ha)	F	NR	L	23	1.5 (7%)	0.1 (<1%)
5. K224 - Paekakariki bush D (2.0 ha)	F	NR	L	23	0.7 (3%)	0.1 (<1%)
6. K225 - Paekakariki bush E (0.9ha)	F	NR	L	23	0.6 (3%)	0.2 (1%)
7. K226 - Paekakariki bush F (0.6ha)	F	NR	L	23	0.2 (1%)	0.2 (1%)
8. K227 - Paekakariki bush G (0.2ha)	F	NR	L	23	1.0 (4%)	0.6 (3%)
9. K228 - Paekakariki bush H (1.0ha)	F	NR	L	23	4.1 (18%)	2.3 (10%)
10. K229 - Paekakariki bush I (4.1ha)	F	NR	M	23	0.1 (0%)	0.1 (<1%)
11. K230 - Paekakariki bush J (0.1ha)	F	NR	L	23	6.6 (29%)	1.6 (7%)
Regenerating indigenous forest represented by						
12. Seral / regenerating forest (mahoe)	F	-	L	113	3.4 (3%)	0.8 (1%)
Shrublands and scrub represented by						
13. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	L	35	8 (23%)	3.3 (9%)
Horokiri East Catchment						
Wetlands represented by						
14. Horokiri Wildlife Management Reserve	DS	PNA	H	6	0 (0%)	0 (0%)
15. Sphagnum / Juncus wetland on valley floor	D	-	L	6	0.8 (13%)	0 (0%)
Mature or maturing indigenous forest represented by						
16. PCC172 – Transmission Gully Saddle (1.9ha)	D	SNA	L	66	0.6 (1%)	0 (0%)

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Regenerating indigenous forest represented by							
17. PCC199 – TG Riparian Area (0.3ha)	D	SNA	L	110	5.4 (5%)	0.8 (1%)	
Shrublands and scrub represented by							
18. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	L	245	19.8 (8%)	4.2 (2%)	
Pasture							
19. Battle Hill Regional Park (501ha)	F	PNA	Nil	809	21.7 (3%)	8.2 (1%)	
Ration Catchment							
Wetlands represented by							
20. Ration Stream (Riparian Margins)	D	Listed	L	3	1.3 (43%)	0.8 (27%)	
Shrublands and scrub represented by							
21. Advanced Mitigation Planting - Sites 6 & 7	D	Mitigate	L	25	8.8 (35%)	3.4 (14%)	
22. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	Nil	16	3.4 (21%)	1.8 (11%)	
Pauatahanui Catchment							
Wetlands represented by							
23. Pauatahanui Wildlife Management Reserve	DS	PNA	VH	173	0 (0%)	0 (0%)	
24. Pauatahanui Inlet Wildlife Refuge	DS	PNA	VH	173	0 (0%)	0 (0%)	
25. Pauatahanui Stream (Riparian Margins)	F	Listed	L	173	1.9 (<1%)	0.9 (<1%)	
Regenerating indigenous forest represented by							
26. PCC196 – Scoresby Grove Kanuka (4.7ha)	F	PNA	M	798	3.1 (<1%)	1.2 (%)	
Shrublands and scrub represented by							
27. Advanced Mitigation Planting - Sites 5	F	Mitigate	L	798	4.2 (<1%)	2.3 (%)	
Duck Creek Catchment							
Wetlands represented by							
28. Duck Creek Scenic Reserve	DS	PNA	H	6	0 (0%)	0 (0%)	
29. Duck Creek Riparian Margins	F	Listed	L	6	0.5 (8%)	0 (0%)	
Mature or maturing indigenous forest represented by							
30. PCC155b – Whitby West Bush (9.2ha)	F	PNA	M	26	0.1 (<1%)	0 (0%)	
31. PCC33 – James Cook Drive Bush (12.9ha)	F	SNA	M	26	1.1 (4%)	0.3 (1%)	
Regenerating indigenous forest represented by							
32. PCC190 – Exploration Drive Kanuka (8.0ha)	F	SNA	M	55	0.8 (1%)	0.3 (1%)	
Shrublands and scrub represented by							
33. Advanced Mitigation Planting - Sites 1, 2, 3, 4	F	Mitigate	L	88	4.7 (9%)	2.1 (4%)	
34. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	L	88	0.4 (<1%)	0 (0%)	
Pasture							
35. Belmont Regional Park (3,446ha)	F	PNA	Nil	513	48.8 (10%)	12.1 (2%)	
Kenepuru Catchment							
Mature or maturing indigenous forest represented by							
36. WCC 0702.15 - Head of Cannons Creek (1.1ha)	D	SNA	M	4	0.7 (18%)	0 (0%)	
37. WCC 0702.16 - Head of Cannons Creek (1.3ha)	F	SNA	M	4	1 (25%)	0.1 (3%)	
Regenerating indigenous forest represented by							
38. Porirua Park Bush (43.2ha)	F	PNA	H	78	7 (9%)	1.9 (2%)	
39. PCC12 – Cannons Creek Bush (41.7ha)	F	PNA	H	78	1.1 (1%)	0.2 (<1%)	
40. Seral forest on slopes above Porirua East	F	-	L	78	1.9 (2%)	0.2 (<1%)	
Shrublands and scrub represented by							
41. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	L	213	13.2 (6%)	4.7 (2%)	
Porirua Catchment							
Wetlands represented by							
42. Onepoto Arm of Porirua Harbour	DS	-	H	61.5	0 (0%)	0 (0%)	
Mature or maturing indigenous forest represented by							
43. PCC88 – Roberts Bush (3.7ha)	D	SNA	L	15	0.6 (4%)	0.2 (1%)	
44. Unnamed Site identified by BML surveys	F	-	L	15	0.6 (4%)	0.1 (1%)	
Regenerating indigenous forest represented by							
45. Seral forest on slopes above Porirua East	F	-	L	529	0.6 (<1%)	0.2 (<1%)	
Shrublands and scrub represented by							
46. Shrublands & scrub (tauhinu/gorse/mahoe)	F	-	L	412	3.2 (1%)	1.3 (0%)	

6.4 SUMMARY

Whareroa Catchment

- Within this catchment approximately 1 ha of the 9.8 ha McKays Wildlife Reserve wetland lies within the Designation. This is a protected site of high value, due to rarity of this At Risk habitat within the Ecological District, and the presence in the wetland of a range of rare plants and fauna. It is not affected by the Footprint as currently designed but could be affected by associated construction activity. This regionally significant wetland should be avoided if possible and recommendations to that effect are required.
- No other indigenous vegetation within this catchment lies within the Designation.

Wainui Catchment

- In the Wainui Catchment, approximately 1 ha of the 2.8 ha Rowans bush lies within the Designation. This is a protected site (QEII covenant) of high value due to the rarity of this At Risk habitat within the ED. Based on the current project design, this forest falls outside the project Footprint but could be affected by associated construction activity. This regionally significant forest remnant should be avoided if possible, and recommendations to that effect are required.
- No other indigenous vegetation within this catchment lies within the Designation.

Te Puka Catchment

- 16 ha of the 20 ha of mature or maturing indigenous forest that lies within the Designation are found in the Te Puka Valley.
- Approximately 4 ha of the Akatarawa Whakatikei Forest Park lies within the Designation. This forest is considered to be regionally significant due both to its size, continuity, the presence of a wide range of rare and threatened flora and fauna, and its habitat values. It is considered to be the most important terrestrial habitat along the route. Based on the current project design, this forest falls outside the Footprint but could be affected by associated construction activity. Of particular concern would be any activity that cut into the forest margin which could lead to die-back and windthrow, potentially affecting the emergent podocarps upslope of the forest margins. This forest remnant should be avoided and recommendations to that effect are required.
- Approximately 12 ha of small kohekohe dominated forest fragments (K223 to K229) lie within the Footprint in this catchment and all will be partly or entirely lost. All but one of these fragments are only considered to have low value due to their small size and high degree of modification. However, any parts that remain following construction can form the cores and seed sources for restoration. One fragment is considered to have moderate value due to its size and the relative integrity of the canopy.
- There are small areas of young kanuka scrub and regenerating mahoe forest within the Designation and Footprint, typically in gullies and riparian margins. These are considered to have low botanical value but moderate habitat value, especially where they form riparian margins along perennial streams. Any areas not affected by construction can form cores and seed sources for regeneration and restoration.
- There are a number of areas of pioneer shrubland and scrub dominated by gorse and tauhinu within the Designation of this catchment (8 ha). These have in all cases regenerated in recent years through pasture and are of low floristic diversity. They have negligible botanical or habitat value.

Horokiri Catchment

- No sites of high botanical or habitat value lie within the Designation in the Horokiri catchment.

- The only terrestrial site of high value that could be potentially affected by works in the Horokiri catchment is the wetlands of the Horokiri Wildlife Management Reserve (PCC 65) which lies on the margins of Pauatahanui Estuary and downstream of the corridor.
- There are two sites within the Horokiri catchment with moderate botanical or habitat value. The first is an area of regenerating riparian bush (PCC 199) which does not contain rare or representative plants or communities but provides habitat and connectivity along this regionally significant stream. Part of this site may be lost beneath the Footprint. The extent of loss should be reduced as much as practical through design, and mitigation will need to be provided.
- The second site is an area of boggy and heavily cattle pugged pasture which nonetheless has developed areas of sphagnum dominated bog which contains at least one locally uncommon wetland plant. This site has not been previously identified as having value. While it lies within the Designation it is unlikely to be affected by the Footprint, and provides opportunities for restoration.
- There are a number of gullies that lie beneath the Footprint where seral broadleaf scrub and low forest is developing. This vegetation provides habitat value, riparian cover, and restoration opportunities. These sites should be considered in determining mitigation and provide opportunities for enrichment.
- In the location of the alignment, Battle Hill Regional Farm Park has no indigenous vegetation.

Ration Catchment

- In Ration Stream the only native vegetation that falls within the Designation are the three areas of early retirement planting carried out as required by conditions for the original Designation. This planting has progressed rapidly in the two oldest areas and now provides very good riparian cover. Management of construction to limit loss of this vegetation is recommended.
- There is some other riparian vegetation, typically rushlands in grazed pasture. This has limited floristic or habitat values.

Pauatahanui Catchment

- No sites of high botanical or habitat value lie within the Designation in the Pauatahanui catchment.
- The only site of high value that could be potentially affected by works in the Pauatahanui catchment is the Pauatahanui Wildlife Management Reserve on the margins of Pauatahanui Estuary and downstream of the corridor.
- There is a stand of tall kanuka forest (PCC 196) on the margins of Pauatahanui Stream that is considered to have moderate value. Some of this lies beneath the project Footprint and will be lost. This will be need to be mitigated.
- There is a small stand of tawa, first described during this study, in a small gully within the Designation. This stand is considered to have low value but if it can be avoided could provide a core to enhance mitigation planting.

Duck Creek Catchment

- Like Pauatahanui and Horokiri catchment, the only site of high value that could be potentially affected by works is the Duck Creek Scenic Reserve saltmarsh on the margins of Pauatahanui Estuary and downstream of the corridor.
- One site of moderate value is an area of kanuka forest called James Cook Drive bush (PCC 33). Some of this lies beneath the project Footprint and will be lost. This will be need to be mitigated.
- In the Duck Creek catchment, the only native vegetation that falls within the Designation and Footprint are the three areas of early retirement planting carried out as required by conditions for the original Designation. This planting has progressed rapidly in the two oldest











areas and now provides very good riparian cover. Management of construction to limit loss of this vegetation is recommended.

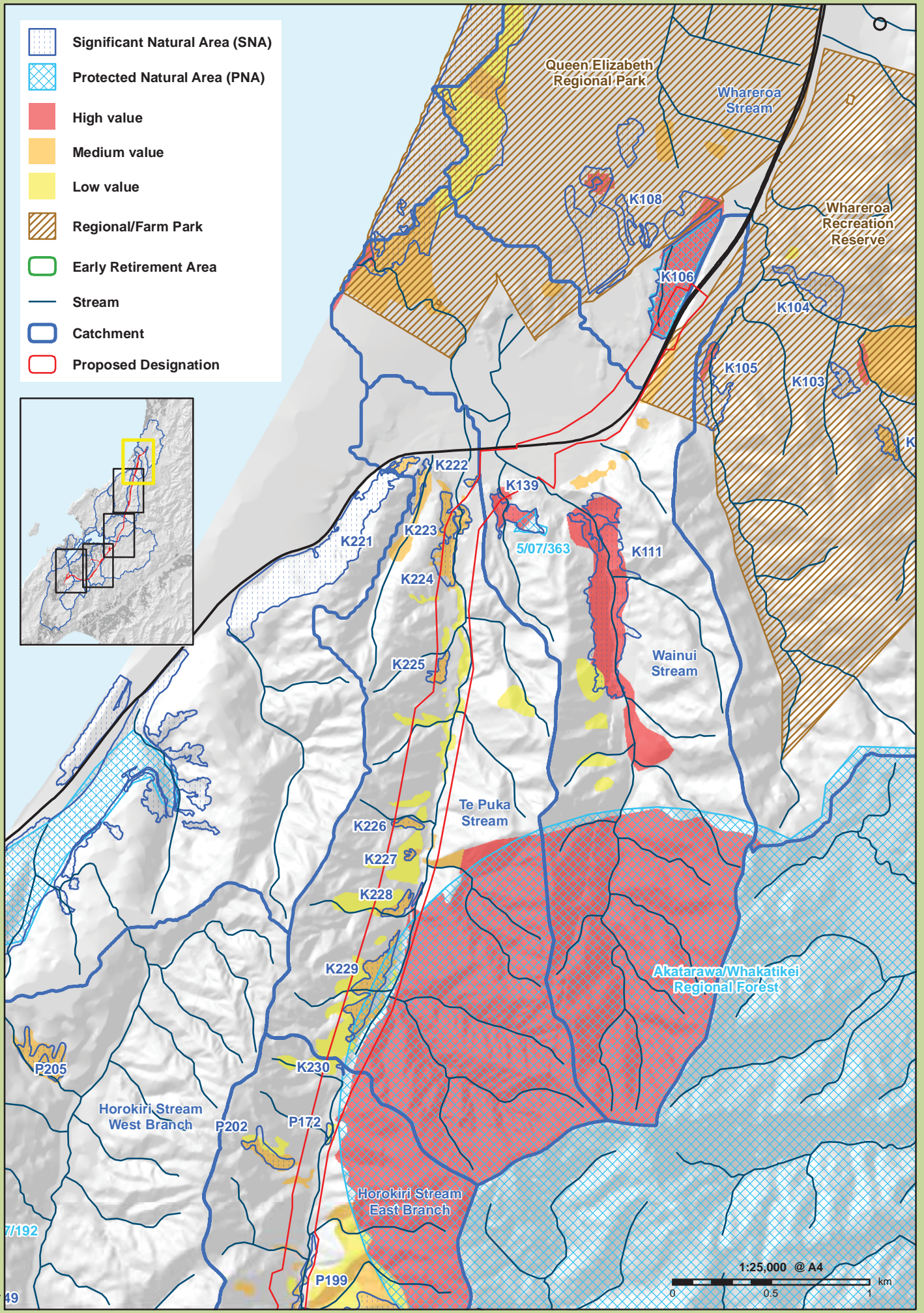
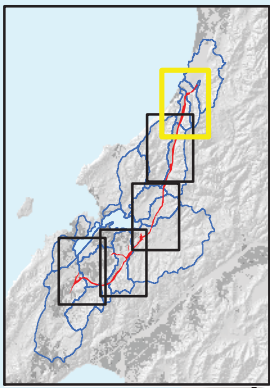
Kenepuru Catchment

- Within the Kenepuru Catchment, Cannons Creek Bush (PCC12) and the areas of contiguous shrubland and low forest surrounding it, are considered to have high ecological value. There will be some parts of this vegetation which will be lost beneath the Footprint, both through construction of the Cannons Creek Bridge, and in the western approaches to that bridge. This loss will need to be mitigated.
- Within Cannons Creek Bush and lying beneath or in close proximity to the bridge, are two small stands of maturing tawa forest (WCC Ecosites 0702.15, W0702.16). These have been determined to have moderate ecological value. Attempts should be made to minimise adverse effects on these stands which are integral to the values of the wider reserve.

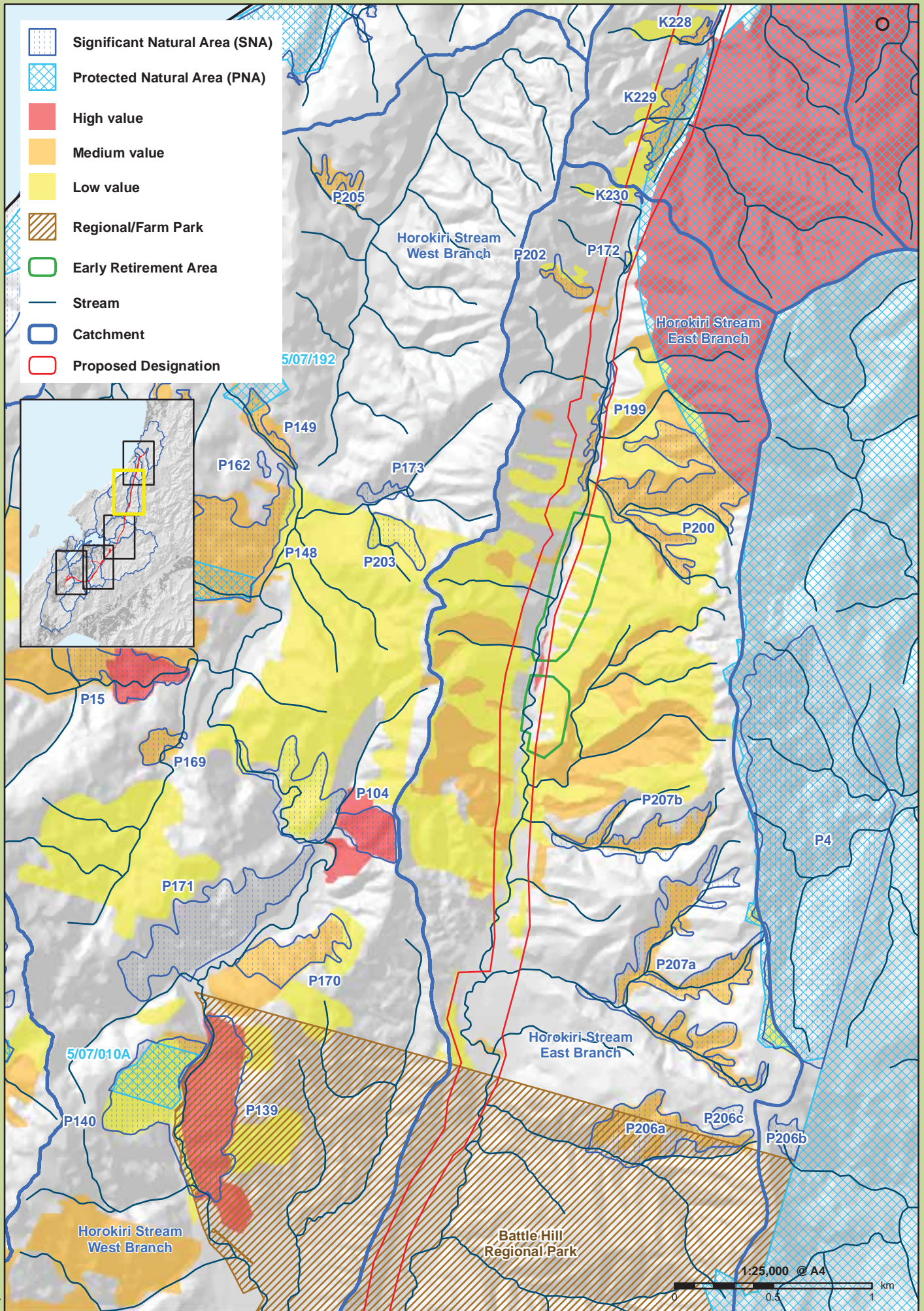
Porirua Catchment

- One area within this catchment, Porirua Park Bush, has high ecological values. The Footprint of the project encroaches into the scrub and low forest margins of this forest. Every effort needs to be made to limit this encroachment through the detailed design process. In addition to the loss of habitat, this type of forest is highly susceptible to die back where the protective marginal vegetation has been removed, allowing wind, frost and weeds to encroach. The management of effects and mitigation need careful consideration.
- Two additional small areas of tawa forest, Roberts Bush (PCC88) and a small remnant located by this study, lie within the Designation but may not be affected by the Footprint. Avoiding these small stands should be attempted if possible.

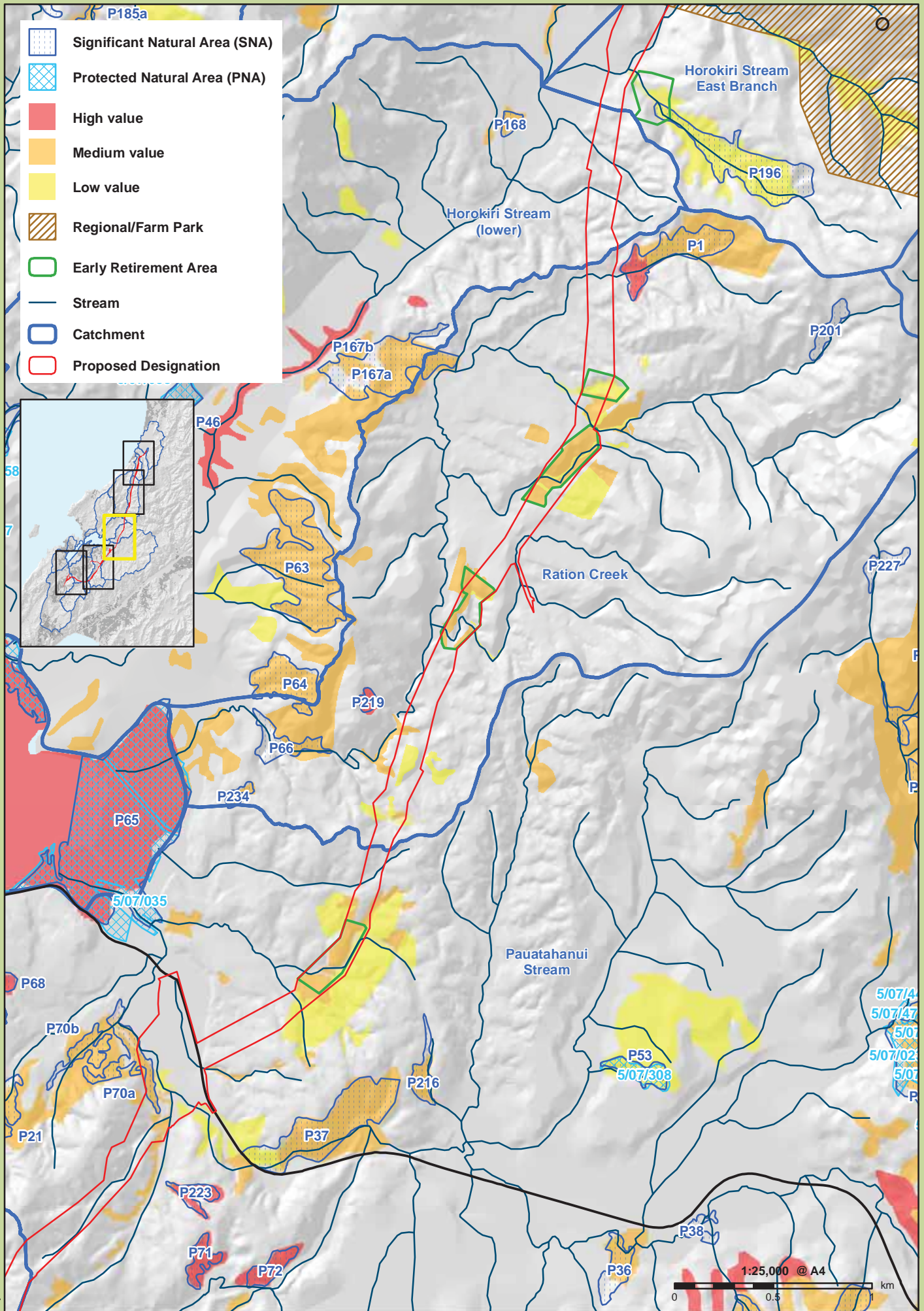
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-  Protected Natural Area (PNA)
-  High value
-  Medium value
-  Low value
-  Regional/Farm Park
-  Early Retirement Area
-  Stream
-  Catchment
-  Proposed Designation



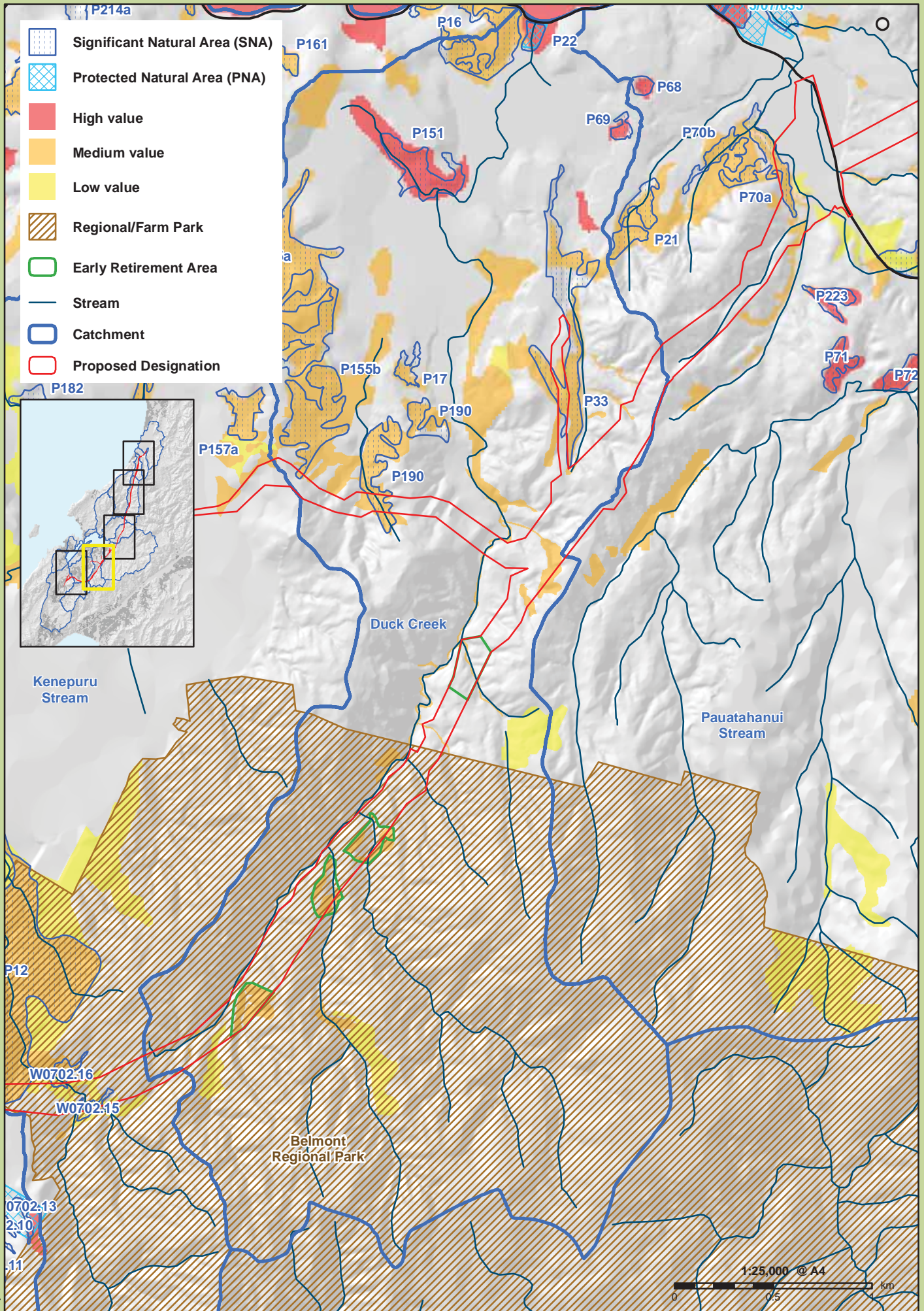
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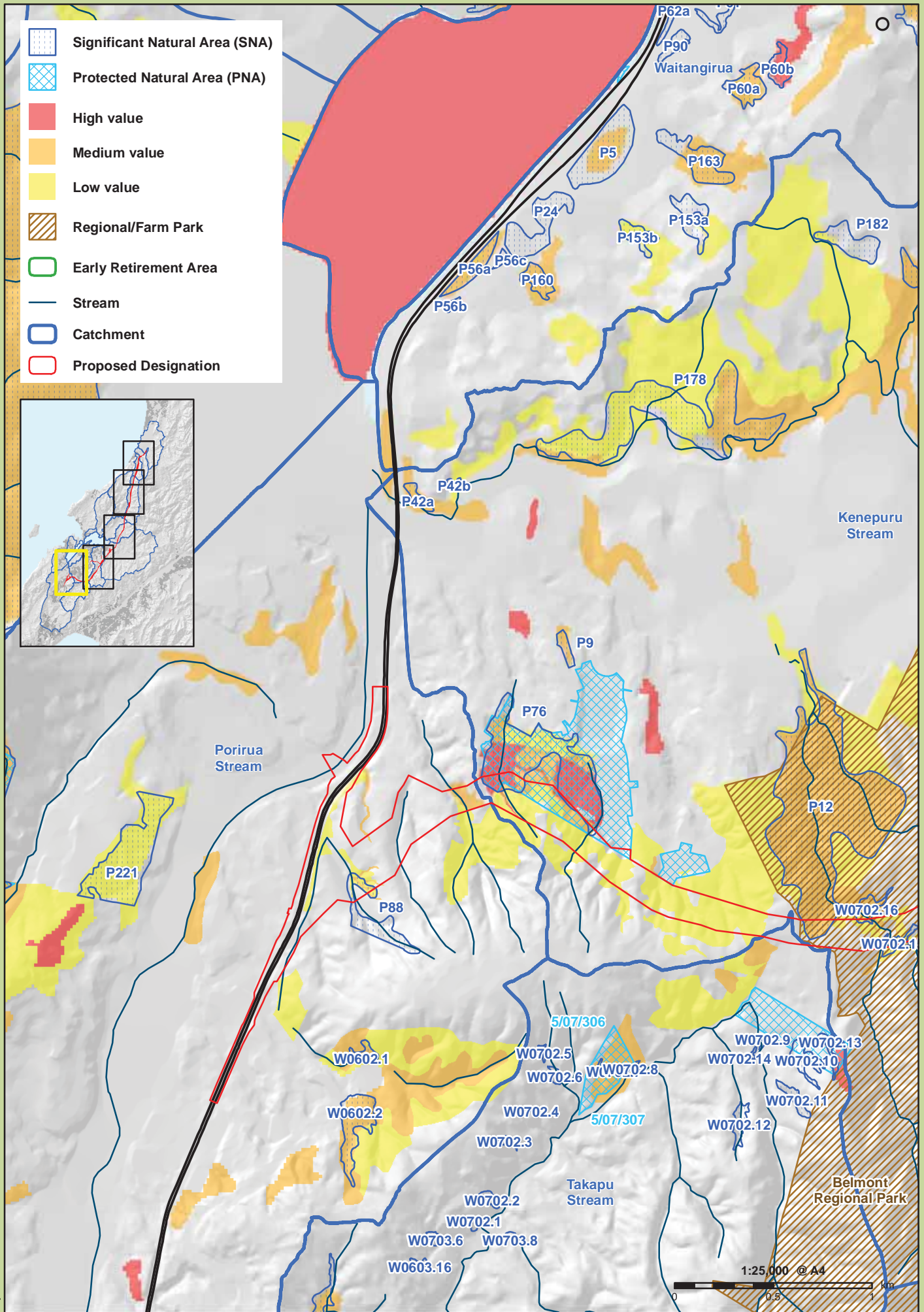
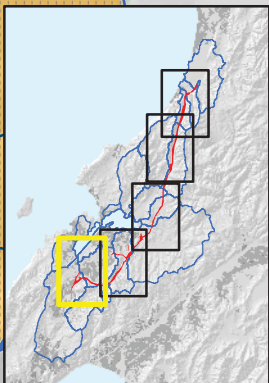
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-  Significant Natural Area (SNA)
-  Protected Natural Area (PNA)
-  High value
-  Medium value
-  Low value
-  Regional/Farm Park
-  Early Retirement Area
-  Stream
-  Catchment
-  Proposed Designation



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7. DISCUSSION

This study has examined mapped and described the vegetation within a 500 m wide corridor running along the 27 km length of the Alignment and associated link roads (a total mapped area of 850ha). A small number of transects were carried out to better describe several indigenous plant communities that are potentially affected by the alignment. A botanical survey of six key habitats was carried out to identify any rare species.

The results show that the great majority (72%) of the project Designation lies in a highly modified pastoral landscape including croplands, plantation pine and associated exotic forest communities, or is classed as urban. These communities have no botanical value and typically have low habitat value.

13% of the vegetation within the Designation is in pioneer shrublands and scrub within pasture. These have low botanical value and minimal habitat value. We do not propose that mitigation is required for the loss of any of these communities.

9% of the vegetation within the Designation is in seral scrub and forest dominated by either kanuka or mahoe. These communities have a range of botanical and habitat values and mitigation will need to be considered for their loss.

Mature indigenous forest makes up less than 4% (6ha) of the plant communities affected. There may be opportunities to reduce the loss of forest which lies within the Designation but outside the Footprint. Key areas where this may be possible are identified and a number of recommendations are made to this effect.

All rare, threatened or locally uncommon plant species were identified from a range of sources. From these sources we also identified the key habitats within the Designation that were likely to contain any of these plants. Upon inspection only one rare plant was found, located in a small wetland area in pasture. This was not surprising given the almost complete historical removal of native forest from this landscape and the long history of grazing. A number of locally uncommon plants were identified within forest remnants and this added to our assessment of the significance of these forests.

A significance assessment has been carried out of the plant communities that could be affected by this project. This has taken into account a range of factors including historical surveys and site inventories, rare and threatened species, communities and habitats, and recent case law. It has identified nine sites of high ecological value: two that currently lie beneath the Footprint and will suffer some loss of habitat (Porirua Park Bush & Cannons Creek Bush); three that lie within the Designation but may be avoided (McKays Crossing, Rowans Bush, Akatarawa Forest Park); and four that lie downstream and could be indirectly affected by sediment and stormwater (Horokiri Wildlife Reserve, Pauatahanui Wildlife Reserve, Duck Creek Scenic Reserve, and Onepoto Harbour).

We have considered a range of other site influences including climate, geology, soils, and slope and identified a number of major site limitations which require consideration when developing mitigation and revegetation packages. We note that large areas of the project Designation sits on Class 7 and 8 land (23%, or 104 ha). While most of this land has been historically cleared and is currently in rough pasture or scrub, Class 7 and 8 land is generally described as “not suitable for production and should be left in forest for protection”.

Related to this issue is the amount of the Designation (26%) which lies on land described in the regional soil plan as erosion prone. Retirement of this land as part of any mitigation package could potentially have wider benefits than just regeneration of vegetation, including reduction of downstream effects from sedimentation due to natural erosion.

We have also described the likely historical vegetation of the site which can guide any revegetation that is undertaken.

8. RECOMMENDATIONS

- Every effort should be made to minimise effects on any mature forest (coastal kohekohe, lowland podocarp/tawa, or montane podocarp hardwood forest) that falls within the Designation but not the project Footprint. This includes
 - Rowans Bush (139) in the Wainui Catchment.
 - The various coastal kohekohe remnants in the Te Puka Catchment (KCDC Ecosites K223-229)
 - The Akatarawa - Whakatikei Regional Forest Park
 - TG Riparian Area (PCC Ecosite 199).
 - Tawa remnants within Cannons Creek Bush (PP12) in the vicinity of the Cannons Creek Bridge
 - Porirua Park Bush (PCC76)

Where any of these forests cannot be avoided, mitigation needs to be provided that takes into account their value and maturity.

- Where possible attempts should be made to avoid seral scrub and forest (kanuka scrub and forest, mahoe dominated scrub and low forest) particularly where it is found as riparian cover. This includes:
 - Gullies crossed by the TG alignment on the western slopes of Te Puka and Horokiri catchments.
 - Scoresby Grove Kanuka (PCC Ecosite 196).
 - James Cook Drive Bush (PCC Ecosite 33).
 - Whitby Bush (PCC Ecosite 155b).
 - Exploration Drive Kanuka (PCC 190).
 - Cannons Creek Bush (PCC 12).
 - Roberts Bush (PCC88).
- The Sphagnum dominated wetland in Horokiri valley provides opportunities for enhancement and should be considered in any mitigation package.
- The early retirement plantings undertaken by NZTA over the last eight years as part of conditions for the original Designation are now the best areas of indigenous forest within the Designation in the Ration Catchments and within the main branch of Duck Creek. The original purpose of these was to provide advance mitigation for stream loss and provide some buffer between construction effects and these streams. Where possible they should be maintained and any opportunities to expand them should be considered as part of any mitigation package.

9. ACKNOWLEDGEMENTS

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Botanical Survey and Species Lists prepared by Pat Enright
GIS mapping and analysis by Martin Pecher & David Irvine
Vegetation Mapping by Matiu Park

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