BAY OF PLENTY REGION
SAND DUNE VEGETATION MAPPING
AND CONDITION ASSESSMENT
METHODS FOR TAURANGA
ECOLOGICAL DISTRICT

AUGUST 2008

Report No. 2033

Prepared for:

ENVIRONMENT BAY OF PLENTY
P.O. BOX 364
WHAKATANE

Wildland CONSULTANTS

WILDLAND CONSULTANTS LTD, 99 SALA STREET, P.O. BOX 7137, TE NGAE, ROTORUA
Ph 07-343-9017, Fax 07-343-9018, email ecology@wildlands.co.nz, www.wildlands.co.nz

CONTENTS

PROJECT TEAM

Sarah Beadel - Field trial, report preparation.
Chris Bycroft - Field work, report compilation.
Matt Renner - Field work, report compilation.
Lisette Collins - Technical input, report compilation.
William Shaw - Technical review.
Roger Bawden - GIS mapping.

Reviewed and approved for release by:

_____
Sarah Beadel
Director
Wildland Consultants Ltd

1. INTRODUCTION

"Sand dunes occur where sea and land meet, and are formed from sand derived from both terrestrial and marine sources. The formation of dune systems is influenced by a number of factors, including the shape of the coastline and beach, currents and the ocean swell, prevailing wind, frequency of storms and the sand's particle size."

(MfE & DOC 2007)

Recently it has been estimated that only 21,300 ha of sand dunes remain throughout New Zealand (Leathwick *et al*. 2003). This is only about 11.6% of the original extent. As well as the removal of sand dunes, the indigenous character of the areas remaining has generally been heavily modified through grazing, fire, and weed invasion.

Environment Bay of Plenty wishes to map the extent of coastal dunes and indigenous vegetation cover, and to capture information on selected 'condition factors'. It is proposed that the data collected will be used for long-term monitoring of change in vegetation cover and condition. Wildland Consultants was commissioned to develop methods for dune mapping and condition assessment.

This report describes methods for mapping dune vegetation implemented in the first season of the field survey (Wildlands Consultants 2008b). The methods were trialled prior to the full field survey at three sites: Pukehina Spit, Pukehina Beach, and Maketu Spit (Wildland Consultants 2008a). This field trial was undertaken to ensure that the methods captured relevant data suitable for the purpose of dune monitoring, and that the methods were amenable to field application. The methods implemented during the first full field survey (of Tauranga Ecological District in March-April 2008 (Wildlands 2008a)) were those refined as a result of that field trial. The methods described here not only provide an explicit description of the survey methods, they also communicate those subtle nuances encountered during the first full implementation of this monitoring protocol. It is hoped that this will facilitate the seamless replication of this monitoring protocol in future seasons, as required.

2. PROJECT OBJECTIVES

- To describe methods to map dune vegetation and capture information on selected condition factors in a manner that can be used for long-term monitoring of change in vegetation cover and condition of the dunes.

3. SAND DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT

To achieve the objectives identified by Environment Bay of Plenty, it was determined that three data sets need to be created:

- Extent of dunes (developed and undeveloped) (GIS map);
- Vegetation map of wild undeveloped areas (GIS map);

- Condition assessments undertaken along a stratified series of belt transects having a random origin.

3.1 Total extent of dunelands

The extent of sand dunes was mapped for the whole of the Bay of Plenty (except for Tauranga City - see below) by utilising the appropriate 1:250,000 scale Geological Map of New Zealand field maps, particularly Kingma (1965), Healy *et al*. (1964), and Schofield (1973). The locations of active duneland also followed maps in Hilton *et al*. 2000, and current knowledge of Wildland Consultants Ltd staff of sand dune systems in the Bay of Plenty Region.

The extent of sand dunes within the Tauranga City Council boundaries (TCC) was based on landform data from the Tauranga City Council State of the Environment (SOE) report 2005 (Wildland Consultants 2005). These landforms were first mapped in *c.*1996 based on Department of Conservation (DOC) landform maps for the Bay of Plenty Conservancy (Department of Conservation 1996). In 2000, the landform boundaries were redefined and mapped in more detail than the original DOC maps, based largely on digital contour information supplied by Tauranga District Council in 2000 (mostly 1 m contours) (Wildland Consultants 2000). These 2000 boundaries were then reviewed according to newer aerial photography for the 2005 SOE (State of the Environment) report.

Mapping of the sand dune landform was field checked during the course of the vegetation mapping and monitoring component of the full field survey of Tauranga Ecological District. Mapping of the sand dunes outside of the Tauranga Ecological District will need to be refined following the detailed field survey in the summer of 2008/2009.

3.2 Land use/cover

The following broad land use/cover categories were mapped onto sand dune landforms using 2007 High Resolution Coastal Photographs or using the 2003 Regional Digital Aerial Mosaic (RDAM), where the 2007 coverage was not available:

- Agriculture/Horticulture (includes pasture, orchards, cropping land etc);
- Plantation forest;
- Residential and built-up area (includes commercial, industrial etc);
- Roads/Parking areas/Railway line;
- Urban parkland (includes parks, green belts etc);
- Wild undeveloped areas.

The scale of mapping was 1:1,000 where there was coverage by the 2007 High Resolution Coastal Photographs (there is a slight spatial difference between the NZTM and NZMG aerials, NZMG was used where possible) or at 1:5,000 where only the 2003 RDAM was available.

3.3 Location and extent of study sites

The entire coastline of the Tauranga Ecological District was divided into sites based on the natural area boundaries identified in the coastal environment study (Wildland Consultants 2006) Significant Vegetation and Habitat Zone (SVHZ) sites, and the Tauranga Natural Areas Survey (Wildland Consultants (2008). 'Wild undeveloped areas' (see Section 3.4 below) within these sites were identified and assigned a "Sand Dune Vegetation mapping and Condition assessment site" (SDVC) number (e.g. Pukehina Spit: SDVC-18), ordered west to east along the Bay of Plenty coastline. Areas that lay between SVHZ sites and Natural Area sites were treated as single SDVC sites when dune landform was continuous, or nearly continuous, between natural area boundaries. Where dune landform comprised two or more discrete areas, separated by rivers or long areas of non-dune coast, each discrete area was treated as a separate site. Twenty-one sites were identified.

The vegetation cover of all areas of sand dunes identified as 'wild undeveloped areas' within the dune landform map was mapped in detail as part of this project (see Figures 1 and 2).

3.4 Transects

3.4.1 Location of transects

Belt transects were located at 1 kilometre intervals along the Bay of Plenty coastline.

This system of belt-transects was laid out by firstly chosing a geodesic anchor for the random location. The Kaituna River mouth was chosen for this anchor because it was near the pilot study site. This anchor determined the first four digits of the Easting for the nearest transect, which was the one randomly located. Next a random number between 1 and 1000, and containing three digits, was generated. This number comprised the last three digits within the easting of the nearest transect to the Kaituna River mouth and effectively randomized the location of the nearest transect within a kilometre of the river mouth. The actual anchor chosen did not influence the randomness inherent in transect location based on random numbers, because it facilitates full randomisation of transect location within 1 kilometre, for transects spaced at 1 kilometer intervals. The transect origin was then located at the intersection of the randomised easting and the topographic coastline derived from the NZMS260 map series. Once the location of the initial randomised transect location had been fixed, the remaining transects were laid out up and down the coast at 1 kilometer intervals based on the NZMS 260 series digital coastline (including estuaries, harbours, and sand dunes) by using the ArcGIS "divide" command.

The direction (bearing) of each transect was perpendicular to the topographic coastline of the NMS260 map series.

With the exception of transects at the northern end of Matakana Island, each transect terminated at the inland end of the wild unmanaged dune system, at managed margins or a change in landform.

Figure 1

Figure 2

At the northern end of Matakana Island transects were extended over managed boundaries and into isolated wild unmanaged areas surrounded by managed vegetation where the presence of these areas had been identified on the basis of 1:1000 aerial photographs. Managed vegetation was neither mapped nor assessed.

The sole exception to this extension rule at the northern end of Matakana Island was Transect 015, whose orientation intersected several other transects. This transect was terminated at the first point of intersection with another transect, No. 016. This rule should be revisited in future surveys to facilitate monitoring of vegetation within Natural Area 059 (Wildland Consultants 2008a).

In the field each belt transect was located using 1:1,000 scale aerial photographs and a late-model, hand-held GPS unit (Garmin 60 CSx, with sufficient memory to record tracks; including the boundaries of each belt transect). This made it easy to identify transect boundaries in the field. The tracking function also facilitated systematic coverage of the entire transect.

3.4.2 Additional transects

The 1 kilometre spacing of belt transects did not always allow for the sampling of every individual site, and also failed to sample all vegetation types greater than 1 hectare in size within sites. Additional transects were located as required to ensure:

(i) at least one transect bisects each SDVC site;
(ii) all vegetation types greater than 1 ha within each SDVC site are traversed by at least one transect.

The location of these transects was achieved by inserting a proposed transect half-way between the two transect lines closest either side of the target site. If this proposed transect did not dissect the target area another proposed transect was located halfway between the existing transect and the previous proposed transect (Figure 3). This divide, then divide again until successful strategy was repeated until a proposed transect intersected the target site. This proposed transect was then identified, and surveyed in the same way as usual. Additional proposed transects were identified before fieldwork was carried out through visual inspection of 1:1000 aerial photographs. However, additional transects can be located during the course of fieldwork following the above strategy if needed.

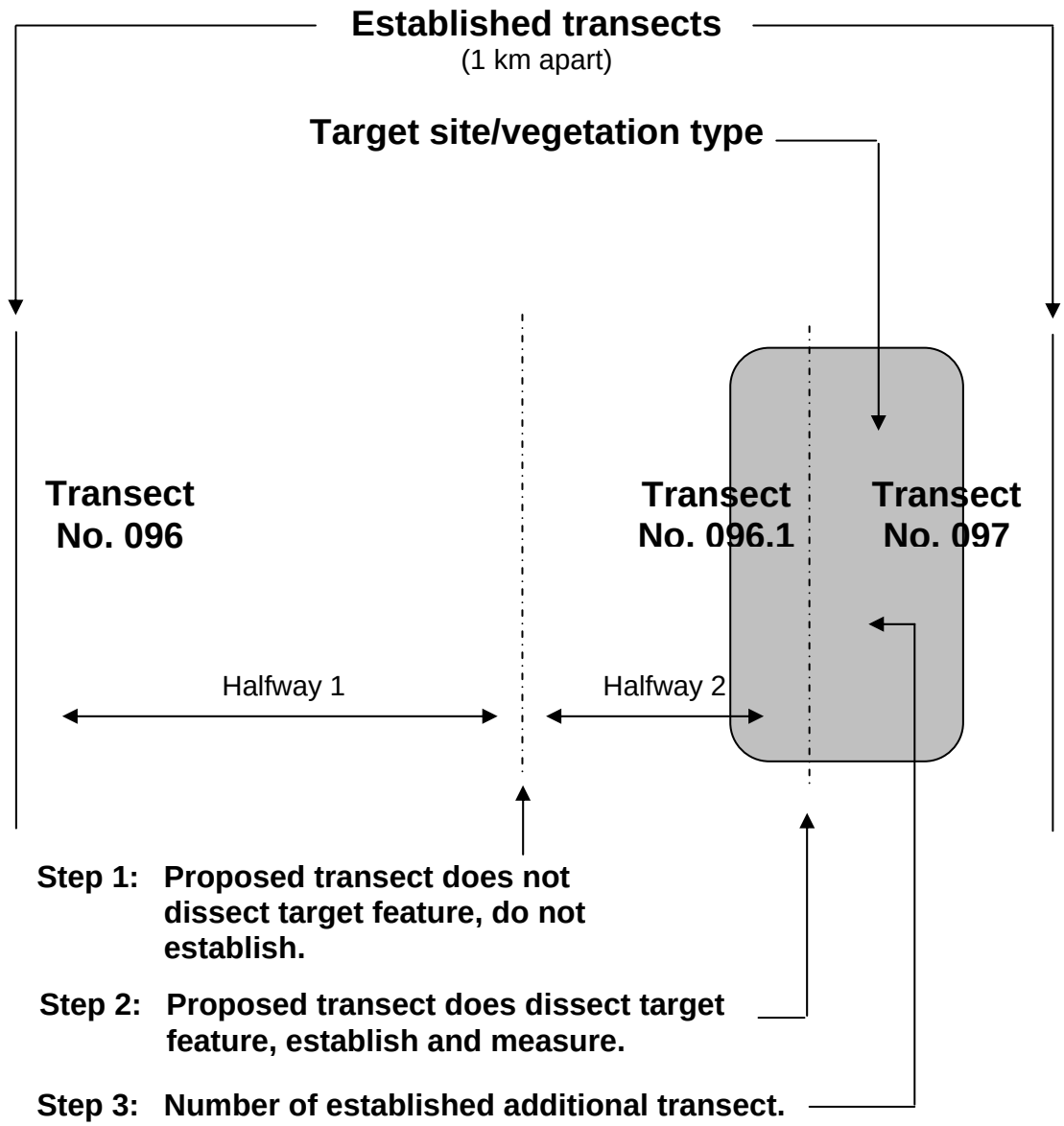

Figure 3: Diagram illustrating the process of locating additional transects.

3.4.3 Transect numbering

Transects are numbered by 1 kilometre increments reflecting their distance from the most norther westerly transect. Additional transects were numbered for the kilometre transect immediately north, and then identified by a subsidiary number (for example 096.1).

3.4.4 Transects located on non-dune coastal landforms

Proposed transects dissecting rocky coastlines, estuarine margins, or other areas without dune landforms were not measured. However, as these transects are components of the 1 kilometer intervals upon which transect location within dune

systems is based, they remain an integral component of the sampling design. Seven transects (004, 068, 069, 070, 071, 074, and 084) were not measured as they were located on parts of the coastline where there were no sand dunes.

4. FIELD SURVEY

4.1 Prior to field survey

Hard copies of digital aerial photographs at a scale of 1:1,000 were printed showing the boundaries of SDVC assessment sites, and transect locations.

A walk through survey of all dune vegetation within each site was completed. This walk through survey aimed to sight and identify all vegetation types discernable on 1:1000 aerial photographs. It also facilitated assessment of continuity of vegetation types between transects, despite internal heterogeneity that might manifest in the form of a proliferation of slightly different Atkinson (1985) descriptions (Appendix 1) between adjacent transects.

Vegetation mapping proceeded during the course of this walk through survey. There is no substitute for on the ground observations as a tool for training the surveyor to recognise relevant regularities and patterns in vegetation, particularly those associated with different dune landforms, i.e. transgressive dunefields, dune swales and so on.

During the site inspections, vegetation type boundaries were refined (see Figures 4 and 5 for examples of vegetation maps), vegetation type names were assigned - following Atkinson 1985 - refer to Appendix 1 for an explanation (also see section on vegetation classification below), and a brief description of each vegetation type (2-3 sentences) was compiled.

The distance between points of detailed examination (900 m) meant that intrinsic internal variability in vegetation types can be encapsulated within the vegetation descriptions from different transects within sites. Mapping of vegetation types at 1:1,000 required some of the detailed types identified during transect assessment to be combined when vegetation for whole sites was mapped and described. Continuity between vegetation types despite slight internal variability was usually perceptible on the ground, and was apparent when mapping on aerial photographs at 1:1000. Where different vegetation types at the transect level required amalgamation at the scale of mapping for the entire coastline, the description of the vegetation types associated with mapped polygons presented on the site sheets was expanded to encompass observed variability on the ground at the site level. This enabled the spatial distribution of different vegetation types to be mapped along the entire site.

The third scale of vegetation description was at a vegetation class level. Vegetation types identified and mapped for each site should be site-specific and detailed. However, for the purposes of broad scale vegetation mapping of the Tauranga Ecological District and the entire Bay of Plenty, detailed vegetation types developed for each site need to be translated into broader vegetation classes. A vegetation classification system for the dune vegetation observed by this survey was developed for this purpose, an extract from which is presented in Table 1. This allowed

Figure 4

Figure 5

information on particular types or groups of vegetation types to be summarised. Care was taken to avoid a proliferation of detailed 'types' within this broad system of vegetation classification. This system should facilitate quantification of the extent and relative abundance of different kinds of vegetation within the dune system throughout the entire ecological district by specifying vegetation classes that can be compared across disparate geographic localities. The hierarchical relationship between, and nestedness of, these three levels of vegetation description is illustrated diagrammatically in Figure 6.

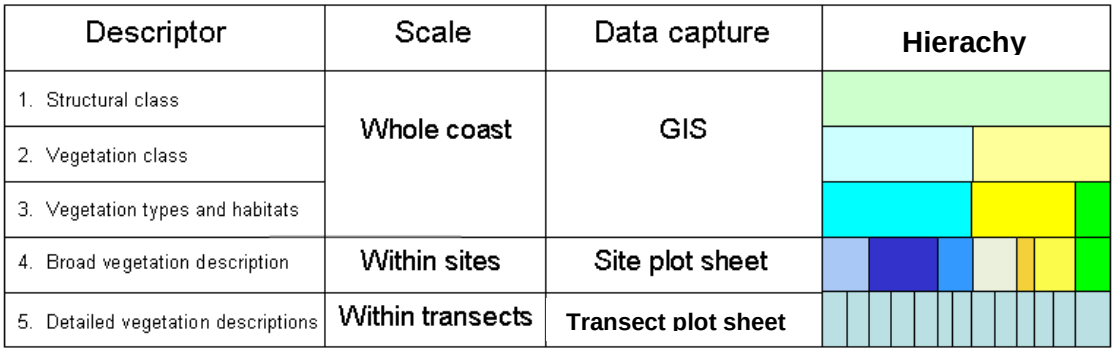

Figure 6: Hierarchical relationship between the three levels of vegetation description employed by this study.

Data Set 5 was collected to measure vegetation condition at specific sites and was used along with the Data Set 4 to generate the standard vegetation types and habitats identified and mapped for the Ecological District (Data Set 3). An example of vegetation types included within Data Set 3 is presented in Table 1.

Table 1: Example of a hierarchical vegetation classification system for vegetation types mapped for sand dunes within the Tauranga Ecological District.

Structural Class	Vegetation Class	Vegetation Types and Habitats (on GIS Vegetation Map of Tauranga Sand Dunes)
01 Forest	01 Pohutukawa-dominant forest	01 Pohutukawa forest
	02 Radiata pine-dominant forest	01 Radiata pine/mingimingi-grey willow-cabbage tree/*Baumea juncea* forest
02 Treeland	01 Mixed exotic tree dominated treeland	01 Banksia-(radiata pine)/houpara/ *Ficinia nodosa* treeland and sedgeland
03 Vineland	01 Pohuehue dominant vineland	01 Pohuehue vineland 02 *Ficinia nodosa*/pohuehue vineland and sedgeland 03 *Ficinia nodosa*/pohuehue vineland 04 Pohuehue-spinifex vineland
04 Scrub	01 Mixed exotic scrub	01 Gorse-lupin-pampas scrub
	02 Gorse-dominant scrub	01 Gorse scrub
05 Shrubland	01 Coast tea tree-dominant shrubland	01 Coast tea tree shrubland
08 Grassland	01 Spinifex-dominant grassland	01 Spinifex grassland 02 Spinifex-pingao grassland 03 Spinifex-marram grassland 04 Spinifex-*Calystegia soldanella*-pingao

Structural Class		Vegetation Class		Vegetation Types and Habitats (on GIS Vegetation Map of Tauranga Sand Dunes)	
					grassland
		02	Marram-dominant grassland	01	Marram grassland
		03	Mixed exotic grassland	01	Lupin/sweet vernal-Yorkshire fog grassland
13	Herbfield	01	Gazania-dominant herbfield	01	Gazania herbfield
19	Sandfield	01	Spinifex-dominant sandfield	01 02	Spinifex sandfield Spinifex-pingao sandfield
		02	Sandfield (vegetation cover <1%)	02	Sandfield

The following data were also recorded on the site sheets:

- Site number
- Site name
- Date of field survey
- Transect number(s)
- Field surveyor(s)
- Vegetation types: List vegetation type name - as per Atkinson 1985 - and description (2-3 sentences for each type) (see the last column in Table 1).
- Each vegetation type was assigned its own unit number. This unit number could also be used on the vegetation unit condition assessment sheets, along with the vegetation type (name). The unit numbers presented on site sheets from the first field season are the same vegetation numbers as those presented in the Tauranga Natural Areas survey report (Wildlands Consultants 2008b) where site boundaries are equivalent.
- The hydroclass (Appendix 3) for each vegetation type identified in the field.
- The landform(s) (Appendix 4) for each vegetation type identified in the field.

4.2 Vegatation unit condition sheets

Vegetation unit condition sheets (Appendix 7) were completed for each vegetation unit identifiable in transects. Aerial photographs were used to assist in identification of vegetation units. A brief description of the vegetation type accompanied the Atkinson (1985) vegetation name on the site sheet. Within height classes, the order of species within the vegetation type name follows their relative abundance from highest to lowest. Presence and cover-abundance of weed species was recorded, as was the total cover of exotic species within the vegetation type once the systematic survey of the survey was completed following the scoring scheme presented in Appendix 5.

The following data were also recorded on the Vegetation Unit Condition Assessment sheet:

- Field surveyor(s);

- Date of field survey;

- Transect number;

- Polygon number. The polygon number was used during the field survey to relate vegetation units to polygons mapped on aerials. As vegetation types within transects were encountered they were numbered sequentially from 1. This number was recorded on unit condition plot sheets in the form: "Transect number"/ "vegetation unit number". The number was used to identify polygons on the aerials. Vegetation unit numbers were started from 1 for each transect;

- Vegetation type name (as per Atkinson 1985);

- Weeds: Pest plant species (weeds) and weed groups which are commonly present on sand dunes in the Bay of Plenty are listed on the record sheet. A cover class was to be assigned to each of these species and groups. A cover class was also to be assigned for the total cover of pest plants within that vegetation unit (see Appendix 5 for cover classes). Additional pest plant species were identified and listed individually if they are prominent at a site or are threatening ecological value;

- Threatened and significant plant species are also listed on the record sheet, and were assigned cover classes within each vegetation unit;

- Impacts: A list of common types of impacts is provided on the record sheet. For each of the impacts which are observed within the vegetation type unit the intensity of the impact was scored as having a positive or negative effect on a scale of -3 to +3 (refer to Appendix 8 for further explanation of the scoring system);

- A visual estimate, to closest 10%, of the indigenous cover within the vegetation type should be collected during the course of future surveys (see Appendix 8 for plot sheets);

- Additional notes about a site can be recorded in the final section of the record sheet.

- The unit number refers to the unique number assigned to each broad Atkinson vegetation description within each site on the site sheets. This field can be filled out once all transects within a site have been completed, and all vegetation types within a site have been identified. It can be complemented with the Atkinson vegetation type (see Figures 4 and 5).

4.3 GPS location transects and photographs

The Seaward GPS location was recorded at the intersection of MHWS (strand line) and the transect line. One photo was taken from this point looking inland down line of transect.

The Inland GPS location was recorded at the intersection of the transect line and the managed edge or landform boundary. Two photos were taken at this point, each looking toward the beach and offset at 45º to transect line, one looking up the coast, the other down the coast.

The "Impacts" listed in the table on the site sheet were assessed at the end of the systematic walk through.

GPS location of rare and threatened flora and fauna (as per Hitchmough *et al.* 2007) species recorded, number of individuals counted. Populations could be photographed for future reference to historical condition of individuals. Only definite observation of threatened species was recorded. Within the context of analyses of occurrence data only definite presence can be assessed with confidance. Absence is methodologically difficult to determine, and as yet there is no way in which the likelihood of species occurrence can be quantified. For these reasons only species observed at sites during the course of survey work were recorded.

Management recommendations assessed at time of site survey and recorded on transect sheets. Specific recommendations for different vegetation types also recorded.

A transect sheet was completed for each transect. The following data were also recorded on the Transect sheets (refer to Appendix 7):

- Site number;
- Transect number;
- Number of polygons;
- Date of field survey;
- Location: GPS waypoint (at inland and seaward ends of transect);
- Photo records: Included GPS waypoint, camera and lens details, and photograph identifier number. Photographs were taken at 1.70 metres height, and at a 45 degree angle in each direction from the transect centre line bearing (when looking towards the ocean), at the inland end of the transect. Additional photographs were also taken to record additional vegetation types. Photographs were taken with a 35 mm equivalent digital sensor.

5. TIMING OF FIELDWORK

This survey was conducted in March-April at the end of one of the driest summers on record. Virtually no exotic annual grass species were observed on dunes during this survey. These are likely to contribute to cover abundance scores obtained in future surveys, and may over-ride dune condition signals this survey is designed to give, at least in the short term. This could be avoided by giving two cover abundance scores in the next remeasurement - one including exotic annual grasses and one excluding exotic annual grasses. The absence of annual grasses on dunes highlights another crucial point: the contribution of seasonal variation to difference in vegetation. We recommend that repeat surveys be carried out at the same time of year, or at least within the same season, to avoid the potentially confounding influence of season.

6. DATA CAPTURE ANALYSIS

- The vegetation mapping data, including site boundaries, vegetation type boundaries, vegetation types and structural classes) were captured as polygons and metadata within a GIS shapefile.

- The areas (ha) of each site, and the extent of each vegetation type present within a site were calculated on the basis of this GIS shapefile.

Suggestions for data analyses that would quantify degrees of change in the level of weed invasion are presented in Section 6.2 of Wildland Consultants (2008b).

7. REMEASUREMENT

Remeasurements will need to follow the same methods and be applied in a consistent manner by an ecologist very experienced with sand dune vegetation. Where remeasurements show changes in vegetation type boundaries, reasons for changes will need to be identified. It will be important to identify whether it is a real change in vegetation extent or cover composition, or simply an artefact of the level of detail being captured, or a different interpretation of the vegetation pattern.

The timing of remeasurements for the vegetation mapping component will be driven by availability of up-to-date aerial photography. It will be most relevant to undertake mapping relatively soon (i.e. within a year) of updated aerial photography becoming available. Transect remeasurements should be undertaken at the same time of year as previous surveys, or could be event-driven. The latter could be initiated if it is perceived that there have been major changes in vegetation condition at specific locations/sites or throughout the region, or there may have been major storm events or other environmental perturbation of the dune system.

8. DISCUSSION

The methods presented in this report will provide an effective approach to monitor extent and condition in sand dunes in the Bay of Plenty Region, if the monitoring is carried out on a regular basis by experienced ecologists who are familiar with coastal dune ecosystems and consistently follow the prescribed methods. The data gathered will enable analysis of changes in the extent of vegetation types and identify changes in dune vegetation condition, at individual sites and in any mapped areas. Vegetation classes within individual sand dune sites are clearly visible on the 1:1,000 scale aerial photography, and some impacts and changes are very obvious, e.g. walking and vehicle tracks and blow-outs.

Information on impacts (particularly those which are human-induced) will enable assessment of gross changes in condition to be identified and quantified. This should enable management agencies to improve the management of the remaining indigenous vegetation on dunes in the Bay of Plenty by identifying and addressing key issues. Similarly, the data on weeds, threatened plants, and fauna will also enable improved decision-making and will play an important part in the assessment of relative priorities for specific projects.

ACKNOWLEDGMENTS

Nancy Willems and Sue Mavor (Environment Bay of Plenty) instigated this project and provided logistical support. Heather Blackwell (Environment Bay of Plenty) assisted with fieldwork on twenty of the transects. Thanks to Tom Pyatt (Department of Conservation, Bay of Plenty Conservancy) for access to historical maps showing the active duneland (Hilton *et al*. 2000).

REFERENCES

Atkinson I.A.E. 1985: Derivation of vegetation mapping units for an ecological survey of Tongariro National Park, North Island, New Zealand. *New Zealand Journal of Botany, 23*: 361-378.

Hesp P.A. 2000. Coastal Sand Dunes: Form and Function. *The Coastal Dunes Vegetation Network Technical Bulletin No.4.* Forest Research, Rotorua. 29pp.

Leathwick J., McGlone M., Walker S. 2003: New Zealand's Potential Vegetation Pattern. Unpublished report.

Ministry for the Environment (MfE), Department of Conservation (DOC) 2007: Protecting our Places. Information about the statement of natural priorities for protecting rare and threatened biodiversity on private land. Ministry for the Environment and Department of Conservation, Wellington. 51 pp.

Ministry of Works 1962: National resources survey, Part 2. Bay of Plenty Region. R.E. Owen, Government Printer, Wellington.

Wildland Consultants 2006: Significant indigenous vegetation and significant habitats of indigenous fauna in the coastal environment of the Bay of Plenty Region. *Wildland Consultants Ltd Contract Report No. 1345.* Prepared for Environment Bay of Plenty. Volume 1 - 553 pp, Volume 2 - maps 49 pp.

Wildland Consultants Ltd 2007: Ecological survey of regenerating indigenous dune forest, Matata, Bay of Plenty. *Wildland Consultants Ltd Contract Report No. 1678.* Prepared for Environment Bay of Plenty. 62 pp.

Wildland Consultants Ltd 2008a: Bay of Plenty Region sand dune vegetation mapping and condition assessment trial. *Wildland Consultants Ltd Contract Report No. 1816.* Prepared for Environment Bay of Plenty. 41 pp.

Wildland Consultants Ltd 2008b: Natural areas in Tauranga Ecological District. *Wildland Consultants Ltd Contract Report No. 1914.* Prepared for Environment Bay of Plenty. 689 pp.

Wildland Consultants Ltd 2008c: Sand dune vegetation and condition monitoring, and management recommendations, Tauranga Ecological District. *Wildland Consultants Ltd Contract Report No. 1915.* Prepared for Environment Bay of Plenty. 45 pp.

VEGETATION DESCRIPTION METHODS AND VEGETATION STRUCTURAL CLASS DEFINITIONS (FROM ATKINSON 1985)

Atkinson (1985) details a standardized method for describing vegetation that incorporates both compositional and structural information, as summarised below.

Atkinson Vegetation Descriptions

The dominant canopy species are listed first, and then any species in lower vegetation tiers (if these are known) followed by the structural class of the vegetation, e.g. rimu/tawa-kamahi forest; *Ficinia nodosa*/pohuehue sedge-vineland. Common names are preferred (when they cannot be mistaken) otherwise Latin names are used (see list of common and Latin name equivalents).

The percentage cover of particular species and their position in the vegetation tiers are indicated as follows:

(tawa)	less than 5% cover of the bracketed species
(rimu)/tawa	indicates less than 5% cover of rimu emergent over a canopy of tawa
tawa-hinau	indicates tawa and hinau occur in the same tier
⇔	indicates a mosaic of two or more vegetation types exists within a defined area

Structural Classes for Atkinson Vegetation Descriptions

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 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, e.g. mahoe/rarahu treeland. (Note: Vegetation consisting of trees above shrubs is classified as either forest or scrub depending on the proportion of trees and shrubs in the canopy.)
Vineland	Vegetation in which the cover of unsupported (or artificially supported) woody vines in the canopy is 20-100% and in which the cover of these vines exceeds that of any other growth form or bare ground. Vegetation containing woody vines that are supported by trees or shrubs is classified as forest, scrub or shrubland. Examples of woody vines occur in the genera *Actinidia, Clematis, Lonicera, Metrosideros, Muehlenbeckia, Ripogonum, Vitis* and others.
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 sub-class for areas where tussocks are >20% but less than shrubs. (Note: the term scrubland is not used in this classification.)

Tussockland	Vegetation in which the cover of tussocks in the canopy is 20-100% and in which the tussock cover exceeds that of any other growth form or bare ground. Tussocks include all grasses, sedges, rushes, and other herbaceous plants with linear leaves (or linear non-woody stems) that are densely clumped and >10 cm height. Examples of the growth form occur in all species of *Cortaderia, Gahnia* and *Phormium*, and in some species of *Chinochloa, Poa, Festuca, Rytidosperma, Cyperus, Carex, Uncinia, Juncus, Astelia, Aciphylla* and *Celmisia*.
Fernland	Vegetation in which the cover of ferns in the canopy is 20-100% and in which the fern cover exceeds that of any other growth form or bare ground. Tree ferns >10 cm dbh are excluded as trees (cf. forest).
Grassland	Vegetation in which the cover of grass in the canopy is 20-100% and in which the grass cover exceeds that of any other growth form or bare ground. Tussock-grasses are excluded from the grass growth-form.
Sedgeland	Vegetation in which the cover of sedges in the canopy is 20-100% and in which the sedge cover exceeds that of any other growth form or bare ground. Included in the sedge growth form are *Leptocarpus similis* and many species of *Carex, Uncinia, Isolepis*, and *Bolboschoenus*. Tussock-sedges and reed-forming sedges (cf. reedland) are excluded.
Rushland	Vegetation in which the cover of rushes in the canopy is 20-100% and in which the rush cover exceeds that of any other growth form or bare ground. Included in the rush growth form are some species of *Juncus*, most species of *Leptocarpus*, and all species of *Sporadanthus*, and *Empodisma*. Tussock-rushes are excluded.
Reedland	Vegetation in which the cover of reeds in the canopy is 20-100% and in which the reed cover exceeds that of any other growth form or open water. Reeds are herbaceous plants growing in standing or slowly-running water that have tall, slender, erect, unbranched leaves or culms that are either hollow or have a very spongy pith. Examples include *Typha, Bolboschoenus, Schoenoplectus tabernaemontani, Eleocharis sphacelata,* and *Baumea articulata*.
Cushionfield	Vegetation in which the cover of cushion plants in the canopy is 20-100% and in which the cushion-plant cover exceeds that of any other growth form or bare ground. Cushion plants include herbaceous, semi-woody and woody plants with short densely packed branches and closely spaced leaves that together form dense hemispherical cushions. The growth form occurs in all species of *Donatia, Gaimardia, Hectorella, Oreobolus,* and *Phyllachne* as well as in some species of *Aciphylla, Celmisia, Centrolepis, Chionohebe, Colobanthus, Dracophyllum, Drapetes, Haastia, Leucogenes, Luzula, Myosotis, Poa, Raoulia,* and *Scleranthus*.
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. Herbs include all herbaceous and low-growing semi-woody plants that are not separated as ferns, tussocks, grasses, sedges, rushes, reeds, cushion plants, mosses or lichens.
Mossfield	Vegetation in which the cover of mosses in the canopy is 20-100% and in which the moss cover exceeds that of any other growth form or bare ground.

Lichenfield	Vegetation in which the cover of lichens in the canopy is 20-100% and in which the lichen cover exceeds that of any other growth form or bare ground.
Rockland	Land in which the area of residual bare rock exceeds the area covered by any one class of plant growth-form. Cliff vegetation often includes rocklands. They are named from the leading plant species when plant cover ≥1%, e.g. [koromiko] rockland.
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%.
Stonefield/gravelfield	Land in which the area of unconsolidated bare stones (20-200 mm diam.) exceeds the area covered by any one class of plant growth-form. The appropriate name is given depending on whether stones or gravel form the greater area of ground surface. Stonefields and gravelfields are named from the leading plant species when plant cover ≥1%.
Sandfield	Land in which the area of bare sand (0.02 - 2 mm diam.) exceeds the area covered by any one class of plant growth-form. Dune vegetation often includes sandfields which are named from the leading plant species when plant cover ≥ 1%.
Loamfield/Peatfield	Land in which the area of loam and/or peat exceeds the area covered by any one class of plant growth-form. The appropriate name if given depending on whether loam or peat forms the greater area of ground surface. Loamfields and peatfields are named from the leading plant species when plant cover ≥1%.
Flaxland	Vegetation in which the cover of flax in the canopy is 20-80%, and in which the flax cover exceeds that of any other growth form or bare ground.
Pasture	Pasture comprises exotic grasses and herbs, and often includes sweet vernal, ryegrass, browntop, dandelion, foxglove, with scattered Yorkshire fog, selfheal, and white clover.

SITE SHEETS

A. SITE SHEET (Sheet 1)

BAY OF PLENTY REGION SAND DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT

Site No.: | **Site Name:** | **Date:**

Transect No(s): | **Surveyor(s):**

Unit No.	Vegetation Type Name (as per Atkinson 1985) and Description (2-3 sentences)	Hydro Class	Landform

IMPACTS

Activity	Unit No.	✓ for presence	Comments
Restoration plantings			
Pest plant control			
Walking tracks (official)			
Walking tracks (unofficial)			
Vehicle tracks			
Pest plants			
Blowouts			
Exotic gardens			
Aesthetic indigenous plantings			
Other vegetation clearance			
Drains			
Organic waste dumping			
Inorganic waste dumping			
Recreation impact			
Litter			
Rabbits			
Weeds			
Other (specify)			

SITE SHEET (Sheet 2)

BAY OF PLENTY REGION SAND DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT

Site No.: **Date:**

WEEDS

Species	Cover Class	Species	Cover Class	Species	Cover Class
Acacia sophorae		*Lupinus arboreus*		Other exotic annuals	
Agapanthus praecox		*Lycium ferocissimum*		Other exotic garden/ plantings escapes	
Ammophila arenaria		*Myoporum insulare*		**Others (specify)**	
Araucaria heterophylla		*Opuntia vulgaris*			
Araujia sericifera		*Osteospermum fruticosum*			
Artotheca calendula		*Pennisetum clandestinum*			
Asparagus asparagoides		*Pinus radiata*			
Banksia integrifolia		*Rhamnus alaternus*			
Cakile maritima		*Rubus fruticosus*			
Canna indica		*Rumex saggitatus*			
Carpobrotus edulis		*Salix cinerea*			
Chrysanthemoides monilifera		*Senecio angulata*			
Cortaderia selloana		*Senecio elegans*			
Crocosmia x *crocosmiiflora*		*Tradescantia fluminensis*			
Erythrina x *sykesii*		*Watsonia bulbillifera*			
Euonymus japonicus		*Yucca* sp.			
Gazania linearis		Other succulents			
Hedychium gardnerianum		Flatweeds			
Ipomea indica		Other lianes			
Leptospermum laevigatum		Other woody plants			
Lilium formosum		Other exotic grasses			
Lonicera japonica		Other exotic herbs		**Total Cover**	

THREATENED AND SIGNIFICANT PLANT SPECIES

Species	Cover Class	Species	Cover Class
Austrofestuca littoralis		*Oxalis rubens*	
Carex pumila		*Ozothamnus leptophylla*	
Coprosma acerosa		*Pimelea arenaria*	
Coprosma repens		*Tetragonia tetragonioides*	
Desmoschoenus spiralis		*Zoysia pauciflora*	
Euphorbia glauca		Other (specify)	
Kunzea "Thornton"			
Lachnagrostis billardierei			
Melicytus novae-zelandiae			
Metrosideros excelsa			
Myoporum laetum			

Threatened Fauna:	**Notes:**

SITE SHEET (Additional Vegetation Recording Sheet if Required)

BAY OF PLENTY REGION SAND DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT

Site No.: [ ] **Date:** [ ]

Unit No.	Vegetation Type Name (as per Atkinson 1985) and Description (2-3 sentences)	Hydro Class	Landform

HYDROCLASS DEFINITIONS

Terrestrial All areas on land that are not wetlands (c.f. other hydroclass categories).

Estuarine Tidal and non-tidal saline wetlands associated with a coastal body of water with a free connection to the open sea and where fresh water, derived from land drainage (usually rivers) is mixed with sea water (Allaby 1994).

Palustrine Small open-water bodies, vegetated wet ground, and all other non-tidal wetlands not covered by riverine or lacustrine (Buxton 1991).

Riverine Flowing waters contained within a channel, e.g. streams, rivers, and their margins (Buxton 1991).

Lacustrine Dams or lakes with open water (Buxton 1991).

LANDFORM DEFINITIONS (FROM HESP 2000)

Berm: A wave-built terrace landform lying between dunes and high water. Impressive example at the western end of Matakana Island appears to be the result of massive inshore movement of subtidal sand bars during recent (2007) storm events. Unvegetated dry sand on the surface of berms constitutes a significant source of Aeolian sand.

Blowout: Blowouts are erosional dune landforms. They are either saucer-, cup-, bowl-, or trough-shaped depressions or hollows formed by wind erosion of a pre-existing sandy substrate or dune.

Established Foredune: Established foredunes are older, more permanent foredunes. They develop from incipient foredunes and are distinguished by the growth of intermediate, often woody plant species, and commonly by their greater complexity of form, height, and width.

Foredune Plain: A coastal plain comprising two or more foredunes.

Incipient Foredune: A new foredune formed by Aeolian sand deposition within pioneer plants commonly on the back of the beach above the spring high tide line.

Parabolic Dune: Parabolic dunes are U-shaped or V-shaped dunes which roughly describe a parabola (upside down U) in outline. They are characterised by trailing ridges which terminate downwind in a parabolic-shaped depositional lobe. They may be active or relict (i.e. fully vegetated).

Transgressive Dunefield: Transgressive dunefields are relatively large-scale Aeolian sand deposits formed by the downwind and/or alongshore movement (or transgression) of sand over vegetated to semi-vegetated terrain.

COVER CLASSES

Cover classes used to assess vegetation cover:

1 = <1%
2 = 2-5%
3 = 6-25%
4 = 25-50%
5 = 50-75%
6 = 75-100%

TRANSECT SHEETS

B. TRANSECT SHEET

BAY OF PLENTY REGION SAND DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT

Site No.: **Transect No.:**

Date: **No. of Polygons:** **Surveyor(s):**

GPS:		
Inland		**Camera/lens details:**
Seaward		

GPS Reference:		**Photo Number:**	

GPS Reference:		**Photo Number:**	

Brief Description and Management Priorities:

Weed Management Priority	**H**	**M**	**L**

Notes:

Weed Management Priority	H	M	L

VEGETATION UNIT CONDITION ASSESSMENT SHEETS

C. VEGETATION UNIT CONDITION ASSESSMENT (Sheet 1)

BAY OF PLENTY REGION SAND DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT

Transect No.		Polygon No.[1]		Surveyor(s):		Date:	

Unit No.	Vegetation Type Name (as per Atkinson 1985)

WEEDS

Species	Cover Class	Species	Cover Class	Species	Cover Class
Acacia sophorae		*Lonicera japonica*		Other woody plants	
Agapanthus praecox		*Lupinus arboreus*		Other exotic grasses	
Ammophila arenaria		*Lycium ferocissimum*		Other exotic herbs	
Araujia sericifera		*Myoporum insulare*		**Others (specify)**	
Artotheca calendula		*Opuntia vulgaris*			
Asparagus asparagoides		*Osteospermum fruticosum*			
Banksia integrifolia		*Pennisetum clandestinum*			
Canna indica		*Pinus radiata*			
Carpobrotus edulis		*Rhamnus alaternus*			
Chrysanthemoides monilifera		*Rubus fruticosus*			
Cortaderia selloana		*Rumex saggitatus*			
Crocosmia x *crocosmiiflora*		*Salix cinerea*			
Erythrina x *sykesii*		*Senecio angulata*			
Euonymus japonicus		*Senecio elegans*			
Gazania linearis		*Tradescantia fluminensis*			
Hedychium gardnerianum		*Watsonia bulbillifera*			
Ipomoea indica		Other succulents			
Leptospermum laevigatum		Flatweeds			
Lilium formosum		Other lianes		**Total Cover**	

THREATENED AND SIGNIFICANT PLANT SPECIES

Species	Cover Class	Species	Cover Class
Austrofestuca littoralis		*Myoporum laetum*	
Carex pumila		*Oxalis rubens*	
Coprosma acerosa		*Ozothamnus leptophylla*	
Coprosma repens		*Pimelea arenaria*	
Euphorbia glauca		*Tetragonia tetragonioides*	
Kunzea "Thornton"		*Zoysia pauciflora*	
Lachnagrostis billardierei			
Melicytus novae-zelandiae			
Metrosideros excelsa			

[1] Comprises transect number and vegetation type number, e.g. 14-1.

VEGETATION UNIT CONDITION ASSESSMENT (Sheet 2)

BAY OF PLENTY REGION SAND DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT

Date: | **Polygon No.**

IMPACTS

Activity	+ve/-ve	Comments
Restoration plantings		
Pest plant control		
Walking tracks (official)		
Walking tracks (unofficial)		
Vehicle tracks		
Blowouts		
Exotic gardens		
Other vegetation clearance		
Drains		
Organic waste dumping		
Inorganic waste dumping		
Recreation impact		
Litter		
Rabbits		
Other (specify)		

Notes:

IMPACTS

+VE/-VE EFFECTS

-3 Major negative impacts such as large scale vegetation clearance, widespread dumping of refuse.

-2 Moderate negative effects.

-1 Minor negative effects.

0 Neutral, no change evident, unknown.

1 Minor positive works/effort.

2 Moderate positive works/effort.

3 Major positive works/effort.

EXAMPLE PLOT SHEET AND MAPS: PUKEHINA SPIT (SDVC-018)

COMPLETE SITE

VASCULAR PLANTS OF SAND DUNES IN THE BAY OF PLENTY
(Sarah Beadel)

Notes

1. Species list excludes wetland species present at stream mouths and in interdune wetlands.
3. To be updated and expanded following completion of Bay of Plenty Region sand dune study.

INDIGENOUS SPECIES

Monocot. trees and shrubs

Cordyline australis	ti kouka
Phormium cookianum	whaririki, mountain flax
Phormium tenax	harakeke, flax

Dicot. trees and shrubs

Beilschmiedia tawa	tawa
Brachyglottis repanda s.s.	rangiora
Coprosma acerosa	
Coprosma grandifolia	kanono
Coprosma lucida	kanono
Coprosma propinqua subsp. *propinqua* x *C. robusta*	
Coprosma repens	taupata
Coprosma robusta	karamu
Coriaria arborea var. *arborea*	tutu
Corynocarpus laevigatus	karaka
Dodonaea viscosa	akeake
Entelea arborescens	whau
Fuchsia excorticata	kotukutuku
Geniostoma rupestre var. *ligustrifolium*	hangehange
Hebe stricta var. *stricta*	koromiko
Knightia excelsa	rewarewa
Kunzea ericoides var. *ericoides*	kanuka
Kunzea aff. *ericoides* (Thornton)	coastal kanuka species
Leptospermum scoparium	manuka
Leucopogon fasciculatus	mingimingi
Leucopogon fraseri s.s.	patotara
Litsea calicaris	mangeao
Macropiper excelsum var. *excelsum*	kawakawa
Melicytus novae-zelandiae	coastal mahoe

Melicytus ramiflorus	mahoe
Metrosideros excelsa	pohutukawa
Myoporum laetum	ngaio
Myrsine australis	mapou
Ozothamnus leptophylla	tauhinu
Pimelea arenaria	
Pittosporum crassifolium	karo
Pittosporum tenuifolium subsp. *tenuifolium*	kohuhu
Pomaderris sp. (aff. *P. phylicifolia*)	
Pseudopanax arboreus var. *arboreus*	whauwhaupaku, five finger
Pseudopanax lessonii	houpara
Pseudopanax crassifolius x *P. lessonii*	
Schefflera digitata	pate
Solanum aviculare var. *aviculare*	
Vitex lucens	puriri

Monocot. lianes

Ripogonum scandens	kareao, supplejack

Dicot. lianes

Calystegia sepium	pohue
Calystegia sepium × *C. soldanella*	
Calystegia soldanella	panahi
Ipomoea palmata	morning glory
Muehlenbeckia australis	puka
Muehlenbeckia complexa	pohuehue
Muehlenbeckia australis x *M. complexa*	
Tetragonia implexicoma	kokihi; New Zealand spinach
Tetragonia tetragonioides	kokihi

Ferns

Asplenium appendiculatum subsp. *maritimum*	
Asplenium oblongifolium	huruhuruwhenua
Asplenium polyodon	petako
Blechnum novaezelandiae	kiokio
Cyathea dealbata	ponga
Cyathea medullaris	mamaku
Dicksonia fibrosa	wheki-ponga
Dicksonia squarrosa	wheki
Diplazium australe	
Hypolepis ambigua	
Hypolepis lactea	
Microsorum pustulatum	kowaowao (hounds tongue fern)
Paesia scaberula	matata
Pellaea rotundifolia	tarawera (button fern)
Pneumatopteris pennigera	pakau
Pteridium esculentum	rarahu (bracken)

Pteris macilenta (incl. *P. pendula*)	sweet fern
Pteris tremula	turawera (shaking brake)
Pyrrosia eleagnifolia	leather-leaf fern
Rumohra adiantiformis	

Orchids

Microtis unifolia	maikaika
Thelymitra longifolia	maikuku

Grasses

Austrofestuca littoralis	hinarepe
Cortaderia fulvida	toetoe
Deyeuxia quadriseta	
Lachnagrostis billardierei	perehia
Microlaena stipoides	patiti
Oplismenus hirtellus subsp. *imbecillis*	
Poa pusilla	
Spinifex sericeus	kowhangatara
Zoysia pauciflora	

Sedges

Baumea juncea	
Bolboschoenus fluviatilis	ririwaka
Carex breviculmis	
Carex geminata	
Carex inversa	
Carex maorica	
Carex pumila	
Carex "raotest"	
Carex secta	purei
Carex solandri	
Carex testacea	
Carex virgata	purei
Cyperus ustulatus	toetoe upokotangata
Desmoschoenus spiralis	pingao
Ficinia nodosa	wiwi
Schoenus nitens	

Rushes

Apodasmia similis	oioi
Juncus edgariae	wi
Juncus planifolius	

Monocot. herbs (other than orchids, grasses, sedges and rushes)

Dianella nigra	turutu
Phormium tenax	harakeke, flax
Triglochin striata	arrow grass
Typha orientalis	raupo

Composite herbs

Pseudognaphalium sp. (*P. luteoalbum* agg.)
"*Pseudognaphalium* coast"
Senecio biserratus
Senecio glomeratus
Senecio hispidulus
Senecio lautus
Senecio quadridentatus

Dicot. herbs (other than composites)

Atriplex hollowayi (AK 3965) (collected in 1890)
Chenopodium ambiguum
Dichondra repens
Euphorbia glauca[1]
Geranium solanderi
Haloragis erecta subsp. *erecta* toatoa
Oxalis rubens
Parietaria debilis
Persicaria decipiens
Solanum americanum

EXOTIC SPECIES

Gymnosperms

Araucaria heterophylla	Norfolk Island pine
Chamaecyparis lawsoniana	Lawsons cypress
Cupressus macrocarpa	macrocarpa
Juniperus sp.	
Pinus patula	patula pine
Pinus pinaster	maritime pine
Pinus radiata	radiata pine

Dicot. trees and shrubs

Abutilon × *hybridum*	Chinese lantern
Acacia sophorae	
Acacia mearnsii	black wattle

[1] Off-shore islands only, planted on mainland.

Albizia lophantha	brush wattle
Allocasuarina luehmanii	bulloak
Anigozanthos sp.	kangaroo paw
Banksia integrifolia	banksia
Banksia intermedia	banksia
Berberis glaucocarpa	barberry
Bougainvillea glabra	bougainvillea
Buddleja davidii	buddleia
Callistemon sp.	bottlebrush
Camelia japonica	camelia
Casuarina littoralis	she-oak
Casuarina sp.	sheoak
Chamaecytisus palmensis	tree lucerne
Chrysanthemoides monilifera	boneseed
Cistus × *skanbergii*	
Cistus sp.	
Clerodendron trichotomum	harlequin glory bower
Coleonema pulchellum	
Convolvulus sabatius subsp. *mauritanicus*	convolvulus
Cotoneaster glaucophyllus	cotoneaster
Cotoneaster sp.	
Crataegus monogyna	hawthorn
Cytisus scoparius	broom
Dahlia sp.	dahlia
Daphne odora	daphne
Echium candicans	tower of jewels
Erica lusitanica	Spanish heath
Eriobotrya japonica	loquat
Erythrina x *sykesii*	coral tree
Eucalyptus botryoides	eucalyptus
Euonymus japonicus	Japanese spindle tree
Fatsia japonica	fatsia
Feijoa sellowiana	feijoa
Ficus carica	fig
Ficus macrophylla	Moreton Bay fig
Fuchsia sp.	fuchsia
Grevillea spp.	
Hibiscus syriacus	blue hibiscus
Hibiscus sp.	hibiscus
Hydrangea macrophylla	hydrangea
Impatiens sodenii	shrub balsam
Juglans regia	walnut
Lagunaria patersenii	Norfolk Island hibicus
Lathyrus latifolius	everlasting pea
Lavatera arborea	tree mallow
Lavendula angustifolia	lavender
Leonotis leonurus	lion’s ear
Leptospermum laevigatum	coast tea tree
Ligustrum lucidum	tree privet
Ligustrum sinense	Chinese privet

Lophostemon confertus	brush box
Lupinus arboreus	lupin
Lycium ferocissimum	African boxthorn
Mahonia bealei	leather leaf mahonia
Malus × *domestica*	apple tree
Melaleuca sp.	
Mellianthus major	cape honey flower
Myoporum insulare	Australian ngaio
Nerium oleander	oleander
Opuntia vulgaris	prickly pear
Paraserianthes lophantha	brush wattle
Pelargonium sp.	geranium
Plumbago auriculata	leadwort
Podalyria sericea	
Populus alba cv. Nivea	silver poplar
Populus sp.	poplar
Prunus domestica	plum
Prunus persica	peach tree, nectarine
Prunus sp.	ornamental cherry
Pyracantha coccinea	pyracantha
Quercus ilex	oak
Rhamnus alaternus	Italian buckthorn
Rhapiolepis umbellatum	Yeddo hawthorn
Rosa rubiginosa	sweet brier
Rosa sp.	climbing rose
Rosmarinus officinalis	rosemary
Rubus sp. (*R. fruticosus* agg.)	blackberry
Salix cinerea	grey willow
Salix fragilis	crack willow
Salix matsudana cv. *tortuosa*	corkscrew willow
Schinus terebinthifolius	Brazilian pepper tree
Solanum mauritianum	woolly nightshade
Solanum rantonetti	
Tecomaria capensis	Cape honeysuckle
Telopea sp.	warratah
Ulex europaeus	gorse
Westringia fruticosa × *W. eremicola*	

Ferns

Nephrolepis cordifolia	tuber ladder fern

Dicot. lianes

Anredera cordifolia	madeira vine
Araujia sericifera	moth plant
Cucurbita sp.	pumpkin
Elaeagnus × *reflexa*	elaeagnus
Hedera helix	ivy
Ipomoea indica	blue morning glory

Lonicera japonica	Japanese honeysuckle
Mandevillea laxa	
Passiflora caerulea	passionflower
Passiflora edulis	black passionfruit
Rumex saggitattus	climbing dock
Salpichroa origanifolia	lily of the valley vine
Senecio angulatus	cape ivy
Senecio mikanioides	German ivy
Solanum jasminoides	potato vine
Vinca major	periwinkle

Monocot. trees and shrubs

Cordyline fruticosus	ti
Phoenix canariensis	Phoenix palm

Grasses

Agrostis capillaris	browntop
Agrostis stolonifera	creeping bent
Aira caryophyllea	silvery hairy grass
Alopecurus geniculatus	kneed foxtail
Ammophila arenaria	marram
Anthoxanthum odoratum	sweet vernal
Arundo donax	giant reed
Avena barbata	slender oat
Briza maxima	large quaking grass
Bromus diandrus	ripgut brome
Bromus hordeaceus	soft brome
Bromus willdenowii	prairie brome
Cortaderia selloana	pampas
Cortaderia jubata	pampas
Cynodon dactylon	Indian doab
Dactylis glomerata	cocksfoot
Digitaria sanguinalis	summer grass
Echinochloa crus-galli	barnyard grass
Ehrharta erecta	veld grass
Eleusine indica	crowfoot grass
Elytrigia pycnantha	sea couch
Elytrigia repens	couch
Festuca arundinacea	tall fescue
Festuca rubra subsp. *rubra*	red fescue
Glyceria maxima	reed sweetgrass
Holcus lanatus	Yorkshire fog
Lagurus ovatus	harestail
Lolium perenne	rye grass
Paspalum dilatatum	paspalum
Paspalum distichum	Mercer grass
Pennisetum clandestinum	kikuyu grass
Poa pratensis	Kentucky bluegrass

Pseudosasa japonica	bamboo
Schedonorus phoenix	tall fescue
Sporobolus africanus	ratstail
Setaria viridus	green bristle grass
Stenotaphrum secundatum	buffalo grass

Sedges

Carex divulsa	
Cyperus eragrostis	
Cyperus involucratus	umbrella sedge

Rushes

Juncus acuminatus	
Juncus articulatus	
Juncus effusus	soft rush
Juncus microcephalus	

Monocot. herbs (other than orchids, grasses, sedges and rushes)

Agapanthus praecox	agapanthus
Agave americana	cactus
Alocasia macrorrhiza	elephant's ear
Aloe arborescens	aloe
Aloe sp.	aloe
Alstroemeria psittacina	alstroemeria
Amaryllis belladonna	belladonna lily
Asparagus asparagoides	smilax
Asparagus densiflorus 'Sprengeri'	
Asparagus scandens	climbing asparagus
Canna indica	canna lily
Colocasia esculenta	taro
Crocosmia × *crocosmiiflora*	montbretia
Eucomis comosa	
Gladiolus cv. Grandiflorus	gladioli
Hedychium gardnerianum	wild ginger
Iris siberica	iris
Kniphofia × *praecox*	red hot poker
Libertia peregrinans	
Lilium formosanum	
Saponaria officinalis	
Tradescantia fluminensis	tradescantia
Watsonia sp.	watsonia
Zantedeschia aethiopica	arum lily
Zantedeschia sp.	calla lily

Composite herbs

Achillea millefolium	yarrow
Anthemis cotula	stinking mayweed
Arctotis stoechadifolia	cape daisy
Artemisia arborescens	hedge artemisia
Bidens frondosa	beggars' ticks
Chrysanthemum segetum	corn marigold
Cirsium arvense	California thistle
Cirsium vulgare	Scotch thistle
Conyza albida	fleabane
Conyza canadensis	Canadian fleabane
Crepis capillaris	hawksbeard
Erigeron karvinskianus	Mexican daisy
Gamochaeta spicata	cudweed
Gazania linearis	gazania
Hypochoeris radicata	catsear
Lactuca serriola	prickly lettuce
Leontodon taraxacoides	hawkbit
Osteospermum fruticosum	rain daisy/dimorphotheca
Senecio bipinnatisectus	Australian fireweed
Senecio cineraria	
Senecio elegans	purple groundsel
Senecio jacobaea	ragwort
Senecio skirrhodon	gravel groundsel
Sonchus oleraceus	puha

Dicot. herbs (other than composites)

Acanthus mollis	
Aeonium arboreum	
Amaranthus deflexus	prostrate amaranth
Amaranthus retroflexus	mat amaranth
Amaranthus powellii	redroot
Anagallis arvensis	scarlet pimpernel
Anthericum sp.	spider plant
Antirrhinum sp.	snapdragon
Artemisia verlotiorum	Chinese mugwort
Atriplex prostrata	orache
Beta vulgaris	silver beet
Brassica rapa subsp. *sylvestris*	wild turnip
Cakile edentula	sea rocket
Cakile maritima	sea rocket
Calendula officinalis	marigold
Carpobrotus aegnilaterus	ice plant
Carpobrotus edulis	ice plant
Chenopodium album	fathen
Chenopodium ambrosioides	Mexican tea
Cosmos bipinnatus	cosmos
Cotyledon orbiculata	pig's ear

Crassula tetragona	
Datura stramonium	thorn apple
Drosanthemum sp.	ice plant
Euphorbia lathyris	caper spurge
Euphorbia peplus	milkweed
Foeniculum vulgare	fennel
Fumaria muralis	scrambling fumitory
Galium aparine	cleavers
Geranium robertianum	herb Robert
Impatiens walleriana	busy Lizzie
Lepidium virginicum	pepper grass
Lepidium sp.	
Linum bienne	
Linun trigynum	yellow flax
Lobelia erinus	edging lobelia
Lobularia maritima	sweet alyssum
Lotus pedunculatus	lotus
Lunaria annua	honesty
Lycopersican esculentum	tomato
Medicago sativa	lucerne
Melilotus indicus	King Island melilot
Mentha sp. (edible)	mint
Modiola caroliniana	creeping mallow
Nasturtium sp.	
Nigella damascena	love-in-a-mist
Oenothera stricta	evening primrose
Orobanche minor	broomrape
Oxalis pes-caprae	oxalis
Pastinaca sativa	wild parsnip
Persicaria capitata	
Petunia × *hybrida*	petunia
Physalis peruviana	cape gooseberry
Phytolacca octandra	inkweed
Plantago lanceolata	narrow-leaved plantain
Plantago major	broad-leaved plantain
Plectranthus ciliata	plectranthus
Polygonum hydropiper	water pepper
Polygonum persicaria	willow weed
Portulaca oleracea	wild portulaca
Ranunculus repens	creeping buttercup
Raphanus raphanistrum subsp. *maritumus*	
Rumex acetosella	sheep’s sorrel
Rumex obtusifolius	dock
Sagina procumbens	pearlwort
Sedum album	white stonecrop
Sedum prealtum	
Sedum × *rubrotinctum*	jellybean plant
Sedum spectabile	
Silene gallica	catchfly
Solanum chenopodioides	velvety nightshade

Solanum nigrum var.	black nightshade
Solanum tuberosum	potato
Stellaria media	chickweed
Trifolium arvense	haresfoot trefoil
Trifolium dubium	suckling clover
Trifolium pratense	red clover
Trifolium repens	white clover
Tropaeolum majus	garden nasturtium
Verbena bonariensis	purple-top
Vicia sativa	vetch
Vicia sp.	
Viola riviana	viola
Viola × *wittrockiana*	pansy

ADVENTIVE SPECIES

Gymnosperms

Araucaria heterophylla	Norfolk Island pine
Chamaecyparis lawsoniana	Lawsons cypress
Cupressus macrocarpa	macrocarpa
Juniperus sp.	
Pinus patula	patula pine
Pinus pinaster	maritime pine
Pinus radiata	radiata pine

Dicot. trees and shrubs

Abutilon × *hybridum*	Chinese lantern
Acacia sophorae	
Acacia mearnsii	black wattle
Albizia lophantha	brush wattle
Allocasuarina luehmanii	bulloak
Anigozanthos sp.	kangaroo paw
Banksia integrifolia	banksia
Banksia intermedia	banksia
Berberis glaucocarpa	barberry
Bougainvillea glabra	bougainvillea
Buddleja davidii	buddleia
Callistemon sp.	bottlebrush
Camelia japonica	camelia
Casuarina littoralis	she-oak
Casuarina sp.	sheoak
Chamaecytisus palmensis	tree lucerne
Chrysanthemoides monilifera	boneseed
Cistus × *skanbergii*	
Cistus sp.	
Clerodendron trichotomum	harlequin glory bower
Coleonema pulchellum	
Convolvulus sabatius subsp. *mauritanicus*	convolvulus

Cotoneaster glaucophyllus	cotoneaster
Cotoneaster sp.	
Crataegus monogyna	hawthorn
Cytisus scoparius	broom
Dahlia sp.	dahlia
Daphne odora	daphne
Echium candicans	tower of jewels
Erica caffra	
Erica lusitanica	Spanish heath
Eriobotrya japonica	loquat
Erythrina x *sykesii*	coral tree
Eucalyptus sp. (*botryoides*?)	eucalyptus
Euonymus japonicus	Japanese spindle tree
Fatsia japonica	fatsia
Feijoa sellowiana	feijoa
Ficus carica	fig
Ficus macrophylla	Moreton Bay fig
Fuchsia sp.	fuchsia
Grevillea spp.	
Hibiscus syriacus	blue hibiscus
Hibiscus sp.	hibiscus
Hydrangea macrophylla	hydrangea
Impatiens sodenii	shrub balsam
Juglans regia	walnut
Lagunaria patersenii	Norfolk Island hibicus
Lathyrus latifolius	everlasting pea
Lavatera arborea	tree mallow
Lavendula angustifolia	lavender
Leonotis leonurus	lion’s ear
Leptospermum laevigatum	coast tea tree
Ligustrum lucidum	tree privet
Ligustrum sinense	Chinese privet
Lophostemon confertus	brush box
Lupinus arboreus	lupin
Lycium ferocissimum	African boxthorn
Mahonia bealei	leather leaf mahonia
Malus × *domestica*	apple tree
Melaleuca sp.	
Mellianthus major	cape honey flower
Myoporum insulare	Australian ngaio
Nerium oleander	oleander
Opuntia vulgaris	prickly pear
Paraserianthes lophantha	brush wattle
Pelargonium sp.	geranium
Plumbago auriculata	leadwort
Podalyria sericea	
Populus alba cv. Nivea	silver poplar
Populus sp.	poplar
Prunus domestica	plum
Prunus persica	peach tree, nectarine

Prunus sp.	ornamental cherry
Pyracantha coccinea	pyracantha
Quercus ilex	oak
Rhamnus alaternus	Italian buckthorn
Rhapiolepis umbellatum	Yeddo hawthorn
Rosa rubiginosa	sweet brier
Rosa sp.	climbing rose
Rosmarinus officinalis	rosemary
Rubus phoenicolasius	Japanese wineberry
Rubus sp. (*R. fruticosus* agg.)	blackberry
Salix cinerea	grey willow
Salix fragilis	crack willow
Salix matsudana cv. *tortuosa*	corkscrew willow
Schinus terebinthifolius	Brazilian pepper tree
Solanum mauritianum	woolly nightshade
Solanum rantonetti	
Tecomaria capensis	Cape honeysuckle
Telopea sp.	warratah
Ulex europaeus	gorse
Westringia fruticosa × *W. eremicola*	

Ferns

Nephrolepis cordifolia	tuber ladder fern

Dicot. lianes

Anredera cordifolia	madeira vine
Araujia sericifera	moth plant
Cucurbita sp.	pumpkin
Elaeagnus × *reflexa*	elaeagnus
Hedera helix	ivy
Ipomoea indica	blue morning glory
Lonicera japonica	Japanese honeysuckle
Mandevillea laxa	
Passiflora caerulea	passionflower
Passiflora edulis	black passionfruit
Rumex saggitattus	climbing dock
Salpichroa origanifolia	lily of the valley vine
Senecio angulatus	cape ivy
Senecio mikanioides	German ivy
Solanum jasminoides	potato vine
Vinca major	periwinkle

Monocot. trees and shrubs

Cordyline fruticosus	ti
Phoenix canariensis	Phoenix palm

Grasses

Agrostis capillaris	browntop
Agrostis stolonifera	creeping bent
Aira caryophyllea	silvery hairy grass
Alopecurus geniculatus	kneed foxtail
Ammophila arenaria	marram
Anthoxanthum odoratum	sweet vernal
Arundo donax	giant reed
Avena barbata	slender oat
Axonopus fissifolius	narrow-leaved carpet grass
Briza maxima	large quaking grass
Bromus diandrus	ripgut brome
Bromus hordeaceus	soft brome
Bromus willdenowii	prairie brome
Cortaderia selloana	pampas
Cynodon dactylon	Indian doab
Dactylis glomerata	cocksfoot
Digitaria sanguinalis	summer grass
Echinochloa crus-galli	barnyard grass
Ehrharta erecta	veld grass
Eleusine indica	crowfoot grass
Elytrigia pycnantha	sea couch
Elytrigia repens	couch
Festuca arundinacea	tall fescue
Festuca rubra subsp. *rubra*	red fescue
Glyceria maxima	reed sweetgrass
Holcus lanatus	Yorkshire fog
Lagurus ovatus	harestail
Lolium perenne	rye grass
Paspalum dilatatum	paspalum
Paspalum distichum	Mercer grass
Paspalum vaginatum	saltwater paspalum
Pennisetum clandestinum	kikuyu grass
Poa pratensis	Kentucky bluegrass
Pseudosasa japonica	bamboo
Schedonorus phoenix	tall fescue
Sporobolus africanus	ratstail
Setaria gracilis	knot-root bristle grass
Setaria palmifolia	palm grass
Setaria viridus	green bristle grass
Stenotaphrum secundatum	buffalo grass

Sedges

Carex divulsa	
Cyperus eragrostis	
Cyperus involucratus	umbrella sedge

Rushes

Juncus acuminatus	
Juncus articulatus	
Juncus bufonius	
Juncus effusus	soft rush
Juncus microcephalus	
Juncus tenuis	track rush

Monocot. herbs (other than orchids, grasses, sedges and rushes)

Agapanthus praecox	agapanthus
Agave americana	cactus
Alocasia macrorrhiza	elephant's ear
Aloe arborescens	aloe
Aloe sp.	aloe
Alstroemeria psittacina	alstroemeria
Amaryllis belladonna	naked lady, belladonna lily
Asparagus asparagoides	smilax
Asparagus scandens	climbing asparagus
Asparagus densiflorus 'Sprengeri'	
Canna × *generalis*	canna lily
Colocasia esculenta	taro
Crocosmia × *crocosmiiflora*	montbretia
Eucomis comosa	
Gladiolus cv. Grandiflorus	gladioli
Hedychium gardnerianum	wild ginger
Iris siberica	iris
Kniphofia × *praecox*	red hot poker
Libertia peregrinans	
Lilium formosanum	
Saponaria officinalis	
Tradescantia fluminensis	tradescantia
Watsonia sp.	watsonia
Zantedeschia aethiopica	arum lily
Zantedeschia sp.	calla lily

Composite herbs

Achillea millefolium	yarrow
Anthemis cotula	stinking mayweed
Arctotis stoechadifolia	cape daisy
Artemisia arborescens	hedge artemisia
Artemisia verlotiorum	Chinese mugwort
Aster subulatus	sea aster
Bidens frondosa	beggars' ticks
Chrysanthemum segetum	corn marigold
Cirsium arvense	California thistle
Cirsium vulgare	Scotch thistle
Conyza albida	fleabane

Conyza canadensis	Canadian fleabane
Crepis capillaris	hawksbeard
Erigeron karvinskianus	Mexican daisy
Gamochaeta spicata	cudweed
Gazania linearis	gazania
Hypochoeris radicata	catsear
Lactuca serriola	prickly lettuce
Lapsana communis	nipplewort
Leontodon taraxacoides	hawkbit
Osteospermum fruticosum	rain daisy/dimorphotheca
Senecio bipinnatisectus	Australian fireweed
Senecio cineraria	
Senecio elegans	purple groundsel
Senecio jacobaea	ragwort
Senecio skirrhodon	gravel groundsel
Sonchus oleraceus	puha
Taraxacum officinale	dandelion

Dicot. herbs (other than composites)

Acanthus mollis	
Aeonium arboreum	
Amaranthus deflexus	prostrate amaranth
Amaranthus retroflexus	mat amaranth
Amaranthus powellii	redroot
Anagallis arvensis	scarlet pimpernel
Anthericum sp.	spider plant
Antirrhinum sp.	snapdragon
Artemisia verlotiorum	Chinese mugwort
Atriplex prostrata	orache
Beta vulgaris	silver beet
Brassica rapa subsp. *sylvestris*	wild turnip
Cakile edentula	sea rocket
Cakile maritima	sea rocket
Calendula officinalis	marigold
Carpobrotus aegnilaterus	ice plant
Carpobrotus edulis	ice plant
Chenopodium album	fathen
Chenopodium ambrosioides	Mexican tea
Chenopodium pumilio (AK 72596)	
Cosmos bipinnatus	cosmos
Cotyledon orbiculata	pig's ear
Crassula muscosa	
Crassula tetragona	
Datura stramonium	thorn apple
Drosanthemum sp.	ice plant
Euphorbia lathyris	caper spurge
Euphorbia peplus	milkweed
Foeniculum vulgare	fennel
Fumaria muralis	scrambling fumitory

Galium aparine	cleavers
Galium divaricatum	slender bedstraw
Geranium robertianum	herb Robert
Geranium sp.	geranium
Impatiens walleriana	busy Lizzie
Lepidium africanum agg.	narrow-leaved cress
Lepidium bonariense	
Lepidium sativum	
Lepidium virginicum	pepper grass
Lepidium sp.	
Linum bienne	
Linun trigynum	yellow flax
Lobelia erinus	edging lobelia
Lobularia maritima	sweet alyssum
Lotus pedunculatus	lotus
Lunaria annua	honesty
Lycopersican esculentum	tomato
Medicago sativa	lucerne
Melilotus indicus	King Island melilot
Mentha sp. (edible)	mint
Modiola caroliniana	creeping mallow
Myosotis sylvatica	garden forget-me-not
Myosotis sp.	forget-me-not
Nasturtium sp.	
Nigella damascena	love-in-a-mist
Oenothera stricta	evening primrose
Orobanche minor	broomrape
Oxalis pes-caprae	oxalis
Pastinaca sativa	wild parsnip
Pelargonium crispum	lemon scented geranium
Pelargonium x *hortorum*	geranium
Persicaria capitata	
Petunia × *hybrida*	petunia
Physalis peruviana	cape gooseberry
Phytolacca octandra	inkweed
Plantago lanceolata	narrow-leaved plantain
Plantago major	broad-leaved plantain
Plectranthus ciliata	plectranthus
Polygonum hydropiper	water pepper
Polygonum persicaria	willow weed
Polygonum tetraphyllum	allseed
Portulaca oleracea	wild portulaca
Prunella vulgaris	selfheal
Ranunculus repens	creeping buttercup
Raphanus raphanistrum subsp. *maritumus*	
Rumex acetosella	sheep’s sorrel
Rumex obtusifolius	dock
Sagina procumbens	pearlwort
Sedum album	white stonecrop
Sedum prealtum	

Sedum × *rubrotinctum*	jellybean plant
Sedum spectabile	
Silene gallica	catchfly
Sison amomum	stone parsley
Solanum chenopodioides	velvety nightshade
Solanum nigrum var.	black nightshade
Solanum tuberosum	potato
Spergularia rubra	sand spurrey
Stellaria media	chickweed
Trifolium arvense	haresfoot trefoil
Trifolium dubium	suckling clover
Trifolium pratense	red clover
Trifolium repens	white clover
Tropaeolum majus	garden nasturtium
Verbena bonariensis	purple-top
Verbena officinalis	vervain
Veronica anagallis-aquatica	water speedwell
Veronica arvensis	field speedwell
Veronica persica	scrambling speedwell
Veronica serpyllifolia	turf speedwell
Vicia sativa	vetch
Vicia sp.	
Vinca major	periwinkle
Viola arvensis	field pansy
Viola riviana	viola
Viola × *wittrockiana*	pansy
Yucca gloriosa	yucca
Wahlenbergia sp.	harebell

APPENDIX 11

VEGETATION TYPES OBSERVED DURING THE FIRST SURVEY OF WILD UNMANAGED VEGETATION ON SAND DUNE LANDFORMS (INCLUDING DUNE WETLANDS) IN THE TAURANGA ECOLOGICAL DISTRICT

Structural Class	Vegetation Class	Vegetation Types and Habitats
01 Forest	01 Pine forest	01.01.01 Pine forest
	02 Banksia forest	01.02.01 Banksia forest
	03 Willow forest	01.03.01 Willow forest
02 Treeland	01 Pine treeland	02.01.01 Pine treeland
	02 Banksia treeland	02.02.01 Banksia treeland
03 Vineland	01 Pohuehue vineland	03.01.01 Pohuehue-*Ficinia nodosa* vineland 03.01.02 Pohuehue-bracken vineland 03.01.03 Pohuehue-marram vineland 03.01.04 Pohuehue-kikuyu vineland 03.01.05 Pohuehue-agapanthus vineland
	02 Cape ivy vineland	03.02.01 Cape ivy vineland
	03 Periwinkle vineland	03.03.01 Periwinkle vineland
	04 Japanese honeysuckle vineland	03.04.01 Japanese honeysuckle vineland
	05 *Muehlenbeckia australis* vineland	03.05.01 *Muehlenbeckia australis* vineland
04 Scrub	01 Mixed indigenous scrub	04.01.01 Ti kouka-karamu scrub 04.01.02 Ti kouka-mamaku-karamu scrub 04.01.03 Mixed indigenous scrub
	02 Gorse scrub	04.02.01 Gorse-pohuehue scrub 04.02.02 Gorse-broom/pohuehue scrub 04.02.03 Gorse-pampas scrub
	03 Coast tea tree scrub	04.03.01 Coast tea tree scrub
	04 Grey willow scrub	04.04.01 Grey willow scrub
05 Shrubland	01 Manuka shrubland	05.01.01 Manuka-mixed indigenous shrubland
	02 Ti kouka-taupata shrubland	05.02.01 Ti kouka-taupata shrubland
	03 Lupin shrubland	05.03.01 Lupin/spinifex shrubland
	04 Gorse shrubland	05.04.01 Gorse/oioi-kikuyu shrubland 05.04.02 Gorse/exotic grasses shrubland 05.04.03 Gorse-pampas shrubland
	05 Coast tea tree shrubland	05.05.01 Coast tea tree-pine shrubland
	06 African boxthorn shrubland	05.06.01 African boxthorn/pohuehue shrubland
	07 Grey willow shrubland	05.07.01 Grey willow shrubland 05.07.02 Grey willow-mixed indigenous shrubland
06 Tussockland	01 Sea rush tussockland	06.01.01 Sea rush tussockland
	02 Pampas tussockland	06.02.01 Pampas-mixed indigenous tussockland 06.02.02 Pampas-*Ficinia nodosa* tussockland 06.02.03 Pampas-gorse tussockland 06.02.04 Pampas-grey willow tussockland
07 Fernland	01 Bracken fernland	07.01.01 Bracken-pohuehue fernland
08 Grassland	01 Spinifex grassland	08.01.01 Spinifex-pingao/*Calystegia soldanella* grassland 08.01.02 Spinifex/*Calystegia soldanella* grassland
	02 Marram grassland	08.02.01 Marram grassland
	03 Buffalo grass grassland	08.03.01 Buffalo grass-pohuehue grassland

Structural Class	Vegetation Class	Vegetation Types and Habitats
	04 Kikuyu grassland	08.04.01 Kikuyu-pohuehue grassland
	05 Cocksfoot grassland	08.05.01 Cocksfoot grassland
	06 Knot-root bristle-grass grassland	08.06.01 Knot-root bristle-grass grassland
	07 Tall fescue grassland	08.07.01 Tall fescue-kikuyu grassland
	08 Sea-couch grassland	08.08.01 Sea-couch dominant grassland
09 Sedgeland	01 Pingao sedgeland	09.01.01 Pingao sedgeland
	02 *Carex testacea* sedgeland	09.02.01 *Carex testacea*-pohuehue-*Ficinia nodosa* sedgeland
	03 *Ficinia nodosa* sedgeland	09.03.01 *Ficinia nodosa*-pohuehue sedgeland
	04 *Baumea juncea* sedgeland	09.04.01 *Baumea juncea* sedgeland
10 Rushland	01 Oioi rushland	10.01.01 Oioi rushland
11 Reedland	01 Raupo reedland	11.01.01 Raupo reedland
	02 *Schoenoplectus tabernaemontani-Baumea articulata* reedland	11.02.01 *Schoenoplectus tabernaemontani-Baumea articulata* reedland
13 Herbfield	01 South African iceplant herbfield	13.01.01 South African iceplant herbfield
	02 Gazania herbfield	13.02.01 *Gazania linearis-Arctotis*-South African iceplant herbfield
	03 Flatweeds herbfield	13.03.01 Flatweeds herbfield
	04 Mixed exotic herbfield	13.04.01 Mixed exotics herbfield
	05 *Asparagus densiflorus* herbfield	13.05.01 *Ficinia nodosa*/*Asparagus densiflorus-Gazania linearis*-pohuehue herbfield 13.05.02 *Asparagus densiflorus*-buffalo grass herbfield
	06 Agapanthus herbfield	13.06.01 *Agapanthus praecox-Gazania linearis*-South African iceplant herbfield
	07 Canna lily herbfield	13.07.01 Canna lily herbfield
	08 *Rorripa palustris* herbfield	13.08.01 *Rorripa palustris* herbfield
19 Sandfield	01 Sandfield	19.01.01 Spinifex sandfield 19.01.02 Pingao-spinifex sandfield 19.01.03 *Carex pumila* sandfield 19.01.04 *Ficinia nodosa-Calystegia soldanella* sandfield 19.01.05 Sea rocket sandfield
22 Open water	01 Open water	22.01.01 Open freshwater 22.01.02 Impounded open water