Indigenous Vegetation Types of Hamilton Ecological District

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Secondary stand of kanuka, mamaku and kowhai;
Waikato River bank, southern Hamilton City

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

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INDIGENOUS VEGETATION TYPES OF HAMILTON ECOLOGICAL DISTRICT

INTRODUCTION

The following descriptions of indigenous vegetation types and lists of the most characteristic species have been compiled for the major landform units of the Hamilton Ecological District, which lies within the Waikato Ecological Region (McEwen 1987). The boundaries of the Hamilton Ecological District correspond approximately to those of the Hamilton basin, with the addition of parts of hills and foothills at the margins of the basin. The vegetation descriptions and species lists are based on knowledge of the flora of vegetation remnants in the ecological district, historical records (e.g., Gudex 1954), and extrapolation of data from other North Island sites with similar environmental profiles.

Indigenous vegetation in the Hamilton Ecological District has been severely depleted. A 1995 report (Leathwick et al.) calculated that less than 2% of all indigenous ecosystems remains within the Hamilton ED. The vegetation types described here would be suitable targets for restoration projects within the Hamilton ED. However, in attempting such restorations, it is important to recognise the need for staged restoration projects; as many of the species characteristic of long established vegetation are not tolerant of conditions at the outset of a restoration project. As well, many of the species listed in a given vegetation type will vary in microhabitat requirements e.g., degree of tolerance of poor drainage. It is best to try and mimic natural successions and plant early successional species first. Later, once an initial cover is established, mid and late successional species can be added by enrichment planting or spreading of seed. It should also be noted that there is no definitive endpoint to be achieved in such restoration projects. The general aim is to establish a range of locally-sourced indigenous species that would have once occurred on the site and let nature take its course. The first major threshold towards successful achievement of the restoration project will be the onset of natural (unassisted) regeneration of the species that have been planted.

To date, no specific guide to restoration of the indigenous ecosystems in the Hamilton ED or Hamilton basin has been prepared. However, some useful information for those starting out on restoration projects can be found in the Gully Restoration Guide (Wall & Clarkson 2006), Native Forest Restoration (Porteous 1993), Hamilton Gullies – a workshop hosted by the University of Waikato (Clarkson et al. 2000) and Botany of the Waikato (Clarkson et al. 2002).

The general landform units for Hamilton Ecological District referred to are:

A	Hills	(i)	hilly land and foothills of ranges at margins of the Hamilton ED
		(ii)	low rolling hills - summits, shoulders, backslopes
		(iii)	low rolling hills - footslopes
B	Alluvial Plains	(i)	low mounds or ridges
		(ii)	shallow depressions or swales
		(iii)	low terraces adjacent to the Waikato River
C	Gullies	(i)	terrace scarps and gully sides
		(ii)	narrow gully floors
D	Peatlands	(i)	peat lakes
		(ii)	peatland margins
		(iii)	peat bogs
		(iv)	peat domes

A HILLS

(i) Hilly land and foothills of ranges at margins of Hamilton Ecological District
(ii) Low rolling hills – summits, shoulders, backslopes

Generalised Soil Parent Material:

Hilly land and foothills of ranges at margins of Hamilton Ecological District

Late Quaternary, composite rhyolitic and andesitic tephras (>1 m thick in south, <1 m thick in north), usually well drained, over weathered Hamilton Ash or colluvium where easy rolling to rolling; underlying units (mainly weathered sedimentary rocks or basalt) exposed on steepland

Low rolling hills – summits, shoulders, backslopes

North of Hamilton City: Thin (<0.5 m) late Quaternary, composite rhyolitic and andesitic tephras on weathered Hamilton Ash, moderately well drained (non-allophanic)

South of Hamilton City: Thick (> 1.0 m) late Quaternary, composite rhyolitic and andesitic tephras, well drained (allophanic)

Vegetation types:

1. Rimu/tawa forest

The low rolling hills throughout the Hamilton Ecological District and the hilly land and foothills of ranges at the margins of the district, to a height of approximately 100 m, were mostly covered in rimu/tawa forest. Typically, occasional rimu, and local miro, kahikatea, totara, and northern rata were emergent over a canopy dominated by tawa. Other widespread broadleaved species in the canopy included titoki, hinau, rewarewa, and pukatea. The understorey was characterised by a variety of small trees, shrubs, and tree ferns including mahoe, pigeonwood, raurekau, and silver fern. Ferns and grasses such as hen and chicken fern, crown fern, *Hymenophyllum demissum*, and *Microlaena avenacea* occurred in the ground layer. Remaining examples of this vegetation type are present on the foothills of the Karakariki Range and Mt Pirongia.

Characteristic Species	Life Form
Asplenium gracillimum	fern
Blechnum filiforme	fern
Coprosma lucida	shrub
crown fern (*Blechnum discolor*)	fern
fragrant fern (*Microsorum scandens*)	fern
hangehange (*Geniostoma rupestre* subsp. *ligustrifolium*)	shrub
hen and chicken fern (*Asplenium bulbiferum*)	fern
hinau (*Elaeocarpus dentatus*)	tree
Hymenophyllum demissum	fern
kahakaha (*Collospermum hastatum*)	epiphyte
kamahi (*Weinmannia racemosa* var. *racemosa*)	tree
kahikatea (*Dacrycarpus dacrydioides*)	tree
kawakawa (*Macropiper excelsum*)	shrub
mahoe (*Melicytus ramiflorus* subsp. *ramiflorus*)	tree
mamaku (*Cyathea medullaris*)	tree fern
mangeao (*Litsea calicaris*)	tree
matai (*Prumnopitys taxifolia*)	tree
Metrosideros fulgens	liane

M. perforata	liane
Microlaena avenacea	grass
miro (*Prumnopitys ferruginea*)	tree
northern rata (*Metrosideros robusta*)	tree
Oplismenus imbecillis	grass
pate (*Schefflera digitata*)	shrub
pigeonwood (*Hedycarya arborea*)	tree
Polystichum richardii	fern
pukatea (*Laurelia novae-zelandiae*)	tree
raurekau (*Coprosma grandifolia*)	shrub
rewarewa (*Knightia excelsa*)	tree
rimu (*Dacrydium cupressinum*)	tree
silver fern (*Cyathea dealbata*)	tree fern
supplejack (*Ripogonum scandens*)	liane
tawa (*Beilschmiedia tawa*)	tree
titoki (*Alectryon excelsus*)	tree
totara (*Podocarpus totara*)	tree
turepo (*Streblus heterophyllus*)	tree

2. Kauri-hard beech forest

Kauri-hard beech forest had a limited distribution within the Hamilton Ecological District, restricted to the hills and foothills of ranges at the northern end of the district. Major canopy species were kauri, hard beech and tanekaha, with canopy associates of rimu, tawa, and rewarewa. The understorey was characterised by the presence of shrubs such as mingimingi and prickly mingimingi, and silver fern and wheki tree ferns. In the ground layer sedges, grasses, and ferns such as crown fern and *Doodia media* were common, with occasional kauri grass. This vegetation type is still represented within the Hamilton ED and accessible to the public at Pukemokemoke Reserve, north-east of Gordonton.

Characteristic Species	Life Form
Alseuosmia quercifolia	shrub
Asplenium flaccidum	fern
Blechnum filiforme	fern
Clematis paniculata	climber
Coprosma arborea	shrub
Coprosma rhamnoides	shrub
Coprosma spathulata	shrub
crown fern (*Blechnum discolor*)	fern
Doodia media	fern
fragrant fern (*Microsorum scandens*)	fern
Gahnia pauciflora	sedge
hangehange (*Geniostoma rupestre* subsp. *ligustrifolium*)	shrub
hard beech (*Nothofagus truncata*)	tree
heketara (*Olearia rani*)	shrub
hounds tongue (*Microsorum pustulatum*)	fern
Hymenophyllum demissum	fern
kahakaha (*Collospermum hastatum*)	epiphyte
kauri (*Agathis australis*)	tree
kauri grass (*Astelia trinervia*)	monocot herb
Lygodium articulatum	fern
mapou (*Myrsine australis*)	tree
Metrosideros perforata	liane
Microlaena avenacea	grass

mingimingi (*Leucopogon fasciculatus*)	shrub
Oplismenus imbecillis	grass
Pellaea rotundifolia	fern
prickly mingimingi (*Cyathodes juniperina*)	shrub
Pyrrosia eleagnifolia	fern
rewarewa (*Knightia excelsa*)	tree
rimu (*Dacrydium cupressinum*)	tree
silver fern (*Cyathea dealbata*)	tree fern
tanekaha (*Phyllocladus trichomanoides*)	tree
tawa (*Beilschmiedia tawa*)	tree
Uncinia banksii	sedge
Uncinia uncinata	sedge
wheki (*Dicksonia squarrosa*)	tree fern
white maire (*Nestegis lanceolata*)	tree

(iii) Low rolling hills - footslopes

Generalised Soil Parent Material:
Colluvium derived from Hamilton Ash and other deposits, poorly to imperfectly drained

Vegetation type: Pukatea-kahikatea forest

On the more poorly drained colluvial footslopes pukatea and kahikatea dominated the forest, with swamp maire as a common canopy associate. Common understorey and ground layer species were fuchsia, mahoe, supplejack, kiekie, hen and chicken fern, and *Astelia fragrans*. No intact remnants of this vegetation type remain in the Hamilton Ecological District.

Characteristic Species	Life Form
Astelia fragrans	monocot herb
Blechnum chambersii	fern
B. filiforme	fern
cabbage tree (*Cordyline australis*)	tree
Coprosma areolata	shrub
fragrant fern (*Microsorum scandens*)	fern
fuchsia (*Fuchsia excorticata*)	tree
hangehange (*Geniostoma rupestre* subsp. *ligustrifolium*)	shrub
hen and chicken fern (*Asplenium bulbiferum*)	fern
kahakaha (*Collospermum hastatum*)	epiphyte
kahikatea (*Dacrycarpus dacrydioides*)	tree
kamahi (*Weinmannia racemosa* var. *racemosa*)	tree
kiekie (*Freycinetia banksii*)	scrambler
mahoe (*Melicytus ramiflorus* subsp. *ramiflorus*)	tree
matai (*Prumnopitys taxifolia*)	tree
pate (*Schefflera digitata*)	shrub
Pneumatopteris pennigera	fern
pukatea (*Laurelia novae-zelandiae*)	tree
raurekau (*Coprosma grandifolia*)	shrub
rewarewa (*Knightia excelsa*)	tree
silver fern (*Cyathea dealbata*)	tree fern
supplejack (*Ripogonum scandens*)	liane
swamp maire (*Syzygium maire*)	tree
turepo (*Streblus heterophyllus*)	tree

wheki (*Dicksonia squarrosa*)	tree fern

B ALLUVIAL PLAINS

(i) Low mounds or ridges

Generalised Soil Parent Material:
Alluvium, mainly rhyolitic sand and gravel (Hinuera Formation), well drained to moderately well drained

Vegetation type: Mixed conifer-broadleaved forest

Extensive areas of well-drained, broad low ridges of the plains were covered in a mixture of species including conifers such as totara, matai, rimu, and kahikatea, and broadleaved trees such as titoki, tawa, and rewarewa. Species common in the understorey and ground layers were mahoe, silver fern, hangehange, raurekau, lacebark, hen and chicken fern, and *Microlaena avenacea.* No intact remnants of this vegetation type remain in the Hamilton Ecological District.

Characteristic Species	Life Form
Asplenium gracillimum	fern
Blechnum filiforme	fern
cabbage tree (*Cordyline australis*)	tree
fragrant fern (*Microsorum scandens*)	fern
hangehange (*Geniostoma rupestre* subsp. *ligustrifolium*)	shrub
hen and chicken fern (*Asplenium bulbiferum*)	fern
kahakaha (*Collospermum hastatum*)	epiphyte
kahikatea (*Dacrycarpus dacrydioides*)	tree
kiekie (*Freycinetia banksii*)	scrambler
kowhai (*Sophora microphylla*)	tree
lacebark (*Hoheria sexstylosa*)	tree
mahoe (*Melicytus ramiflorus* subsp. *ramiflorus*)	tree
matai (*Prumnopitys taxifolia*)	tree
mamaku (*Cyathea medullaris*)	tree fern
Microlaena avenacea	grass
Metrosideros perforata	liane
Oplismenus imbecillis	grass
pate (*Schefflera digitata*)	shrub
pukatea (*Laurelia novae-zelandiae*)	tree
raurekau (*Coprosma grandifolia*)	shrub
rewarewa (*Knightia excelsa*)	tree
ribbonwood (*Plagianthus regius*)	tree
rimu (*Dacrydium cupressinum*)	tree
silver fern (*Cyathea dealbata*)	tree fern
tawa (*Beilschmiedia tawa*)	tree
titoki (*Alectryon excelsus*)	tree
totara (*Podocarpus totara*)	tree
turepo (*Streblus heterophyllus*)	tree

(ii) Shallow depressions or swales

Generalised Soil Parent Material:
Alluvium, mainly pumiceous silt and clay, sand in places (Hinuera Formation), poorly drained

Vegetation type: Kahikatea semi-swamp forest

Semi-swamp forest dominated by kahikatea grew on the poorly drained shallow depressions. Several other species were present in varying amounts, including rimu, matai, pukatea, swamp maire, tawa, pokaka, and occasional cabbage tree. Prominent in the understorey were silver fern, mapou, hangehange, *Coprosma areolata*, and turepo, and tangles of kiekie and supplejack. The ground cover was dominated by ferns, herbs, grasses, and sedges including *Hymenophyllum demissum*, hen and chicken fern, *Astelia fragrans*, *A. grandis*, and *Microlaena avenacea*.

The largest remnant of this once-widespread vegetation type is Yarndleys Bush (14.5 ha). Other remnants of this type include Whewells Bush and Barrett Bush. Claudelands Bush, officially known as Jubilee Park (5.2 ha), is an accessible remnant of this vegetation type located within Hamilton City, and is described in detail in Whaley et al. (1997).

Characteristic Species	Life Form
Astelia fragrans	monocot herb
A. grandis	monocot herb
cabbage tree (*Cordyline australis*)	tree
Carex dissita	sedge
C. lambertiana	sedge
Coprosma areolata	shrub
fragrant fern (*Microsorum scandens*)	fern
hangehange (*Geniostoma rupestre* subsp. *ligustrifolium*)	shrub
hen and chicken fern (*Asplenium bulbiferum*)	fern
Hymenophyllum demissum	fern
kahakaha (*Collospermum hastatum*)	epiphyte
kahikatea (*Dacrycarpus dacrydioides*)	tree
kiekie (*Freycinetia banksii*)	scrambler
mahoe (*Melicytus ramiflorus* subsp. *ramiflorus*)	tree
mapou (*Myrsine australis*)	shrub
matai (*Prumnopitys taxifolia*)	tree
Melicytus micranthus	shrub
Microlaena avenacea	grass
Oplismenus imbecillis	grass
pate (*Schefflera digitata*)	shrub
pokaka (*Elaeocarpus hookerianus*)	tree
pukatea (*Laurelia novae-zelandiae*)	tree
raurekau (*Coprosma grandifolia*)	shrub
rewarewa (*Knightia excelsa*)	tree
rimu (*Dacrydium cupressinum*)	tree
silver fern (*Cyathea dealbata*)	tree fern
supplejack (*Ripogonum scandens*)	liane
swamp maire (*Syzygium maire*)	tree
tawa (*Beilschmiedia tawa*)	tree
turepo (*Streblus heterophyllus*)	tree

(iii) Low terraces adjacent to the Waikato River

Generalised Soil Parent Material:
Alluvium, pumiceous to non-pumiceous silt, sand and gravel (Taupo Pumice Alluvium), well drained

Vegetation type: Totara-matai-kowhai forest

Totara, matai, kowhai, and kanuka dominated the low, narrow terraces associated with the Waikato River. Several divaricating shrubs such as *Coprosma rhamnoides* and *C. rigida*, and tree ferns such as wheki and wheki ponga occurred in the understorey, and ferns and grasses, e.g., *Blechnum* spp. and *Oplismenus imbecillis*, were common in the ground layer. No intact remnants of this vegetation type remain in the Hamilton Ecological District.

Characteristic Species	Life Form
Astelia solandri	epiphyte
Blechnum chambersii	fern
B. filiforme	fern
cabbage tree (*Cordyline australis*)	tree
Coprosma rhamnoides	shrub
C. rigida	shrub
hinau (*Elaeocarpus dentatus*)	tree
kahakaha (*Collospermum hastatum*)	epiphyte
kahikatea (*Dacrycarpus dacrydioides*)	tree
kanuka (*Kunzea ericoides* var. *ericoides*)	tree
kiekie (*Freycinetia banksii*)	scrambler
kiokio (*Blechnum novae-zelandiae*)	fern
kowhai (*Sophora microphylla*)	tree
lacebark (*Hoheria sexstylosa*)	tree
mahoe (*Melicytus ramiflorus* subsp. *ramiflorus*)	tree
mamaku (*Cyathea medullaris*)	tree fern
matai (*Prumnopitys taxifolia*)	tree
Melicope simplex	shrub
Microlaena avenacea	grass
northern rata (*Metrosideros robusta*)	tree
Oplismenus imbecillis	grass
Pellaea rotundifolia	fern
Polystichum richardii	fern
raurekau (*Coprosma grandifolia*)	shrub
rewarewa (*Knightia excelsa*)	tree
ribbonwood (*Plagianthus regius*)	tree
rimu (*Dacrydium cupressinum*)	tree
tawa (*Beilschmiedia tawa*)	tree
totara (*Podocarpus totara*)	tree
turepo (*Streblus heterophyllus*)	tree
silver fern (*Cyathea dealbata*)	tree fern
wheki (*Dicksonia squarrosa*)	tree fern
wheki ponga (*Dicksonia fibrosa*)	tree fern

C GULLIES

(i) Terrace scarps and gully sides

Generalised Soil Parent Material:
Loose, mainly rhyolitic sand and gravel (Hinuera Formation), well drained

Vegetation type: Totara-matai-kowhai forest

The scarps and steep gully side slopes were covered with forest dominated by totara, matai, and kowhai. Kanuka and kamahi were also present, and mahoe occurred in more poorly drained sites. The understorey included shrubs of mapou, mingimingi, and *Rhabdothamnus solandri*, and the ground was covered in a variety of ferns such as *Blechnum chambersii*, *Doodia media*, and *Polystichum richardii*. Slopes too steep for forest had herbaceous or shrubby vegetation including *Machaerina sinclairii*, whaririki, rangiora, koromiko, and heketara. No intact remnants of this vegetation type remain in the Hamilton Ecological District.

Characteristic Species	Life Form
Blechnum chambersii	fern
Cyathea cunninghamii	tree fern
Doodia media	fern
Earina mucronata	orchid
heketara (*Olearia rani*)	shrub
hounds tongue (*Microsorum pustulatum*)	fern
kamahi (*Weinmannia racemosa* var. *racemosa*)	tree
kanuka (*Kunzea ericoides* var. *ericoides*)	tree
koromiko (*Hebe stricta* var. *stricta*)	shrub
kowhai (*Sophora microphylla*)	tree
Machaerina sinclairii	monocot herb
mahoe (*Melicytus ramiflorus* subsp. *ramiflorus*)	tree
mamaku (*Cyathea medullaris*)	tree fern
mapou (*Myrsine australis*)	shrub
matai (*Prumnopitys taxifolia*)	tree
mingimingi (*Leucopogon fasciculatus*)	shrub
northern rata (*Metrosideros robusta*)	tree
pate (*Schefflera digitata*)	shrub
Polystichum richardii	fern
rangiora (*Brachyglottis repanda)*	shrub
rewarewa (*Knightia excelsa*)	tree
Rhabdothamnus solandri	shrub
rimu (*Dacrydium cupressinum*)	tree
totara (*Podocarpus totara*)	tree
silver fern (*Cyathea dealbata*)	tree fern
whaririki (*Phormium cookianum*)	monocot herb

(ii) Narrow gully floors

Generalised Soil Parent Material:
Colluvium, mainly rhyolitic sand, silt and gravel (Hinuera Formation), occasional organic material, poorly drained

Vegetation type: Kahikatea-pukatea-swamp maire forest

The poorly drained gully floors and their associated backswamps were dominated by kahikatea, pukatea, swamp maire, cabbage tree and pokaka. Understorey and ground cover species included mapou, fuchsia, lancewood, pate, *Coprosma rotundifolia*, *Cyathea cunninghamii*, *Astelia grandis*, kiekie, and supplejack. This type is represented in a small (1 ha) remnant, Hammond Bush, located alongside the Waikato River in southern Hamilton City, and is described in detail in de Lange (1996). Kahikatea trees are absent from Hammond Bush, probably a result of the nutrient status at the site, although seedlings of this species have been found there. A larger (2.2 ha) remnant of this vegetation type is present on a private reserve near Temple View. This remnant, Koromatua Bush, is situated within two shallow gullies (de Lange 1996).

Characteristic Species	Life Form
Astelia grandis	monocot herb
cabbage tree (*Cordyline australis*)	tree
Coprosma rotundifolia	shrub
Cyathea cunninghamii	tree fern
fragrant fern (*Microsorum scandens*)	fern
fuchsia (*Fuchsia excorticata*)	fuchsia
hangehange (*Geniostoma rupestre* subsp. *ligustrifolium*)	shrub
Isolepis reticularis	sedge
kahikatea (*Dacrycarpus dacrydioides*)	tree
karamu (*Coprosma robusta*)	shrub
kiekie (*Freycinetia banksii*)	scrambler
lancewood (*Pseudopanax crassifolius*)	tree
mahoe (*Melicytus ramiflorus* subsp. *ramiflorus*)	tree
mapou (*Myrsine australis*)	shrub
Metrosideros fulgens	liane
pate (*Schefflera digitata*)	shrub
pigeonwood (*Hedycarya arborea*)	tree
Pneumatopteris pennigera	fern
pokaka (*Elaeocarpus hookerianus*)	tree
pukatea (*Laurelia novae-zelandiae*)	tree
raurekau (*Coprosma grandifolia*)	shrub
rewarewa (*Knightia excelsa*)	tree
Schoenus maschalinus	sedge
silver fern (*Cyathea dealbata*)	tree fern
supplejack (*Ripogonum scandens*)	liane
swamp maire (*Syzygium maire*)	tree
wheki (*Dicksonia squarrosa*)	tree fern

D PEATLANDS

(i) Peat lakes

Generalised Soil Parent Material:
Part Unclassified (lakes)

Vegetation type: Submerged and marginal herbaceous vegetation

The shallow peat lakes had submerged vegetation dominated by charophytes (*Nitella hookeri/cristata, Chara corallina*), pondweeds (*Potamogeton ochreatus, P. cheesemanii*), and milfoils (*Myriophyllum propinquum*). The emergent marginal vegetation typically comprised narrow monospecific zones of, from the lake shore outwards, raupo, *Baumea articulata*, and *Eleocharis sphacelata.* A good example of this vegetation type occurs at Lake Rotokauri and is described in Champion et al. (1993).

Characteristic Species	Life Form
Baumea articulata	sedge
B. huttonii	sedge
B. rubiginosa	sedge
B. teretifolia	sedge
Chara corallina	charophyte (submerged)
Carex secta	sedge
C. virgata	sedge
Cyperus ustulatus	sedge
Eleocharis acuta	sedge
E. sphacelata	sedge
Glossostigma elatinoides	herb
Isachne globosa	grass
Isolepis prolifer	sedge
Lilaeopsis novae-zelandiae	herb
Myriophyllum propinquum	herb (submerged)
M. triphyllum	herb (submerged)
Myriophyllum propinquum	herb (submerged)
Nitella hookeri/cristata	charophyte
N. pseudoflabellata	charophyte
Potamogeton cheesemanii	herb (submerged)
P. ochreatus	herb (submerged)
raupo (*Typha orientalis*)	herb
Schoenoplectus validus	sedge

(ii) Peatland margins

Generalised Soil Parent Material:
Shallow peat (<0.4 m) on alluvium, poorly drained
Moderately deep peat (0.4-1.0 m), very poorly drained

Vegetation type: Swamp forest and shrubland

Swamp forest and shrubland grew on shallow peat characteristic of the low-lying sites of the plains and the outer margins of the peat bogs. Kahikatea was the main species but individual trees were much smaller than on the better drained soils listed above. Cabbage tree, swamp coprosma, *Coprosma*

propinqua, manuka, flax, *Dianella nigra*, and *Hypolepis distans* were also relatively common. No intact remnants of this vegetation type remain in the Hamilton Ecological District.

Characteristic Species	Life Form
Baumea huttonii	sedge
B. rubiginosa	sedge
B. tenax	sedge
B. teretifolia	sedge
Blechnum minus	fern
cabbage tree (*Cordyline australis*)	tree
Carex secta	sedge
C. virgata	sedge
Coprosma propinqua	shrub
C. robusta	shrub
Dianella nigra	monocot herb
flax (*Phormium tenax*)	herb
Hypolepis distans	fern
karamu (*Coprosma robusta*)	shrub
kahikatea (*Dacrycarpus dacrydioides*)	tree
kaikomako (*Pennantia corymbosa*)	tree/shrub
Leucopogon fasciculatus	shrub
Lobelia anceps	herb
manuka (*Leptospermum scoparium*)	shrub
pokaka (*Elaeocarpus hookerianus*)	tree/shrub
Schoenus brevifolius	sedge
Sparganium subglobosum	monocot herb
swamp coprosma (*Coprosma tenuicaulis*)	shrub
Tetraria capillaris	sedge
wheki (*Dicksonia squarrosa*)	tree fern

(iii) Peat bogs

Generalised Soil Parent Material:
Deep peat (> 1.0 m), very poorly drained

Vegetation type: Shrub sedgeland

Mosaics and mixtures of low-growing shrubland and sedgeland covered extensive areas of peatland on the peat dome margins, around lakes, and in deeper depressions west of the Waikato River. The main species were manuka, cabbage tree, swamp coprosma, *Baumea teretifolia*, *B. rubiginosa*, *Carex secta*, *C. virgata*, and flax. This type is represented around parts of Lake Rotokauri, Lake Rotokaeo, Horseshoe Lake and at the margins of Moanatuatua peat bog within Moanatuatua Scientific Reserve.

Characteristic Species	Life Form
Baumea huttonii	sedge
B. rubiginosa	sedge
B. tenax	sedge
B. teretifolia	sedge
Blechnum minus	fern
cabbage tree (*Cordyline australis*)	tree
Carex secta	sedge

C. virgata	sedge
Coprosma propinqua	shrub
Dianella nigra	monocot herb
Drosera binata	herb
Empodisma minus	jointed “rush”
flax (*Phormium tenax*)	herb
Gleichenia dicarpa	fern
Hydrocotyle pterocarpa	herb
Hypolepis distans	fern
Isolepis prolifer	herb
Juncus planifolius	rush
manuka (*Leptospermum scoparium*)	shrub
Lobelia anceps	herb
Nertera scapanioides	herb
Schoenus brevifolius	sedge
Sparganium subglobosum	monocot herb
Sphagnum cristatum	moss
swamp coprosma (*Coprosma tenuicaulis*)	shrub
Tetraria capillaris	sedge
Thelymitra venosa	orchid

(iv) Peat domes

Generalised Soil Parent Material:
Very deep peat (>1.0 m), very poorly drained

Vegetation type: Restiad “rushland”

The peat domes with deeper peat were very poorly drained with water tables close to the surface for most of the year. They comprised mainly herbaceous vegetation dominated by the peat forming species *Empodisma minus* and *Sporadanthus ferrugineus*, which are members of the jointed “rush” family (Restionaceae). Associated species included stunted shrubs of manuka and *Epacris pauciflora*, sedges such as *Baumea teretifolia* and *Schoenus brevifolius*, and mosses and liverworts such as *Sphagnum cristatum* and *Goebelobryum unguiculatus.* The best remaining example of this vegetation type in the Hamilton Ecological District occurs at Moanatuatua Scientific Reserve (Clarkson et al. 1999).

Characteristic Species	Life Form
Baumea teretifolia	sedge
Campylopus acuminatus subsp. *kirkii*	moss
Epacris pauciflora	shrub
Empodisma minus	jointed “rush”
Gleichenia dicarpa	fern
Goebelobryum unguiculatus	liverwort
manuka (*Leptospermum scoparium*)	shrub
Riccardia crassa	liverwort
Schoenus brevifolius	sedge
Sphagnum cristatum	moss
Sporadanthus ferrugineus	jointed “rush”

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Appendix: Soil Parent Materials of Landforms in the Hamilton Ecological District

Landform Category	Landform Unit	Generalised Parent Material of Soils
Hills	Hilly land and foothills of ranges at margins of Hamilton Ecological District	Late Quaternary, composite rhyolitic and andesitic tephras (>1 m thick in south, <1 m thick in north), usually well drained, over weathered Hamilton Ash or colluvium where easy rolling to rolling; underlying units (mainly weathered sedimentary rocks or basalt) exposed on steepland
	Low rolling hills - summits, shoulders, backslopes *North of Hamilton City* *South of Hamilton City*	 Thin (<0.5 m) late Quaternary, composite rhyolitic and andesitic tephras on weathered Hamilton Ash, moderately well drained (non-allophanic) Thick (> 1.0 m) late Quaternary, composite rhyolitic and andesitic tephras, well drained (allophanic)
	Low rolling hills - footslopes	Colluvium derived from Hamilton Ash and other deposits, poorly to imperfectly drained

Alluvial Plains	Low mounds or ridges (flat to gently undulating)	Alluvium, mainly rhyolitic sand and gravel (Hinuera Formation), well drained to moderately well drained*
	Shallow depressions or swales (flat to gently undulating)	Alluvium, mainly pumiceous silt and clay, sand in places (Hinuera Formation), poorly drained*
	Low terraces adjacent to Waikato River (flat to gently undulating)	Alluvium, pumiceous to non-pumiceous silt, sand and gravel (Taupo Pumice Alluvium), well drained
Gullies	Terrace scarps and gully sides (steepland)	Loose, mainly rhyolitic sand and gravel (Hinuera Formation), well drained
	Narrow gully floors (flat to gently undulating)	Colluvium, mainly rhyolitic sand, silt and gravel (Hinuera Formation), occasional organic material, poorly drained
Peatlands	Peat lakes	Part unclassified
	Peatland margins (flat to gently undulating)	Shallow peat (<0.4 m) on alluvium, poorly drained Moderately deep peat (0.4 – 1.0 m), very poorly drained
	Peat bogs (flat to gently undulating)	Deep peat (> 1.0 m), very poorly drained
	Peat domes (flat to gently undulating)	Very deep peat (>1.0 m), very poorly drained

* A thin ($\leq$ 0.5 m) mantle of composite rhyolitic and andesitic tephras overlies the Hinuera Formation in many places