APPENDIX 12.0 RECOMMENDED AREAS FOR PROTECTION (RAPS)

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The following pages have been extracted from the report:

Beadel SM, Shaw WB, Nicholls JL (March 1998): Rotorua Lakes Ecological District Natural Area Survey.

Note: The reader is advised that the Recommended Areas for Protection (RAPs) for the Lakes A Zone are not sequentially numbered. There is difficulty in numbering the Recommended Areas for Protection (RAPs) sequentially and maintaining the integrity of the source document concerned (Beadel SM, Shaw WB, Nicholls JL: (March 1998): Rotorua Lakes Ecological District Natural Area Survey).

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land of remainder with thick veneers of Taupo tephra. Former vegetation mainly tussock/ heath; whole area now almost entirely under exotic forest, with marginal farmlands.

3. OUTLINE OF SURVEY METHODS

The ecological district was subdivided into bioclimatic zones and land types, to provide the basis for evaluation of ecological data. Descriptions of these are provided below, along with an outline of the criteria used to evaluate each site.

Bioclimatic zones

Three broad bioclimatic zones have been recognised (refer to Figure 4).

Semi-Coastal: Only the very easternmost portion is included in this zone, defined as being below the upper altitudinal limit of kohekohe, *c.*300 m asl.

The shorelines of Lakes Rotorua, Rotokawau, Rotoiti, Rotoehu, Rotoma, Okataina, and Tarawera, are either a very little below or above 300 m. Pohutukawa or pohutukawa x northern rata hybrids occur locally on cliffs or rocky ground by cliffs, abundantly about Lake Tarawera outlet and down river to Tarawera Falls. Kohekohe also occurs nearby some of these lakes, but only very rarely. The distribution of these coastal to semi-coastal species before drastic modifications to lakeside vegetation over the last 600 years or so can never now be known, but was almost certainly confined to occasional favourable niches. Therefore any attempt to delineate an obligatory very narrow strip of semi-coastal zone round the above lakes would be a misleading exaggeration. (With successful introduction of karaka to lakeside kainga and of whau on Mokoia Island, the Maori showed ability to recognise special sites about the extreme upper limit of the semi-coastal zone.)

Lowland: Land inland of the above zone and below the upper altitudinal limit of tawa, *c.*800 m. This applies to nearly all of this ecological district.

Submontane: Confined to two relatively minor areas above 800 m: the highest part of Makatiti Dome, east of Lake Okataina, and Mt Tarawera. Formerly marked by low forest dominated by Hall's totara and broadleaf, widely felled on Makatiti and destroyed on Tarawera during the 1886 eruption. But now regenerating well in both places.

Geological and Landform Units

The district has been stratified into 18 landform units or land types, as illustrated in Figure 5.

To avoid undue complexity, the minimum area demarcated is generally *c.*50 ha. But smaller areas deemed especially distinctive have been shown: e.g. small landmark hills (such as Owhatiura); some wetlands (all under 50 ha); some atypical flats in hilly country, and geothermal areas (also all under 50 ha).

1. Flats

Pumiceous alluvial deposits bordering lakes and streams, predominantly level but with very low terraces or rises in places.

Form an almost continuous ring round the shore of Lake Rotorua, extending well up stream sides in the Ngongotaha-Awahou quarter. Of greatest width in the south, from Rotorua Airport round to the business area of the city. Minor areas only elsewhere; e.g. at the east end of Lake Rotoiti (Hongi's Track), north end of Lake Okareka, and bordering tributaries of the Tarawera River.

2. Wetlands

These were not extensive in pre-historic times, and have become very few and far between owing to drainage for farming and other developments. The mapped areas occur at intervals round Lake Rotorua, at the east end of Lake Rotoiti, and beside Lakes Rotoehu, Rotomahana, and Rerewhakaitu.

3. Geothermal Areas

The only sizeable areas are at Tikitere, Whakarewarewa and nearby Arikikapakapa, and Waimangu. Many further occurrences are active but far too small to map. Urban development has greatly reduced former geothermal activity between Whakarewarewa and the southern end of Lake Rotorua.

4. Low Terraces

A low alluvial terrace surrounds much of Lake Rotorua, *c.*10 m above the flats, marking a higher lake level *c.*20,000 years ago. Of greatest extent in the south, reaching the inner limits of the city suburbs of Western Heights, Fordlands, and Hillcrest, and to the Forest Research Institute and Whakarewarewa. Terraces of comparable height occur very locally elsewhere, as beside Lake Okataina and Lake Tarawera.

5. Tarawera River Terrace

A low terrace bordering the Tarawera River from the lake outlet down to Kawerau. Composed of water-sorted volcanic debris deposited following the Kaharoa eruptive episode *c.*800 years ago, plus some addition in the early 1900s when debris from the 1886 eruption blocking the lake outlet finally broke away.

6. High Terraces

A very prominent alluvial terrace, with an overall gradual rise and moderately dissected in places, occurs round most of Lake Rotorua, up to *c.*90 m above the low terrace and extending a maximum distance of 10 km from the lake as it encircles Mt Ngongotaha. It marks the high stand of a lake which virtually filled the Rotorua Basin from *c.*50,000 to *c.*20,000 years ago, and overflowed

through the Hemo Gorge. Remnants of this terrace occur within the present lake catchment south of the gorge.

High terrace surfaces 200-300 m and 350-400 m asl occur above both sides of the Tarawera River along the first ten kilometres of its course.

7. Alluvial Fans

Erosion debris fans occur below steep flanks of Mt Ngongotaha; they appear to have remained stable during the last 20,000 years.

The far larger, gradually sloping Wharenui Fan in the south-east quarter of the Rotorua Caldera falls from *c.*350 m asl down to about the low terrace level in the Lynmore-Owhata suburban area. It is considered likely to have originated as a sub-aequous debris flow when lake waters rose abruptly to a maximum height some 50,000 years ago.

Note - Mapping of terraces and fans of the Rotorua Caldera in Figure 5 is a simplification of a quite involved pattern mapped and explained in detail by Kennedy *et al.* (1978).

8. Volcanic Fan

The very large fan sweeping down from the south side of Mt Tarawera to Lake Rerewhakaaitu and Lake Rotomahana originated as a pyroclastic flow during the Kaharoa sequence of eruptions *c.*800 years ago.

9. Flat to Undulating

Mosaics of flattish gully or small valley floors and low rolling to moderately steep-sided rises occur very locally, most extensively to the south and west of Lake Rerewhakaaitu, with lesser areas just south of Lake Rotoehu, north of Kawerau, and near the district boundary south of the Rotorua Basin, with rare patches elsewhere.

Markedly exceptional occurrences *c.*600 m asl on old rhyolite flows east of Mt Tarawera are probably owing to very thick tephra cover masking original rougher terrain.

10. Undulating to Hilly

Much more extensive than the above unit. Generally, a close pattern of small gullies and ridges and hills usually no more than 50 m above base levels.

This terrain is typical of most of the Mamaku Plateau surface as it slopes to the Rotorua Caldera; similar relief prevails on a remnant of the same ignimbrite formation between the caldera and Lake Okareka. The unit also occurs fairly widely south of Lake Rerewhakaaitu, where the eroded surface of the Rangitaiki Ignimbrite has a thick cover of tephra.

The weakly consolidated Rotoiti Breccia has become well dissected, giving rise to a fine series of generally narrow, often streamless, gullies and hills with broad rolling tops. This variant is accordingly extensive about the west end of Lake Rotoiti, the south and east sides of Lake Rotoma, to the north of Kawerau, and above the flats and terraces in the Tarawera River valley. Equivalent undulating to hilly terrain is common on the Earthquake Flat Breccia formation along the south-west boundary of the ecological district. Exceptionally, undulating to hilly land surrounding the north half of Lake Rotoehu is the outcome of comparable dissection of a former high level fluviatile terrace.

The broad summits of the numerous rhyolite domes are often undulating to moderately hilly.

11. Undulating with Knolls

This is a landform unit confined to the higher half of the Mamaku Plateau west of Ngongotaha and Awahou. A general strongly undulating terrain is broken by frequent rocky knolls and ignimbrite tors.

12. Hill(s)

A few isolated and thus outstanding hills are mapped, but otherwise this unit embraces very considerable tracts of hill country, mainly moderately steep. It is typical of most of the land from about the southern shores of Lakes Rotoiti, Rotoehu, and Rotoma southward to the Tarawera Valley. The highest point is the summit of the almost entirely hilly Makatiti Dome complex, 934 m asl. An exception to the run of landforms within the Rotorua Caldera is the hilly southern third of Mt Ngongotaha, including its highest point, 757 m asl.

13. Range

A north-east to south-west aligned 4 km long salient ridge, above 500 m and culminating at Whakapoungakau Trig, 758 m asl. Classified here as a range because of the continuity of the main ridge (a rarity in this district) and its clear marking of the divide between the Rotorua and Haroharo Calderas.

14. Very Steep Slopes

The largest area consists of exceedingly steep faces, reaching from 2-300 m asl up to *c.*700 m, above the Kaipara Stream tributary of the Tarawera River. A feature is the outstanding landmark peak Maungawhakamana. The northern flank of Mt Ngongotaha, high faces above the north-west side of Lake Okataina, and the south face of Matawhaura Dome, at the east end of Lake Rotoiti, are also spectacularly steep.

15. Scarps

Also exceedingly steep, scarps characterise the upper-most sides of many of the rhyolite domes and also border spurs above the south-west side of Lake Okataina.

16. Gullies

Steep-sided narrow and often long gullies occasionally seam flat to undulating or moderately hilly terrain, especially on the Mamaku Plateau; some might be regarded as gorges.

17. Volcanic Rifts

The line of 100 m deep, long and wide gulches cleaving the summit of Mt Tarawera, and the associated rift containing the Waimangu geothermal activity, which all opened during the 1886 eruption.

18. Lakes

The feature that characterises this ecological district. Bodies of open water varying markedly in areal extent, depth, hydrology, chemistry, catchment size, and catchment land use. Some are connected and are part of the same catchment; lakes Rotorua and Rotoiti drain into the Kaituna River, Lakes Okareka, Rotokakahi, and Tarawera drain into the Tarawera River. Others don't have obvious outlets, such as Okataina and Rotoma.

Collection of field data

Existing ecological information was compiled from published and unpublished sources (see References and Selected Bibliography). Potential sites for field survey and evaluation were identified using topographic maps, and aerial photographs. Sites were delineated on aerial photographs, and were then inspected on the ground, subject to access approval by landowners. Data was collected using the plot sheet in Appendix 10. Vegetation types or classes were determined in the field and marked on aerial photographs. Not all sites were visited, but all sites were checked using recent aerial photographs and were viewed using binoculars. Information from earlier studies (such as unpublished file reports from earlier inspections) was used to identify, describe and evaluate some sites. Lakes *per se* were not assessed as potential Recommended Areas for Protection (RAP's), although wetlands on lake margins were.

Evaluation

Relative ecological values of the survey areas were assessed using the following 'primary' criteria, and a further set of six 'secondary' criteria.

Primary Criteria

1. Present versus past extent. An estimate of the relative extent of indigenous vegetation remaining in ecological district compared with that in an 1840 reconstruction

2. Landscape and ecological diversity. The diversity of physical and ecological features, and the patterns that exist within the area(s) under consideration.

3. Naturalness. Most mainland ecosystems are modified (e.g. by animal pests and weeds) but the degree of naturalness is an important consideration.

4. Size. Areas which are relatively large (*i.e.* compared to mean size of remaining areas of indigenous vegetation in an ecological district) are preferred to small areas. Larger areas are likely to be more viable in the long term.

5. Shape of area. Areas which are primarily compact are preferable to areas which are highly convoluted or dicontinuous.

6. Surrounding landscape. The degree to which the area is protected/buffered by the surrounding landscape.

7. Fragility and threat. An assessment of known or likely threats and the capability of the vegetation or habitat to resist change initiated by the threat agent(s).

8. Ecological viability and long-term sustainability. The likelihood of an area being able to remain ecologically viable and sustainable in the long term without substantial management input.

9. Representativeness - the primary criterion. One or more of the best examples of the characteristic communities within relevant land types in each bioclimatic zone were identified as Recommended Areas for Protection (RAPs).

(cf. O'Connor *et al.* 1990; Myers *et al.* 1987; Diamond 1975; Young and Mitchell 1994; Shaw 1994; Ogle 1981; Whaley *et al.* 1995.)

An assessment form was designed using these criteria (based on Whaley *et al.* 1995) - see below. High, medium and low values were defined for each criterion (see explanatory notes below).

Other Criteria

The presence of special or rare features was also assessed, and an areas rating as a fauna habitat. Refer to page 2 of the Ecological Assessment Sheet.

Selection of Recommended Areas for Protection

Recommended Areas for Protection (RAPs) were selected using the above criteria, to provide representation of the following:

- The best quality or only remaining representative examples of indigenous vegetation or wildlife habitats on particular land types within each bioclimatic zone not already protected. They contain some of the largest, best quality, or only remaining examples of indigenous vegetation or wildlife habitat, or intact altitudinal or geographic sequences across the ecological district, or diverse assemblages of land type, and vegetation within each bioclimatic zone.
- Relatively small sites with vegetation types or plant taxa under-represented or not represented in protected natural areas.
- Relatively large areas with features which are represented in protected areas but which are nevertheless worthy of protection.
- Sites containing vegetation types which would once have been more common in the ecological district and are unrepresented in protected natural areas but which have been degraded by weed invasion or animal damage, or similar.
- Interesting or special features, although the ecological unit(s) may be in a lower quality condition.