Glen Rock Honey Production Assessment

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SUMMARY

The property was assessed for its honey production potential by a group of four beekeepers, a DPI (Apiculture) officer and an officer from QPWS. Tracks were assessed on their suitability for transporting hives to a bee site. Potential bee sites were chosen during the field assessment, based on accessibility and the presence of suitable honey flora.

Later, however, in the analysis phase, an area was defined within which bees would be expected to obtain most of their nectar and pollen supplies. This was determined by offsetting a distance of 800 metres from suitable tracks. The bulk of Blackfellow Creek valley fell within this productive area and also the lower sections of Black Duck Creek valley. Towards the extremities of the areas in Blackfellow Creek and its tributary, Flaggy Creek, the access was to 4WD standard only and track upgrading would be required to realise the potential of these areas.

The map of areas accessible to bees was then overlaid on the Gatton Shire vegetation map layer (1:25,000) and the planning unit (PUID) boundaries. From the intersections of the layers, calculations were made of the extent of suitable vegetation in each PUID and the location of the PUIDS in relation to suitable access.

From experience the only vegetation types capable of producing commercial quantities of honey were Silver-leaved Ironbark/Narrow-leaved Ironbark and Brush Box. The first type had its main distribution in the drier and lower slopes of both major valleys while Brush Box tended to occur as a gully type intermixed with the Ironbark type.

Annual average yields of honey per hectare were estimated for each of these types using experience as a guide. Figures of 12 kg/ha per annum and 10 kg/ha per annum of honey were used for the Ironbark and Brush Box types respectively. The quality of each was taken to be within the range of the highest grade, currently returning about $1.70 per kilogram.

A total of 43 PUIDS was considered to be capable of producing commercial honey, with a total value of $65 832 per annum. To take into consideration the aggregations of PUIDS which, in reality, would be required to support a bee site containing 100 hives, an additional assessment was made for those PUIDS that are intersected by tracks suitable for beekeepers vehicles. A total of 22 PUIDS fell into this category with production values for their associated aggregations ranging from $964 per annum to $6 009 per annum. Those aggregations with the highest values fell towards the upper reaches of Blackfellow Creek.

The property was also assessed for its potential to build hives prior to harvesting nectar for honey production or for crop pollination purposes. The supply of high quality pollen in sufficient quantity to sustain and build bee colonies was the main criterion applied. In this respect the Forest Red Gum stands along the alluvial flats, sometimes enhanced by clover associated with limited areas of improved pasture, would provide build conditions. A total of about 126 hectares of this vegetation type was judged to be accessible. Forest Red Gum stands could be used for build for about 4 weeks on average most years. However, potential for this purpose may be limited because of low temperatures experienced at Glen Rock in winter and Spring.

A total of 27 PUIDS had some capability for honey build.

The possible interactions between honey production and other open space values, namely nature conservation, recreation and grazing were outlined. A brief literature review was made for the possible effects of commercial beekeeping on native flora and fauna. On this basis it appears that much of the evidence is inconclusive. It was recognised, however, that the exclusion of apiculture in Queensland's national parks was a policy matter that applies to the adjacent Main Range National Park rather than to Glen Rock itself.

On consideration of the nature conservation features identified for Glen Rock it was concluded that apiculture is likely to be largely compatible with nature conservation. Compatibility could be achieved if bee sites were used only in times of peak nectar flows and not used for build unless pollen supplies were copious. Sites would need to be chosen away from the National Park if possible and not accessed during wet conditions when damage to tracks could occur.

In the case of interactions with recreation and grazing it was concluded that potential conflict could be avoided by careful placing of hives away from recreation nodes and infrastructure associated with concentrations of grazing stock.

1. INTRODUCTION AND METHODOLOGY

1.1 INTRODUCTION

The introduced Italian bee (*Apis mellifera ligustica*) is commonly used for honey production in Australia. The honeybees require supplies of nectar and pollen (a source of protein, vitamins, etc.) as well as water for their sustenance and production of honey. Honey in excess of their requirements can be taken by beekeepers for sale. Other saleable products include beeswax, royal jelly, pollen and propolis which are used in the pharmaceutical, cosmetics and health food industries. Managed bees also provide crop pollination services.

In terms of economic benefits the returns to crop owners from crop pollination far exceed the total of all financial returns to the apiarist. The operating profits to apiarists from the use of state forests in South east Queensland are fairly evenly divided between sale of honey and beeswax on one hand and the profits attributed to the use of sites used to build bees for honey production, queen bee breeding and crop pollination.

Eucalypts are the main honey flora but a number of other native plants produce nectar and pollen suitable for honey production, ranging from those found in eucalypt-dominated forests to those of rainforests and mangroves. However, of these species, some yield more than others and some produce better quality honey. Light coloured honey tends to have mild flavours and brings higher prices.

Quantity of yield can vary enormously from year to year depending on the preceding and present seasonal conditions and past events such as wild fires. A series of high rainfall seasons can trigger sustained heavy nectar flows whereas drought can have the effect of lowering yields to such an extent that commercial harvesting is precluded. Topography can also play a part. In dissected terrain the harvesting period may be extended as bees will tend to follow the sequence of flowering from valley floor to upper slope. The ability of bees to produce honey may also be limited by cold conditions associated with frosty sites in narrow valleys and cool, wet sites at higher elevations.

While supplies of nectar are required for the bees to produce honey they also need pollen to maintain their vigour. Healthy hives may then be used for honey production, crop pollination, producing queen bees, nucleus colonies or sold to other apiarists as ‘package bees’. Areas with supplies of plentiful, high quality pollen are used for over-wintering bee colonies and building up their strength prior to honey production. Queen bee breeding is also important to maintain recruitment of new working bees.

A number of honey flora have nectar supplies but little or no pollen. Therefore it is often the combination of species flowering at around the same time that is important rather than the flowering of a single species. An example of this is the combination of Brush Box (a major nectar producer but minor pollen source) with Angophoras and Acacias which are major pollen producers.

Bees can harvest nectar productively up to 2-3 km from their hive. The geographic pattern of harvesting will vary according to the distribution and characteristics of the honey flora. However, for ease of calculation a radial pattern of harvesting from the beehives is assumed.

Most harvesting activity takes place within a distance of 800 metres from the hives under normal honey flow conditions. An area of 200 hectares (eg. the area lying within a radius of 800 metres) was taken to be fully utilised by a bee site. A distance of approximately 1.6 kilometres between bee sites was assumed to be the standard separation to avoid competition between bee colonies. In this planning exercise the area potentially available for honey production is that which lies within 800 metres of a vehicular track suitable for beekeepers.

The standard of access required is that sufficient to allow passage of a 2WD tray body truck. Few beekeepers would have a 4WD vehicle suitable for transporting hives. Relatively flat ground is required for the bee site, large enough to accommodate about 100 hives and a working area for the beekeeper. An ideal site would also be close to a reliable water supply but not in a location likely to flood during periods of high stream flow or heavy rainfall. The best sites are sheltered from wind, shaded in summer or exposed to the sun in winter. The number of hives on a site will vary but generally one can assume 100 as an average within a range of 80 to 120 hives. For queen bee breeding the bee boxes can be partitioned to carry up to 4 nucleus colonies each.

The region around the study area supports a number of commercial operators who utilise State Forest or private property. Commercial migratory beekeepers mainly use the region for hive build rather than for harvesting nectar flows. The Helidon Hills area is valuable for building hives during winter and spring. Principal species include Forest Red Gum (*Eucalyptus tereticornis*), Spotted Gum (*Corymbia citriodora*) and White Mahogany (*E. acmenoides).* However, the area can be used for honey production during occasional high nectar flows, which occur about every 5 to 6 years. Around 4 apiarists currently use about 13 sites located on State Forest in the Helidon Hills. More sites would be used given more favourable flowering than is currently the case.

Glen Rock was used for apiculture prior to its acquisition by Government. However, hives had not been placed on the property for a number of years prior to purchase because of severe drought in the area. Up to 6 sites have been utilised in Blackfellow Creek valley but not elsewhere.

1.2 METHODOLOGY

Glen Rock was divided into 77 planning units (PUIDS) for the purpose of assessment. Prior to estimating the value of each PUID to the honey industry an evaluation was made for each of the vegetation types at Glen Rock. The potential area of vegetation that could be harvested was estimated by offsetting a distance of 800 metres from tracks accessible by beekeeper's trucks (see Map 1). Estimations were made of honey yields for each area of vegetation within the estimated production area in terms of the estimated average annual yields of honey produced for sale and the price per kilogram based on the expected quality. The vegetation units were also assessed for their usefulness as build sites to maintain the vigour and health of bee colonies. PUIDS were then evaluated this basis.

As common practice is to place 100 hives would be placed at each site, an assessment was made for aggregations of PUIDS around those PUIDS which were intersected by roads suitable for beekeepers trucks using a distance of 800 metres as the distance from which bees can access honey flora.. The aggregations were defined by taking PUIDS in turn, delineating tracks from which bee hives can be placed within 800 metres of that PUID and then aggregating those PUIDS to which contained a boundary offset 800 metres from the PUID. Each PUID was also assessed individually. Cleared sites were deducted from the available area but thinned or regrowth areas had a yield reduction of 50% applied.

The following steps were taken in assessing Glen Rock.

(1) Assess honey production capacity of each vegetation type.
A 1:25,000 vegetation map (Grimshaw-1999) was used to assess the potential of vegetation types for honey production using the vegetation descriptions (Map 2). These were briefly checked in a short field assessment using industry personnel. The major plant species listed for each mapped vegetation type were then evaluated for their potential for honey production. Minor map units were ignored. Evaluation was based on the species' relative abundance and their capacity for nectar and pollen yields. An estimate of the average annual honey production for each hive utilising the vegetation type was made (Table 3), using knowledge of the quantity obtained in a good season and the period between such flows.

(2) Define productive (bee accessible) area.
This was done in the field by assessing vehicular tracks on their suitability for 2 wheel drive trucks of the type used by beekeepers to access bee sites. Short road sections suitable for 4WD vehicles were also added to account for possible track upgrading where this may be practical. Areas outside the Glen Rock property were not included in the calculations (Map 4).

(3) Calculate the honey production capacity and estimated honey income for each PUID.
Every patch within the PUID was individually assessed for its effective yield. The formula to calculate the current $ return for each patch in the PUID was:
Annual patch income = Patch area x Vegetation type index x yield/ha x price/kilogram
The PUID income is the sum of the patch income. Estimated yields from thinned areas were reduced by 50% and cleared areas had no yield assigned. Those PUIDS inaccessible to bees were given a zero value (see example for PUID 1 in Table 1).

Table 1 Honey production for PUID 1

Puid No.	Bee site id	Vegetation	RE	RE percentage	Area (ha)	Price /kg	ValueAv. Annual yield xPrice	Effective ha / puid	$ return per PUID	Build Status
1	1	R9h	non remnant	100	12.7	1.7	0.0			0.0
1	1	R8d	regrowth	100	48.4	1.7	493.9			0.0
1	0	R	regrowth	100	12.8	1.7	130.6			0.0
1	0	C	non remnant	100	4.6	1.7	0.0			0.0
1	0	C	non remnant	100	0.2	1.7	0.0			0.0
1	0	8b/8d	12.8.14 - 12.8.17	80/20	1.0	1.7	19.5			0.0
1	0	3a/3c	12.3.7 - 12.3.3	60/40	0.1	1.7	0.0	31.6	644.0	0.1

(4) <u>Calculate the estimated honey income for PUIDS accessible to bees from the potential bee sites closest to the target PUID.</u>

Taking each PUID in turn, delineate the tracks from which it can be accessed by bees (800 metres or less away). From these tracks offset a distance of 800 metres to determine which PUIDS or parts of PUIDS are accessible to bees from the tracks, then calculate the $ value of the accessible portions of these PUIDs. Rate the accessible $ value against the Yellow Box standard (i.e. the value of Yellow Box honey from an equivalent area).

For example PUID 1 is accessible (i.e. within 800m) from roads in PUIDs 1 and 3 (Map 5). Bee sites located on these roads can potentially access some nectar in PUIDs 1,2,3,4,8,9,10,11 (Map 6).

Table 2 Honey Rating for PUID 1

Puid No.	Total Area (ha)	Area Accessible (ha)	Average honey yield kg/ha	Price per kg	$ Value of Puid	$ Value of Yellow Box equivalent	base rating
1	79.7	63.8	4.75	1.7	$515.17	$1,896.86	515.2
2	64.2	51.4	3.77	1.7	$328.82	$1,527.96	
3	76.6	68.9	4.12	1.7	$483.18	$2,050.97	
4	55.9	28.0	9.78	1.7	$464.72	$831.51	
8	41.4	37.3	0.01	1.7	$0.92	$1,108.49	
9	42.1	21.1	0.83	1.7	$29.80	$626.24	
10	30.7	15.4	1.77	1.7	$46.07	$456.66	
11	64.3	12.9	8.62	1.7	$188.52	$382.59	
Total		298.5			$2,057.19	$8,881.27	2.3

rating puid 1 = $ value of puid group/ $ value of YB equivalent + access Bonus = 3.3

(5) <u>Estimate the area of vegetation with build capacity for each PUID</u>.

This estimate was not used in assigning bee sites as the Forest Red Gum vegetation type was located along the valleys where bee site were located anyway on the basis of access and vegetation types suitable for honey production. The capacity for build would enhance, to some degree the value of the bee sites

(7) <u>Use the data in the planning process.</u>

In the planning process the PUID(s) with the highest value are selected first. Because an extra point is given to those PUIDS containing a track suitable for beekeeper access these tend to emerge first.

In the event that other uses have already been assigned to the PUID on the basis of priority, bee keeping would be allowed provided hives were sited so as to be compatible with the previously determined uses. The bee site can be shifted within the PUID if possible to maintain compatibility but if this results in a lower value because associated PUIDS become inaccessible to bees a resort of priority honey PUIDS is undertaken to determine the next best PUID. If the bee site cannot be placed in the vehicle-accessible PUID it is discounted from further consideration for a bee site, although it may still be included as a bee-accessible PUID depending on the sorting process.

Once the bee site has been optimally placed it is locked into the decision list and an 800 metre radius drawn around it. This then acts as a constraint on any nearby bee site. The new site must be chosen so as not to overlap (or marginally at the most) the previously decided bee site. The process is then repeated until all possible bee sites have been placed.

2. HONEY FLORA AT GLEN ROCK

2.1 NECTAR PRODUCING SPECIES

The most important open forest species for honey production at Glen Rock comprise Brush Box (*Lophostemon confertus*), Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Narrow-leaved Ironbark (*E. crebra*).

Nectar sources

Major nectar source: Silver-leaved Ironbark, Brush Box..
Medium nectar source: Narrow-leaved Ironbark, Rough-barked Apple, Pink Bloodwood.
Minor nectar source: Forest Red Gum, Broad-leaved Apple.

Silver-leaved Ironbark is quick budding and has high nectar flows about once in 5-6 years. Yields of 100 kilograms of high quality honey per hive in a season are not uncommon. Under normal conditions an average annual yield of 20 kilograms per hive could be reasonably expected.

Brush Box is also quick budding and generally flowers each year. However, high nectar flows occur about once in 5 to 6 years. Yields of 100 kilograms of high quality honey in a season are not uncommon. Under normal conditions, therefore, an average annual yield of 20 kilograms per hive is a reasonable estimate.

Narrow-leaved Ironbark takes at least 6 to 8 months to flower after buds appear. Flowering is in usually in late winter, or in Spring when temperatures are sufficiently high to permit harvesting by bees. High nectar flows occur about once in 5 to 6 years or more. Yields of 50 kilograms of high quality honey per hive in a season are not uncommon. Under normal conditions an average annual yield of 10 kilograms per hive could be reasonably expected. Pollen supplies vary from medium to poor.

Although Yellow Box (*E. melliodora*) occurs on Glen Rock it is called ‘Yellow Jacket’ by beekeepers to distinguish it from trees of this same species growing in the Traprock country near Stanthorpe. Whereas ‘Yellow Jacket’ flowers in winter, and is not worked by beekeepers because of the cold conditions, the same species flowers in Spring in the Traprock area to become a valuable producer of honey.

The period of production is also important to the operation of the apiarist. At Glen Rock those species which tend to flower in winter and spring (June to November) include Forest Red Gum (*Eucalyptus tereticornis*) and Narrow Leaved Ironbark.

Those that tend to flower in summer and autumn include: Silver-leaved Ironbark, Brush Box, Broad-leaved Apple (*Angophora subvelutina*), Rough-barked Apple (*A. floribunda*), Pink Bloodwood (*Corymbia intermedia*), Forest Oak (*Allocasuarina torulosa*) and White Box (*E. albens*). The nectar flows associated with flowering begin during November and continue through to March.

2.2 HONEY PRODUCTION RATINGS FOR VEGETATION TYPES

Returns to beekeepers are based on yields and quality of honey produced. Yield comparisons can be made on the basis of the major honey flora in a vegetation type or by individual honey flora species.

Estimates were obtained from local beekeepers using their knowledge of the production levels obtainable under high honey flow conditions and their frequency of occurrence.

The formula used for calculating average honey production/ha/yr is.

Honey yield per hive (in Kilograms) x 100 (no of hives at a site) divided by 200 (no. of hectares within 800 metres of the hives) x Number of years between commercial flows.

The yields can be rated against a vegetation type (or species) which, from experience, has higher average yields than any other. This source is given a value of 10 as a standard against which other honey sources are measured.

Taking the Yellow Box/Hill Gum stands in the Traprock country near Stanthorpe as a rating of 10 with an annual average honey yield of 17.5 kg/ha (i.e. yields of about 70 kg per hive approximately 2 years apart) the vegetation types in Table 1 are assigned expected yields and given ratings accordingly. For more information on species' composition of these vegetation types, see Appendix 2.

Honey quality was assessed in terms of the eight quality classes used in the industry. Quality is largely based on colour (Pfund value) with the lightest colour bringing the highest prices. Moisture content and flavour also determine price.

The main honey flora, Brush Box and Silver-leaved Ironbark and Narrow-leaved Ironbark, are in the highest colour class. At present the gross return to the apiarist ranges from $1.70 per kg to $1.47 per kg over the 8 colour classes. Of course prices fluctuate according to market conditions at the time.

The ratings for yield were modified according to the quality class if these differed.

Table 3 Yield Results

Vegetation Code*	**Main Honey Flora** among the dominant species.	**Average annual honey yield (kg) /ha**	**Quality Class**
3a	**Forest Red Gum**, River Oak.	0	
8a	Grey Gum, White Stringybark,	0	
8b	**Forest Red Gum**, Yellow Box.	0	
8d	**Narrow-leaved Ironbark, Silver Leaved Ironbark**.	12	1
8e	**Brush Box**. (gullies)	10	1
8j	**Forest Red Gum**, Yellow Box, **White Box**.	0	
8k	**White Box**.	0	

* Grimshaw P. (1999). Gatton Shire Vegetation Mapping Project.

2.3 POLLEN PRODUCING SPECIES

The main sources of pollen at Glen Rock include: Apples (*Angophora* species), Acacias, Black Tea-tree (*Melaleuca bracteata*), White Stringybark (*E. eugenioides*) and Forest Red Gum. In August, Forest Oak is another source of pollen and, although its quality is poor, the supplies can be abundant. Rainforest areas also produce pollen for spring build. The main role of pollen at Glen Rock is to support hives during honey production. The area has a low capacity for hive building during winter and spring, mainly because of the low temperatures experienced here at this time of year.

Pollen Sources

Major pollen source: Forest Red Gum, Broad-leaved Apple, Rough-barked Apple, Wattles.
Medium pollen source: Pink Bloodwood.
Minor pollen source: Forest Oak, Brush Box.

Forest Red Gum is useful for build as it flowers regularly in winter and spring with good supplies of pollen and some nectar. At Glen Rock the limited area of improved pasture carrying clover (*Trifolium repens*) may be capable of building hives in early Spring, given sufficient rainfall, mild temperatures and low stocking rates if cattle graze the pastures. Pollen supplies from this source would enhance the value of Forest Red Gum stands along the alluvial flats if the flowering was concurrent or overlapped.

2.4 BUILD RATINGS FOR VEGETATION TYPES

The availability of pollen sources is important for hive building. Bees can be prepared for honey production, queen bee breeding, or crop pollination. In this study no distinction was made between these purposes

The value of a vegetation type for build was calculated on the basis how often (in years) the vegetation type could be expected to provide adequate build condition and the average number of weeks the vegetation type around a site would be used in that year to build 100 hives. The timing of pollen supply is crucial to its value for build. Suitable pollen must be available to bees in Spring (August/September) to be of most effective. However, supplies at other times are still important to maintain hive strength during the course of honey production in summer or for over-wintering in the cooler months.

The formula used for rating vegetation types was: Average build weeks per year when used/period in years between use.

Therefore a vegetation type used at a frequency of one in three years for a period of 6 weeks on each occasion would have a value of 2 average build weeks per year.

A vegetation type (or species) is chosen which, from experience, has higher average pollen yields suitable for bees than any other and therefore can be used for a high number of weeks per annum for this purpose. This type is given a value of 10 as a standard against which other build sites are measured.

The better build areas in SE Queensland are based on Turnip Weed (*Rapistrum rugosum*), an introduced species prolific in high quality pollen. These plants are commonly found around cultivated areas on black soils in the Darling Downs or Brisbane Valley together with other pollen sources such as Wild Mustard and Indian Mustard (*Brassica* species). Such build areas may produce prolific pollen for up to about 10 weeks each year. However, the availability of such areas is not necessarily assured and may be affected by insecticide spraying of nearby crops, inadequate rainfall, low temperatures and farm management practices.

If only native vegetation types were used for ratings a suitable standard in Southeast Queensland would be areas containing Hairy Bush Pea (*Pultenaea villosa*) which flowers regularly each year for about 4 weeks in August/ September. Based on a rating of 10 for Hairy Bush Pea the following vegetation types have been rated as shown in Table 4. The distribution of Vegetation Type 3a (RE 12.3.7) is shown in Map 3.

Table 4 Build Ratings

Vegetation Code*	**Major Pollen Flora** among the dominant species	Average build weeks /year	Rating
3a	**Forest Red Gum, River Oak**	4	5
8a	Grey Gum, White Stringybark	0	0
8b	**Forest Red Gum,** Yellow Box	0	0
8d	Narrow-leaved Ironbark, Silver-leaved Ironbark	0	0
8e	**Brush Box**.(gullies)	0	0
8j	**Forest Red Gum**, Yellow Box, **White Box**.	0	0
8k	**White Box**	0	0

* Grimshaw P. (1999). Gatton Shire Vegetation Mapping Project.

2.5 RESULTS

The results appear in Table 5 and Map 7.

An area of 2 761 hectares was deemed to be accessible by bees from suitable tracks located within Blackfellow Creek valley. Most of the access is suitable for a 2WD truck in dry weather with the last few kilometres in Blackfellow Creek and Flaggy Creek considered suitable for 4WD vehicles only. In Black Duck Creek valley another 575 hectares are accessible for honey production using a 2WD truck in dry weather.

Forty-three PUIDS were evaluated as capable of producing honey. Estimated returns from bee sites accessing those 43 sites ranged from $964 per annum to $6 009 per annum.

PUIDS with the highest values (5.0 to 5.8) are located along the valley floor of Blackfellow Creek and Flaggy Creek upstream of their junction.
Medium values (3.3 to 4.9) were located in the downstream sections of Blackfellow Creek and Black Duck Creek as well as slopes upstream of the junction of Blackfellow Creek with Flaggy Creek.
Lowest values (1.5 to 3.2 were calculated for bee-accessible slopes in the lower sections of Blackfellow Ceek and Black Duck Creek valleys (see Map 7).
PUIDS inacccessible to bees or containing unsuitable vegetation types received a zero value eg Cookes tableland , Mount Machar, Christies Tableland).

A total of 27 PUIDS had some capability for honey build with a total area of 125 hectares.

Table 5 Honey Values

PUID Number	Vegetation type	Current accessible $ return for PUID	$ value of PUIDS accessible from PUID	PUID honey rating
1	Regrowth 8d	$643.96	$2,057.19	3.3
2	Regrowth 8d, 8e	$411.02		2.1
3	Regrowth 8d, 8e	$536.86	$2,091.27	3.3
4	Regrowth 8d, 8d/8b	$929.44		2.3
5	8d			0
6	Regrowth 8d, 8d, 8e	$797.34		1.6
7	Regrowth 8e. 8e	$78.73	$964.33	2.6
8	3a/3c	$1.02	$1,317.97	3.3
9	3a/3c	$59.60	$1,789.87	3.3
10	Regrowth 8d	$92.13	$2,628.71	3.3
11	Regrowth 8d,8a/8e	$942.58		2.7
12				0
13	Regrowth 8d	$150.95	$2,161.96	3.7
14	Regrowth 8d	$498.16	$2,511.39	3.7
15	Regrowth 8d, 8e	$773.90		2.7
16	0			0
17	0			0
18	0			0
19	Regrowth 8e			0
20	0	$0.00	$2,079.33	3.8
21	Regrowth 8e	$24.98	$2,079.33	3.8
22	8d, 8e	$932.39		3.4
23	8d			0
24	Regrowth 8d, 8d			0
25	0			0
26	0			0
27	0	$485.09		2.8
28	Regrowth 8d, 3a/3c	$73.60	$3,576.27	4.4
29	0			0
30	0			0
31	0			0
32	0			0
33	0			0
34	Regrowth 8d, 8d/8b			0
35	Regrowth 8d, 8d, 8e	$878.94		3.4
36	3a/3c			3.4
37	Regrowth 8d, 3a/3c	$248.93	$3,993.83	4.4
38	8b 8e. 8e	$1,026.29		3.4

Table 5 (continued)

PUID Number	Vegetation type and area	Current accessible $ return	$ value of PUIDS accessible from PUID	PUID honey rating
39	8e			0
40	3a/3c, regrowth 8d	$111.30		3.4
41	Regrowth 8d	$336.53	$2,753.90	3.8
42	Reg'th 8d, 8d/8b, 3a/3c	$771.69	$3,647.97	3.8
43	0			0
44	0			0
45	Regrowth 8d	$197.04		1.7
46	Regrowth 8d, 8d/8b			0
47	Regrowth 8d, 8d/8b			0
48	Regrowth 8d, 3a/3c	$180.26	$2,556.16	4.5
49	8b/8e	$2,691.49		4.0
50	Regrowth 8d, 3a/3c	$215.52	$2,681.00	3.8
51	Regrowth 8d, 3a/3c	$191.08	$4,190.41	5.0
52	8d/8k	$1,476.60		3.5
53	Regrowth 8d, 8d/8k, 8e	$744.54	$3,782.84	3.3
54	8d/8b, 8e	$1,311.22		4.0
55	Regrowth 8d, 8b/8e, 3a	$219.22	$5,889.61	5.0
56	8d/8k	$1,457.66		1.0
57	0	$0.27		2.3
58	8e/8m			0
59	8a/8e			0
60	0			0
61	0			0
62	8d/8b, 8e			0
63	8e, 3a	$1,059.94		2.8
64	Regrowth 8d, 3a	$50.70	$6,009.33	5.0
65	Regrowth 8d, 8b/8e, 8e	$2,118.68		4.0
66	8d/8k, 8e	$4,125.62		2.3
67	Regrowth 8d, 8e	$1,103.57	$4,404.23	3.3
68	8a/8e			0
69	Regrowth 8d, 8e			0
70	8e/8a	$440.90	$2,664.85	2.8
71	8e/8a, 8b/8e			0
72	0	$926.10		2.8
73	0			0
74	0			0
75	0			0
76	0			0
77	0			0
Total		$29,315.84	$65,831.73	

3. INTERACTIONS WITH OTHER OPEN SPACE VALUES

3.1 INTRODUCTION

The European honey bee (*Apis mellifera*) was introduced to Australia in early colonial times. Races such as the Italian Honey bee have been subsequently introduced and used by apiarists for their industry. Over time honey bees have established feral colonies in native bushland, probably beginning in South east Queensland around the mid 1800s (Weatherhead 1986).

Therefore, bees in bushland may occur either as feral colonies, or as managed hives transported from site to site by apiarists for the purpose of honey production or hive maintenance (New 1994). The distinction is important when considering environmental effects.

Beekeepers require vehicular access to transport their hives close to honey flora. Commonly, a 2WD-tray body truck is used. The bee site is generally large enough to accommodate about 100 hives and a working area for the beekeeper. An ideal location would also be close to a reliable water supply but free from flooding. The area around the hives may be kept clear of flammable material to protect the hives from fire.

Honey bees require supplies of nectar (a source of carbohydrate) and pollen (a source of protein, vitamins, etc.) as well as water for their sustenance and production of honey. Honey in excess of their requirements can be taken by beekeepers for sale.

Bees have a highly complex social organization and behaviour that enables them to obtain food and water supplies very efficiently. They can regulate hive temperature, which enables them to remain active for extended periods during the day, and can fly several kilometres if necessary. When a food source is found it can be rapidly utilised because honeybees communicate the location and type of food source to recruit fellow workers.

Nectar and pollen suitable for honey bees are produced by many plant species in native forests and woodlands, ranging from those found in eucalypt-dominated forests to those of rainforests and mangroves. However, eucalypts are the main honey flora species.

The quantities of pollen and nectar produced can vary enormously from year to year depending on the preceding and present seasonal conditions and past events such as wild fires. A series of high rainfall seasons can trigger sustained heavy nectar flows whereas drought can have the opposite effect.

3.2 NATURE CONSERVATION

The effects on nature conservation values are related to the characteristics of the bees and also to the beekeeper's management practices.

Distinction is made here between feral bees, which are uncontrolled, self-sustained and widespread in SE Queensland and managed bees which are husbanded and moved to nectar and pollen sources for wintering, build and honey production purposes. For example, feral bees may compete with hollow-nesting birds, although the evidence for any significant effect is not compelling. Possibly the main effect of beekeeping on native biota results from managed bees swarming to become feral colonies (Schwartz & Hurst 1994, Seeman 1994).

The following discourse relates to direct environmental concerns rather than the issue of whether apiculture should be practised in National Parks. In the latter case the pivotal issue hinges on the cardinal principle, commonly expressed in legislation, of preserving the area's natural condition. In this respect apiculture, in common with activities such as stock grazing, would compromise this principle by introducing species that are not part of natural ecosystems.

The main concerns relating to managed bees may be treated as follows:

Effects on native fauna.

Introduced bees may have effects on birds, mammals and other insects because of competition for pollen and nectar (Seeman 1994). Honeybees are highly organised. Under favourable conditions it seems that bees tend to forage close to their hives. However, if food sources are more distant they have the ability to fly for several kilometres. Some studies have indicated that the bulk of bees forage within 500 to 800 metres of their hive and usually within 1.5 kilometres (Manning 1994, Paton 1999).

Potentially, native bees are most likely to be affected by introduced honeybees. Australian bees tend to be weakly organised and they are dominated by short-tongued species suited to the shallow flower parts characteristic many native plants such as the Myrtaceae (Eucalypts, etc.). It is likely that particular bee/plant relations have evolved over time but little is known in this regard.

Numbers of native bees may be reduced or displaced when honeybees are introduced nearby, possibly through competition for food supplies (Sugden & Pyke 1991). However, the evidence for this is not at all conclusive. Another study indicated increased levels of native bees when honeybee presence was raised (Schwartz & Hurst 1997). These results may indicate a beneficial effect or it may not. Ants, spiders and other predators take many native bees. The temporary introduction of an alternative food source (honeybees) may reduce predation on native bees, perhaps explaining the increase in numbers. However, when high nectar flows dwindle and the honeybees are transported elsewhere, artificially increased predator numbers could take a greater toll on native bees.

In conditions of abundant nectar and pollen supplies from Banksia heathland no significant differences were recorded in native bee numbers when commercial bees were introduced

(Paton 1999). Clearly, further studies are needed to draw firm conclusions for a range of vegetation types and circumstances.

Many native birds such as honeyeaters and lorikeets depend partially or wholly on supplies of nectar and pollen for food. While the evidence on the effects from honeybees is inconclusive, studies have shown that in high nectar flow conditions (in Banksia heathlands) the number of honeyeaters was not affected by the placement of commercial bee colonies in the area (Paton 1999). Where there are no surplus nectar supplies, territorial honeyeaters may respond to competition for the resource by increasing their feeding territory (Paton 1993). However, under conditions of very limited food supplies the birds may be deprived of supplies and experience adverse effects as a result. This may vary between species as nomadic birds may target distant alternative supplies while sedentary species may not. The possible effect on the long-term viability of honeyeater populations likely to be affected is unknown.

Similarly, honeybees may compete for food supplies with nectar-feeding mammals such as some bat species, gliders and possums but the relationships are not well known. Studies by Paton (1999) indicated that Silky Mice (*Pseudomys apodemoides*) and pygmy possums (*Cercatetus lepidus* and *C. coccinnus*) were unaffected by the presence of commercial hives.

Competition, in the case of nocturnal species generally, may not prove to be significant if honey flora species are able replenish their nectar supplies readily after diurnally active bees retire and nocturnal arboreal and aerial native mammals emerge to feed.

Conversely, native fauna can affect honeybees. Rainbow Bee-eaters (*Merops ornatus*) predate on honeybees and can have significant effects in some areas and when cool, wet conditions limit alternative food sources for the Bee-eater. Queen bees may be especially at risk, being large and slow, while significant numbers of drones can be taken.

Other native insects such as ants can also rob hives or attack bees.

Effects on Native Flora.

Honeybees may affect the pollination of plants and subsequent seed production in several ways (Paton 1994, 1999).

They could:
- supplement the pollination activities of native fauna
- displace, reduce or modify the behaviour of native pollinators and not substitute similar services
- remove pollen that would otherwise be transported to flowers by native pollinators.

Native pollinators include bats, bees and birds. Studies with New Holland Honeyeaters using Scarlet Bottlebrush (Paton 1993) indicated that honeybees tended to displace honeyeaters, a bird, which is a more effective cross-pollinator than the honeybee. As a consequence, fruit production of the Bottlebrush decreased. Genetic differences of the seeds may also result.

In another study involving Correa plants (Paton 1990, 1993,1996) the honeybees were primarily harvesting pollen whereas honeyeaters were feeding on nectar, and pollinating

Correas in the process. However, tests indicated that insufficient pollination was occurring, possibly because of pollen loss to bees prior to honeyeater activity.

In a case involving Desert Banksia (Paton 1995, 1996, 1999) it was shown that the native pollinators were deficient in their services, apparently because of their low numbers (which were not affected by the introduction of honey bees). Seed production of the Desert Banksia was greater at sites with honeybees as a result. However, it is not known if the absence of honeybees would significantly affect the population viability of the Banksia.

Increased hybridisation of native plant species leading to a loss of genetic diversity may result from pollinating activities of honey bees but this possibility has not been tested (Seeman 1994).
Honeybees may assist in the spread of pathogens and minute pests of introduced plants but probably do not spread Brood and other bee diseases among native bees (Seeman 1994).

Management Practices.
Some disturbance to bushland may result from the construction or maintenance of firebreaks around hives, and from wastes left on site. Damage to vehicular tracks, if used under wet conditions could lead to soil erosion and reduced water quality in streams. These issues, however, can be addressed by conditions of permit

Conclusions
On the evidence it seems that any potential adverse effect on nature conservation values can be minimised or avoided by the timing of hive placement and choice of bee site.

The only notable species at Glen Rock that could be affected is the endangered Regent Honeyeater. However, the pair observed was feeding on *Eucalyptus melliodora* at high altitude in a location almost 2 kilometres away from the nearest designated bee site and at a time (October) when commercial bees would not normally be brought into the area. Therefore, any effect was discounted.

Common birds such as many species of lorikeet and honeyeater feed on blossoms at these higher altitudes as well as in the valleys where commercial bees would be placed. Potentially, there could be some competition for nectar at the lower elevations.

However, introducing hives only during peak flows in summer - when nectar supplies are likely to be in excess of native fauna requirements, can reduce competition for nectar. Apiarists would follow this practice in any case to maximise their honey yields.

The area appears to be unsuitable or have a limited capacity for hive build in winter and Spring when pollen and nectar supplies are low. Any impacts on the adjacent National Park would be reduced by placing hives away from its boundary with Glen Rock.

3.3 OUTDOOR RECREATION

Bees may sting or annoy recreational users of bushland if hives are placed too close to recreation nodes such as picnic or camping areas, and conversely, visitors may damage or destroy bee hives. Such conflicts can usually be avoided by placing bee colonies away from such areas and out of sight.

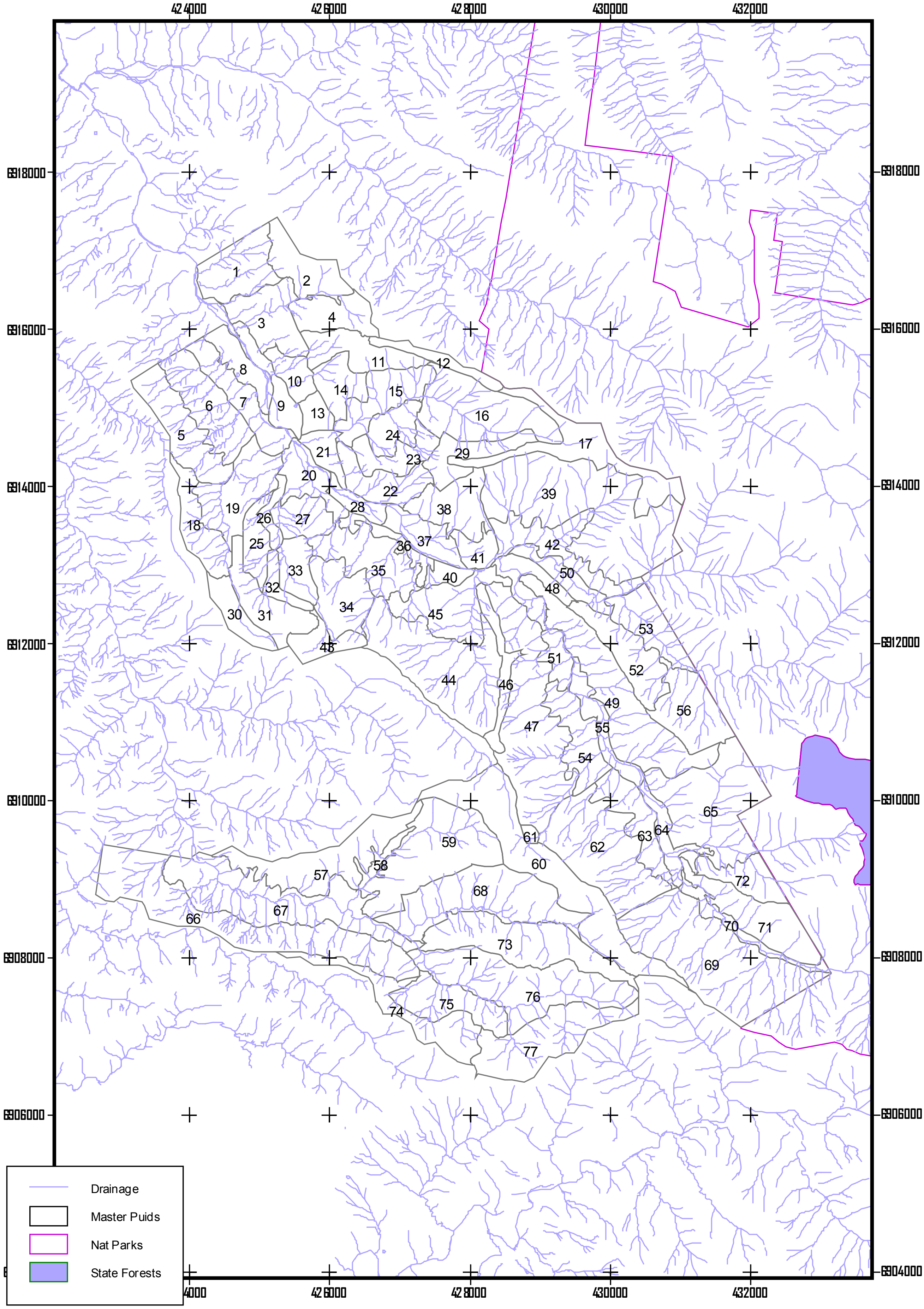
In hot, dry weather bees may frequent waterholes or other water sources which also attract visitors, providing another potential risk. Risks are higher when peak visitor usage coincides with high bee activity.

3.4 GRAZING

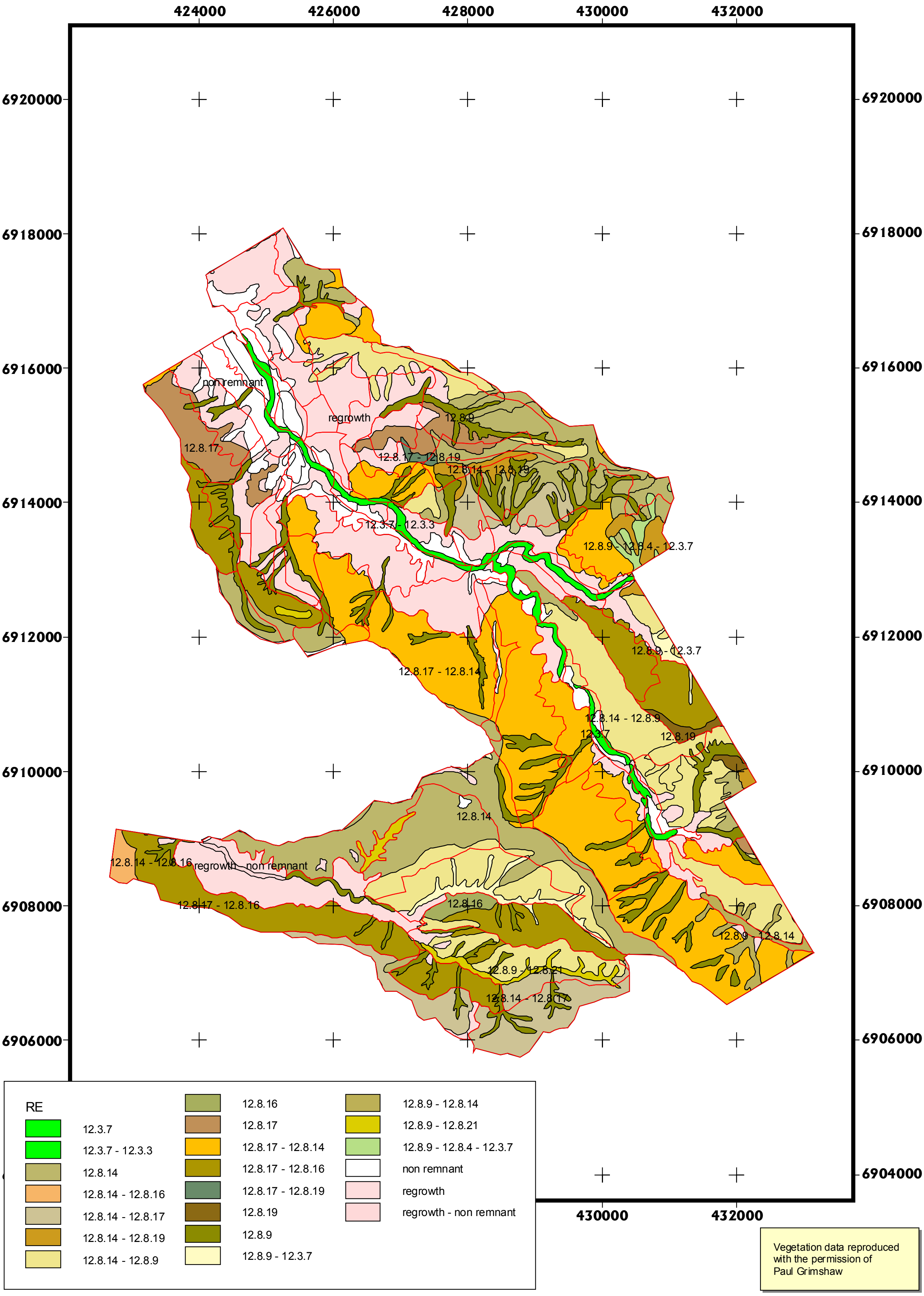
Stock may be annoyed or stung if beehives are placed too close to stock water supplies, yards or camps. These problems can be avoided by placing hives away from such sites used by cattle.

Peter Lawson
Resource Assessment Panel
Glen Rock Planning Study

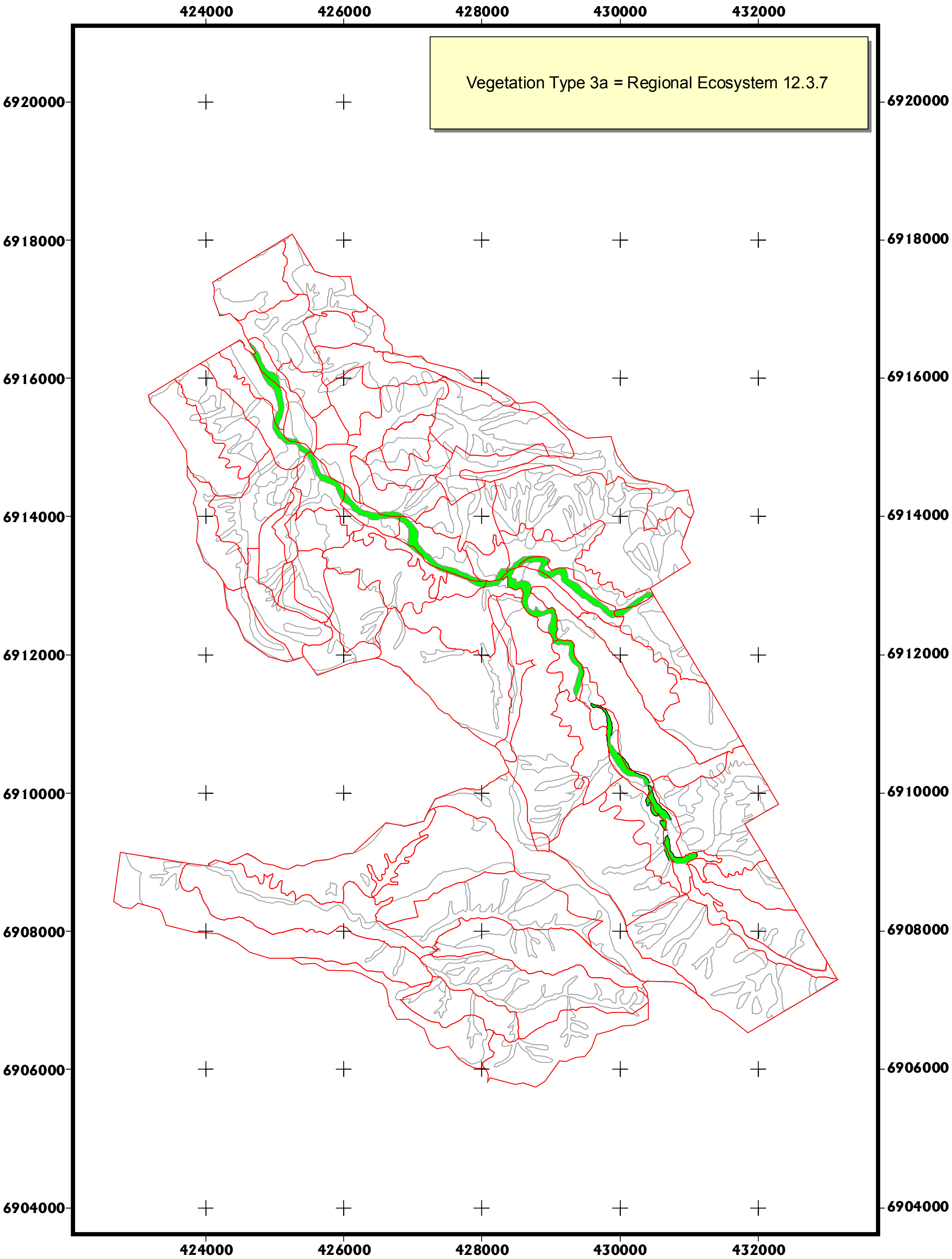
Map 1 Planning Units



Map 2 Regional Ecosystems

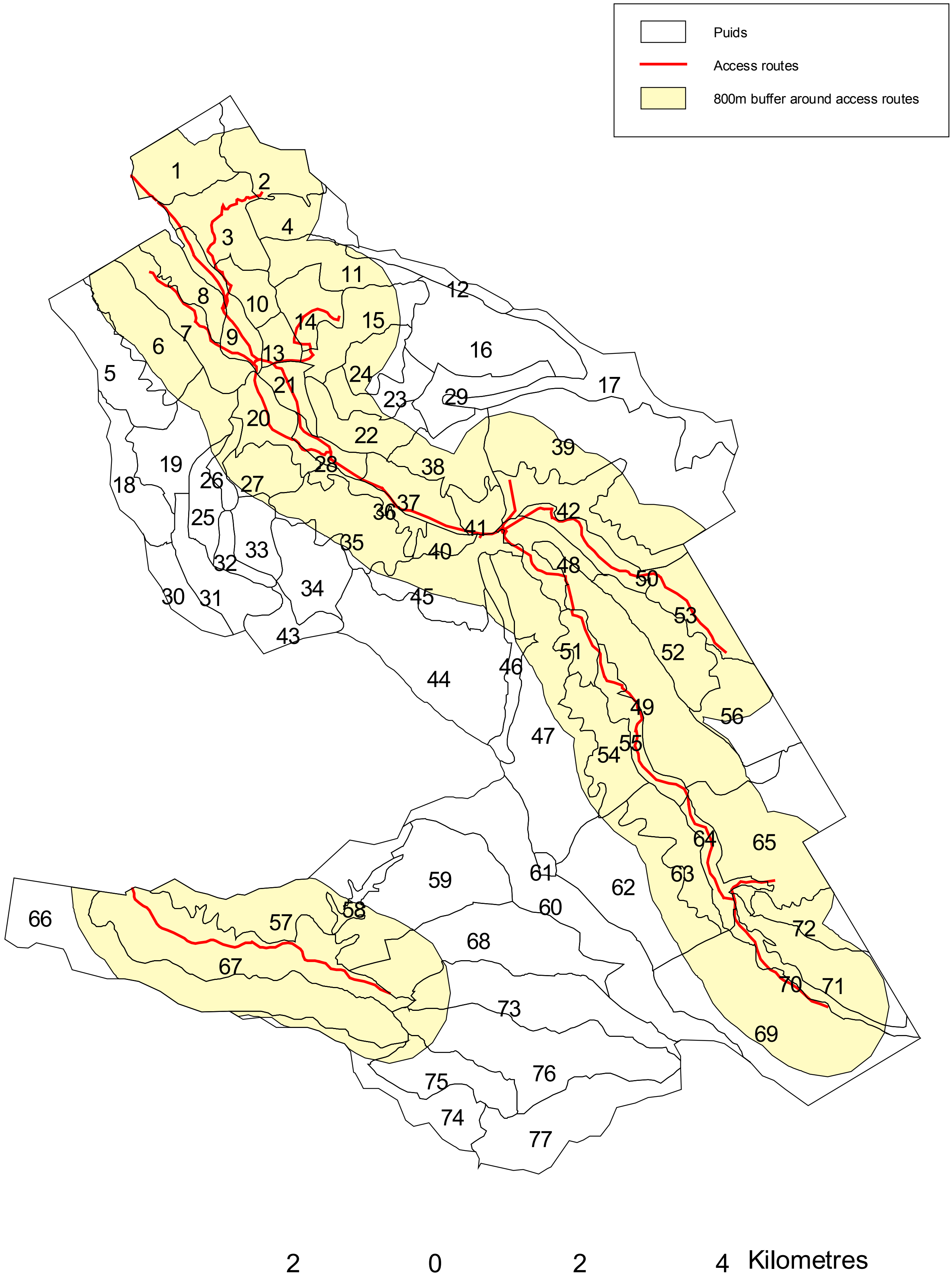


Map 3 Vegetation Suitable for Build

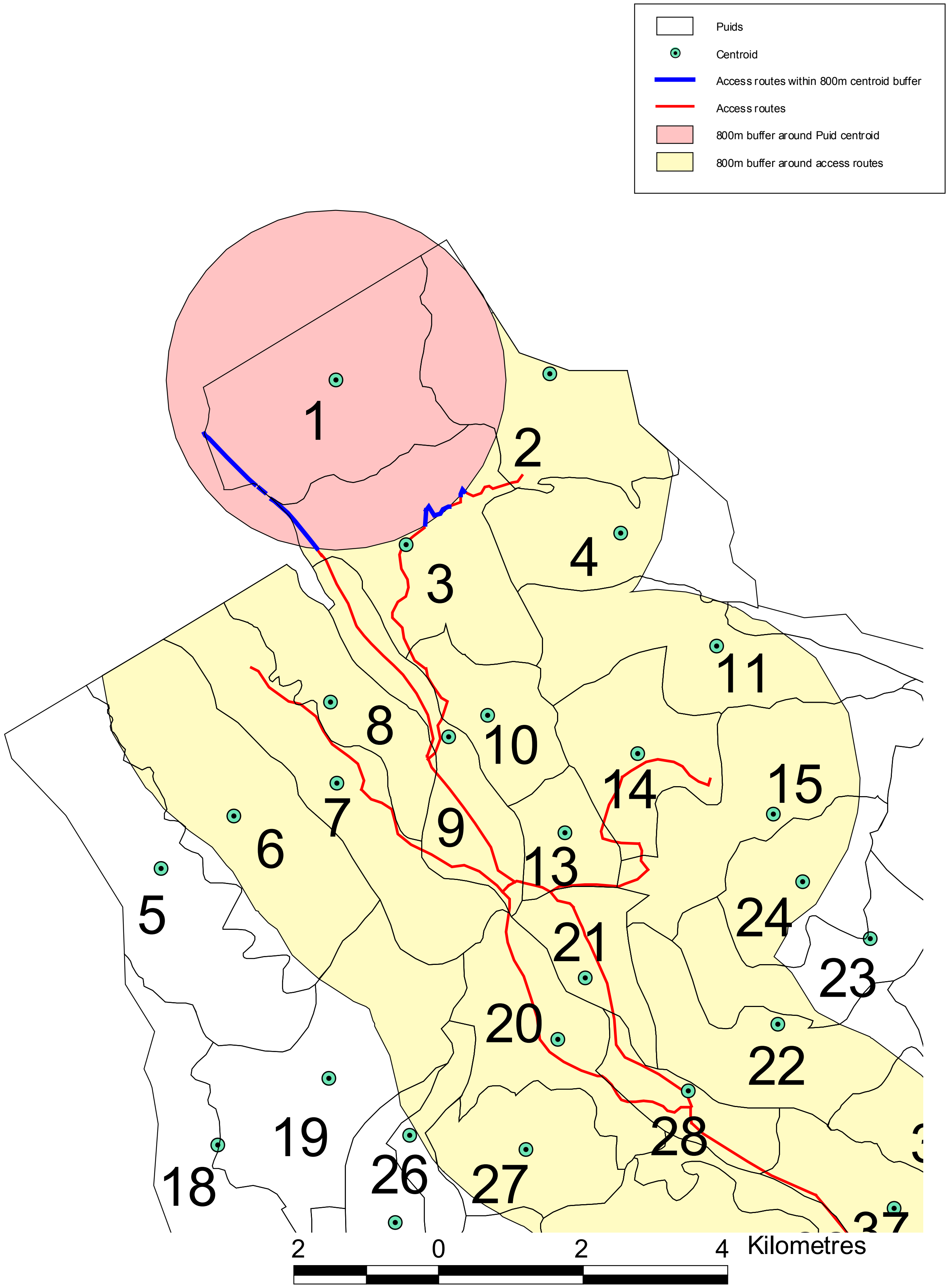


Vegetation data reproduced with the permission of Paul Grimshaw

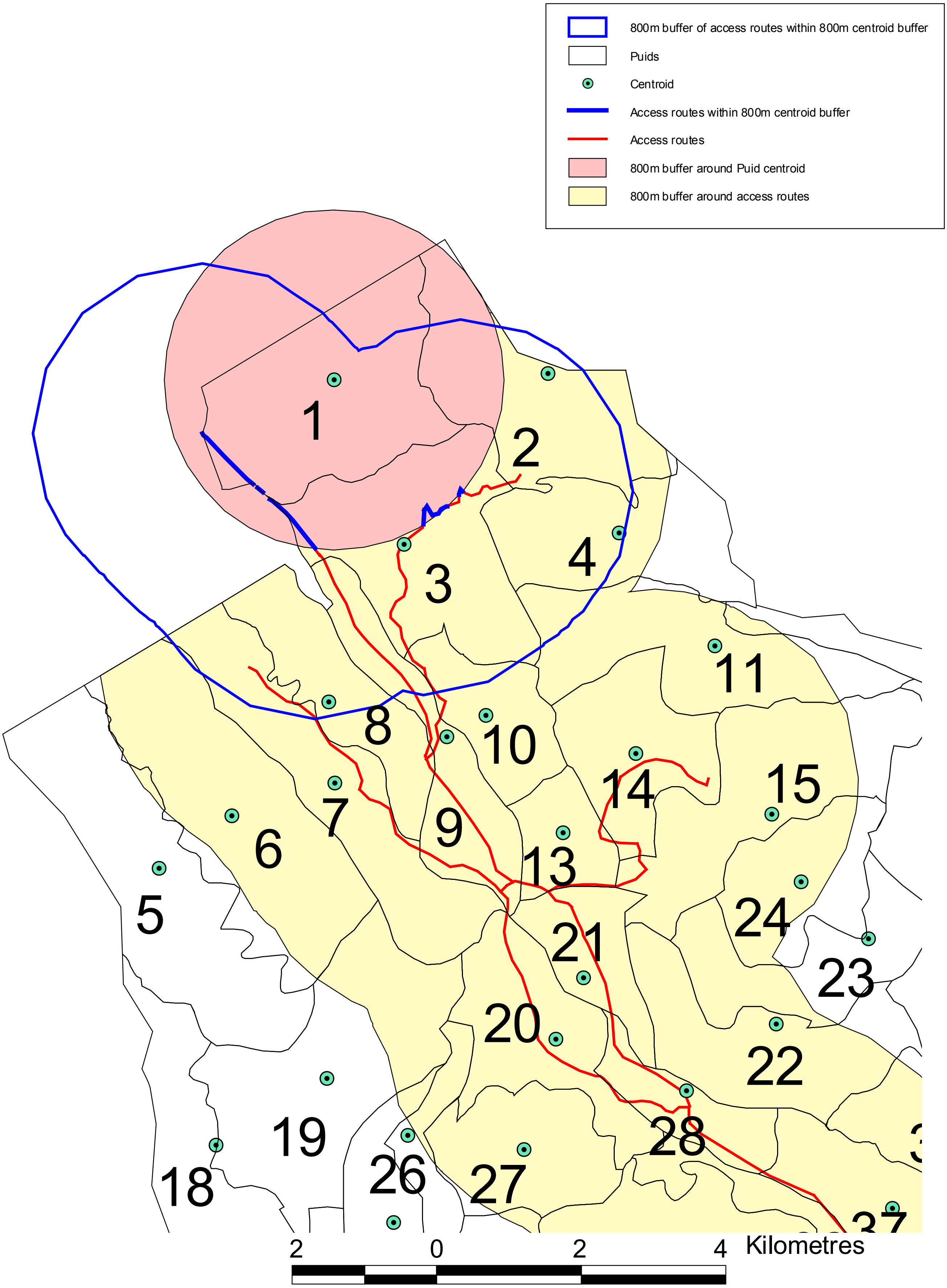
Map 4 800m buffer around access routes



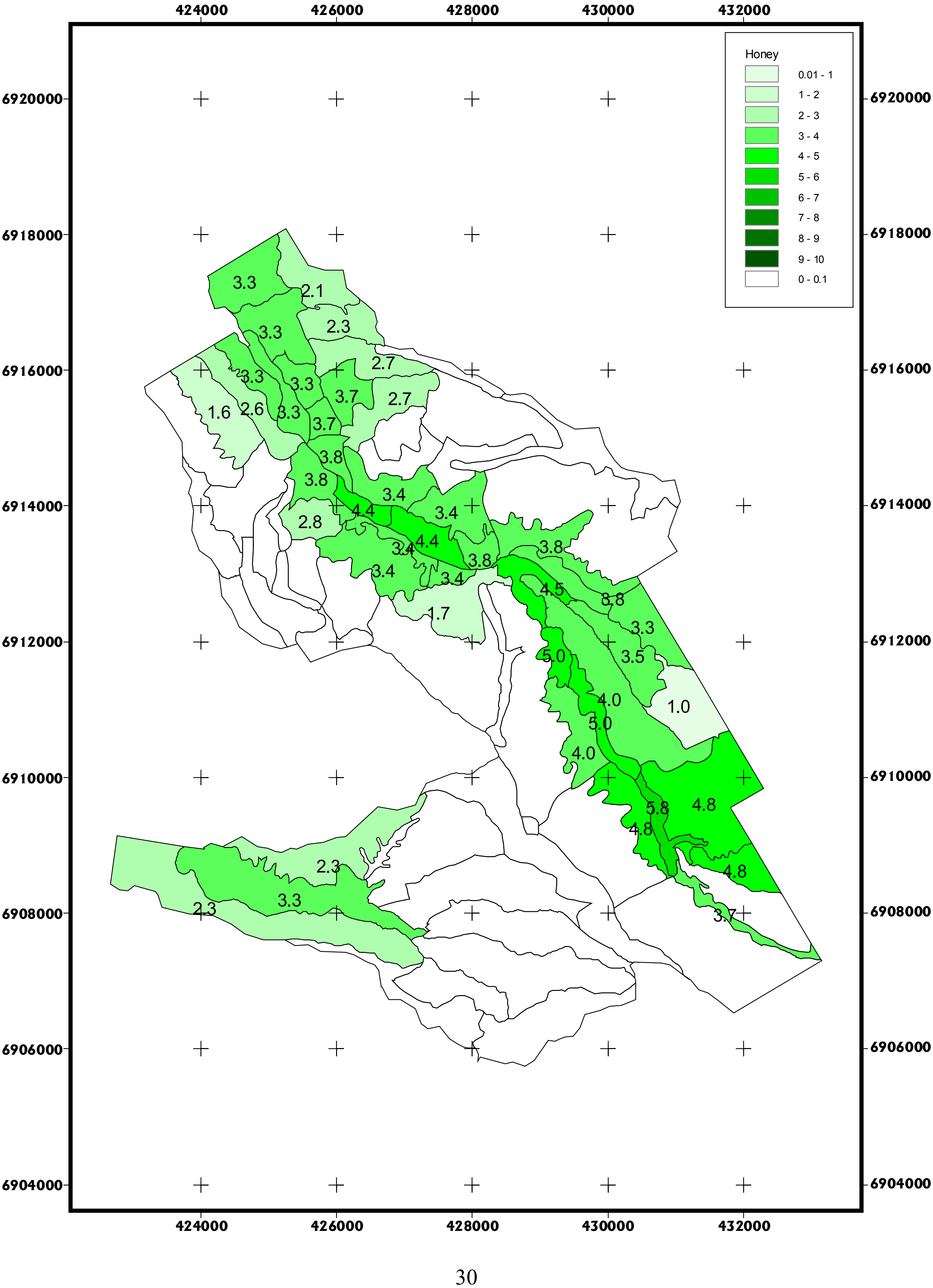
Map 5 Puid 1 800m buffer around centroid



Map 6 Puid 1 800m buffer around access routes



Map 7 Honey Value



APPENDIX 1: MAIN VEGETATION TYPES AND SPECIES

Main Species of Mapped Vegetation Types (Grimshaw. P. - 1999).

Vegetation Code	Major species in main mapping units
3a	**Forest Red Gum, River Oak**. Broad-leaved Apple, Rough-barked Apple, Pink Bloodwood, Moreton Bay Ash, River Bottlebrush, Black Tea-tree, Brush Box, Acacias
8a	**Grey Gum, White Stringybark**. Yellow Box, Forest Red Gum, Pink Bloodwood, Gum-topped Box, White-topped Box, Brush Box, Forest Oak, Broad-leaved Apple, Rough-barked Apple, Acacias
8b	**Forest Red Gum, Yellow Box**. Grey Gum, White Stringybark, Pink Bloodwood, Brush Box, Forest Oak, Broad-leaved Apple, Rough-barked Apple, Narrow-leaved Ironbark, Silver-leaved Ironbark, Acacias
8d	**Narrow-leaved Ironbark, Silver-leaved Ironbark**. Forest Red Gum, Long-fruited Bloodwood, Moreton Bay Ash, Broad-leaved Apple, Rough-barked Apple, White Box, Forest Oak, Acacias.
8e	**Brush Box**. Forest Red Gum, Grey Gum, White Stringybark, Yellow Box, Forest Oak, rainforest species
8i	**Gum Topped Box**. Narrow-leaved Ironbark, Forest Red Gum , Grey Gum, White S,tringybark Forest Oak
8j	Forest Red Gum, Yellow Box, Broad-leaved Apple, Grey Gum, White Stringybark, White Box, Forest Oak, Acacias
8k	**White Box**. Narrow-leaved Ironbark, Yellow Box, Forest Red Gum, White Stringybark
8n	**White Booyong** , Yellow Carabeen, and other cool temperate rainforest species

APPENDIX 2: MAIN HONEY FLORA

Scientific and Common names of main honey flora.

Scientific Name	**Common Name**
Eucalyptus melanophloia	Silver-leaved Ironbark
Lophostemon confertus	Brush Box.
E. crebra	Narrow-leaved Ironbark
Angophora floribunda	Rough-barked Apple
A. subvelutina	Broad-leaved Apple
Corymbia intermedia	Pink Bloodwood
E. tereticornis	Forest Red Gum
E. albens	White Box.
E. melliodora	Yellow Box (Yellow Jacket)
E. biturbinata	Grey Gum
Corymbia citriodora	Spotted Gum
Argyrodendron actinophyllum	Booyong
E. moluccana	Gum-topped Box
E. eugenioides	White Stringybark
Acacia species	Wattles.
Melaleuca bracteata	Black Tea-tree
C. clarksoniana	Long-fruited Bloodwood
Allocasuarina torulosa	Forest Oak

APPENDIX 3: ASSESSMENT SHEET

Assessment Sheet -
Glen Rock Honey Production Potential

Site Number.
Assessor: Date:

Features	**Comments**
Area potentially useful for honey production.	
Access: 2WD, all weather, dry weather only), 4WD	
Water source(s).	
Major honey producing vegetation types Type 1 Type 2 Type 3 Type 4	
Major build vegetation types. Type 1: Type 2 Type 3 Type 4	
Other	

General Comments.

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