Vegetation Assessment and Mapping of Hoddles Creek Education Area, 2009

Prepared for

Parks Victoria
Gembrook Office

by

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Contents

1. Introduction

Hoddles Creek Education Area is a reserve containing 285 hectares of forest 57 km due east of Melbourne, managed by Parks Victoria. An aerial photograph and map of the reserve appears in Figure 1.

The designation, 'Education Area', comes about from classification of the reserve by the Land Conservation Council (1994), which has since been succeeded by the Victorian Environmental Assessment Council. To summarise pp. 183-185 of LCC (1994), Education Areas are reserves set aside for:

- Where relevant, maintenance or restoration of the area's natural, cultural and landscape values;
- Protection from logging, hunting, quarrying and similar exploitation;
- Studying the nature and functioning of reasonably natural ecosystems, without upsetting the integrity of those ecosystems;
- Providing comparison with nearby natural and modified areas;
- Learning and practising environmental analysis and field techniques of the natural sciences;
- Long-term environmental monitoring to understand changes; and
- Where consistent with the above, provision of appropriate facilities.

Under the Yarra Ranges Planning Scheme, the reserve is zoned 'Public Conservation and Resource' and covered by both a Wildfire Management Overlay and Schedule 1 of the Environmental Significance Overlay. The latter overlay is in recognition that the site has been identified as a site of botanical significance (Gullan *et al.* 1979; McMahon *et al.* 1989) and zoological significance (Fleming *et al.* 1979; Mansergh *et al*. 1989).

Despite the reserve's designation as an Education Area, it has rarely if ever been used as an educational resource and there has been little investigation of its natural assets. Nevertheless, the reserve was identified as a site of botanical and zoological significance because even a superficial inspection reveals a level of naturalness that suggests the likely presence of significant habitat and species. This led the Friends of Hoddles Creek to become practically involved in the reserve's conservation.

In 2007, the Friends of Hoddles Creek successfully applied through Parks Victoria for a grant to fulfil the need for information about the reserve's environmental values and how to conserve them. The grant has been used to fund this report and provide training and information to the Friends group and interested members of the local community.

The specific objectives of the project were to:

- Identify and quantify as many as possible of the natural assets of the reserve that should be of interest to park users and managers, with a focus on flora, vegetation communities and wildlife habitat;
- Indicate how these assets may affect future planning and decision making about the use and management of the reserve, with recommendations;
- Devise a program to monitor how the identified natural assets change over time, with a focus on changes that might assist future management;
- Demonstrate different methods of vegetation monitoring, focusing on methods that the Friends Group and community can use; and
- Provide training and information about these matters at two field days for relevant Parks Victoria staff and interested individuals. These days were held on 19th July and 12th October 2008.

A budget of $4,500 was allocated, which places limits on the depth and breadth of the investigation.

To fulfil the consultant's role, I led the field day activities and:

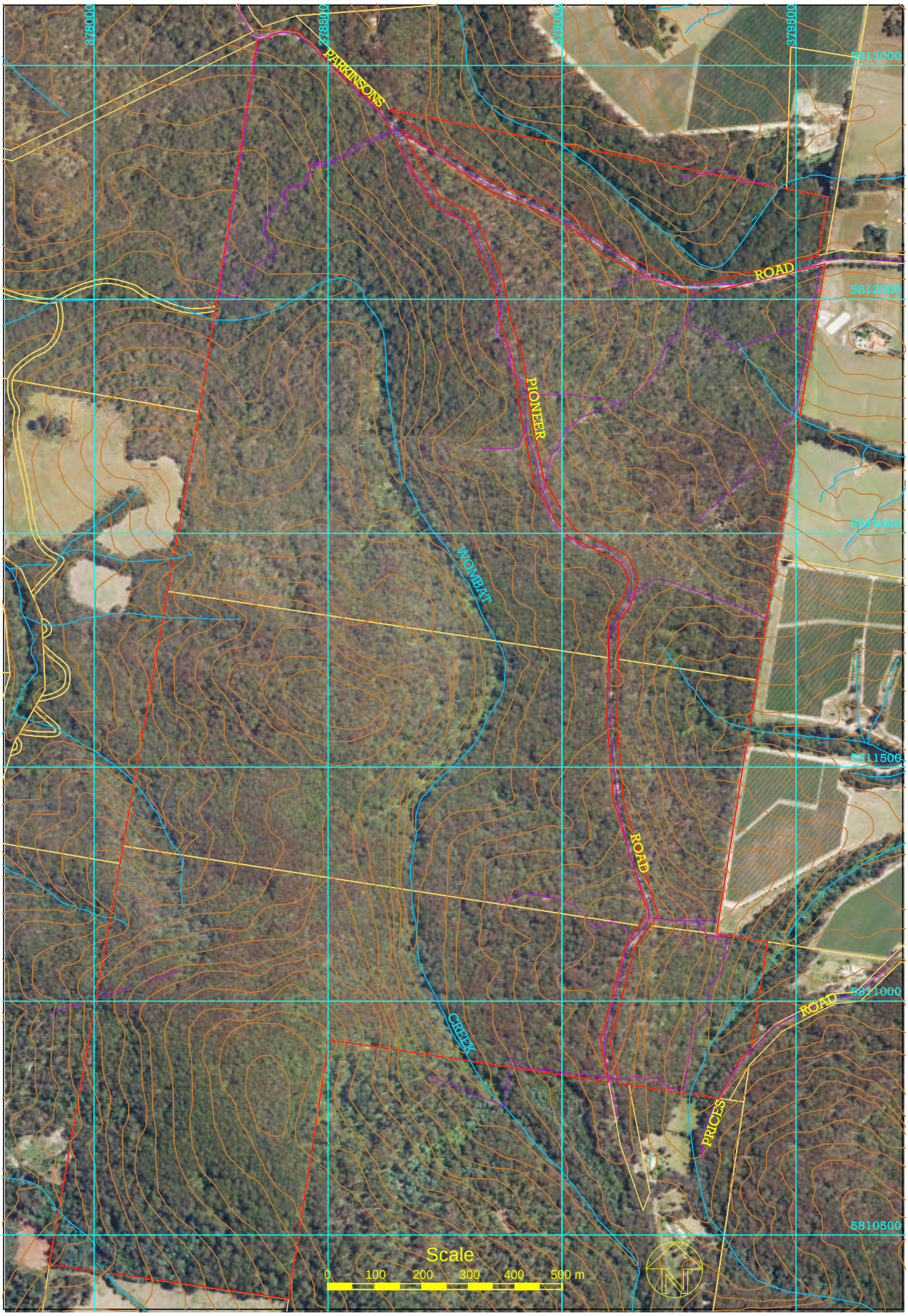

Figure 1. Aerial photograph and map of the Hoddles Creek Education Area (outlined in red).
Purple lines represent tracks. The contour interval is 10 m.

- Researched prior documentation and maps about the Hoddles Creek Education Area and its surroundings (Section 2);
- Extracted all relevant records from the Department of Sustainability & Environment's databases and computer-based mapping;
- Conducted approximately twenty-four hours of fieldwork covering most of the reserve. This work included:
  - Mapping and classification of areas with different Ecological Vegetation Classes (EVCs);
  - Compiling plant lists (not exhaustively) for segments of the reserve, including abundances of each species;
  - Mapping of indigenous plant species that are rare regionally or more widely;
  - Documenting habitat use (observed or likely) by wildlife and pest animals.
- Assessed the significance of species of flora or fauna recorded in or near the reserve;
- Compiled information to assist ongoing monitoring of the reserve, particularly by the Friends of Hoddles Creek; and
- Devised recommendations for management of the reserve.

2. Pre-existing Information

In addition to the geographical data in Section 3, information relevant to the reserve's environmental values was found in each of the references in the Bibliography (page 33) as well as:

- Botanical data from a quadrat (number C00099 in the Department of Sustainability & Environment's Flora Information System[*]) by botanist Neville G. Walsh (and perhaps others) in March 1979 at the junction of Parkinsons Rd and a track junction near MGA coordinates (379485, 5812555), as well as a specimen at the Royal Botanic Gardens, Melbourne, of *Platysace heterophylla*, collected by Dr Walsh while compiling the quadrat data.
- Zoological data from the Department of Sustainability & Environment's 'Victorian Faunal Display[*]' database, which is included in Appendix B on page 34.
- The Department of Sustainability & Environment's 'Interactive Maps' internet software (go to www.dse.vic.gov.au and select 'Interactive maps' from the right margin), for LandSat imagery and coarse-scale mapping of geology and vegetation.
- A soil map from Parks Victoria's geographic information system.
- The Department of Sustainability & Environment's 'EVC Benchmarks' available from www.dse.vic.gov.au – select 'Conservation and Environment' in the left margin, then the 'Native Vegetation Information for Victoria' heading (next to a small, coloured map of Victoria).
- A hand-drawn map from ranger Greg Young of areas that were subject to prescribed burns in 2005 (being all the reserve east of Pioneer Rd).
- Verbal information about disused mines from Greg Young.

[*] © The State of Victoria, Department of Sustainability and Environment.

3. Geography

The geographical attributes of the Hoddles Creek Education Area are as follows:

Location: 57 km due east of Melbourne, officially in Gladysdale despite its name.
Size: 279 hectares of reserve plus 6 hectares of road reservation for Parkinsons Rd and Pioneer Rd.
Landform: Moderately dissected with ridges trending roughly north-south. The terrain relief is typically 100 m from valley floor to adjacent ridge. Slopes are moderately steep and the creeks mostly form narrow, V-shaped valleys except near their confluences, where narrow floodplains sometimes form.
Elevation: 180-360 m (Australian Height Datum).
Slope: Typically 1:5 (moderate) in most of the reserve, reaching 1:3 (steep) in the southwest corner, the southeast corner and several hundred metres south of the main gate on Parkinsons Rd.
Hydrology: The slopes and ridges drain fairly rapidly. The streams' longitudinal gradients are typically 1:20, producing narrow valleys with little if any floodplain. The largest stream is Wombat Ck.
Geology: The reserve's southwestern rectangle has Paleogene extrusive basalt. The reserve's northeastern corner has siltstone geology associated with a Devonian marine formation. The rest of the reserve's regolith derives from two Silurian marine formations of sandstone and mudstone. The lower slopes of the valley beside Prices Rd and the next valley to the north are covered with Quaternary colluvium as a result of hillsides slipping or washing downhill. There are narrow strips of alluvium deposited along the streams.
Soil: The volcanic soil of the southwestern rectangle was not examined in detail. Elsewhere, the soil is predominantly thin, yellowish, stony clay duplex soil. Valley floors have sandy alluvium.
Climate type: Cool temperate, Mediterranean.
Historical average rainfall: 1,200-1,300 mm annually, with a marked seasonal trough in January to March. The closest observing station with an extended rainfall record is at Gladysdale, for which the average monthly falls are displayed in Figure 2.
Biogeographic region: 'Highlands – Southern Fall'

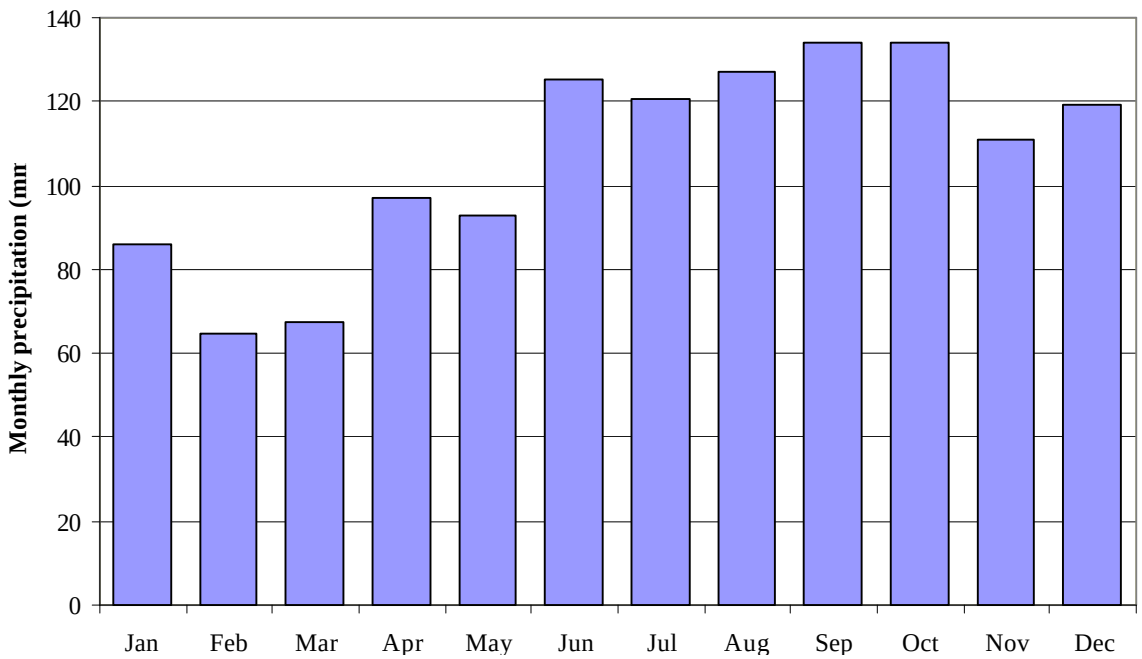

Figure 2. Historical average monthly precipitation, 1948-2009.

4. Landscape Context

The satellite image in Figure 3 helps to provide a landscape-scale context to the habitat of the Hoddles Creek Education Area, which is in the middle of the image. Parks and reserves are outlined with alternating green-white boundaries. Forests are the areas with intense green colouration.

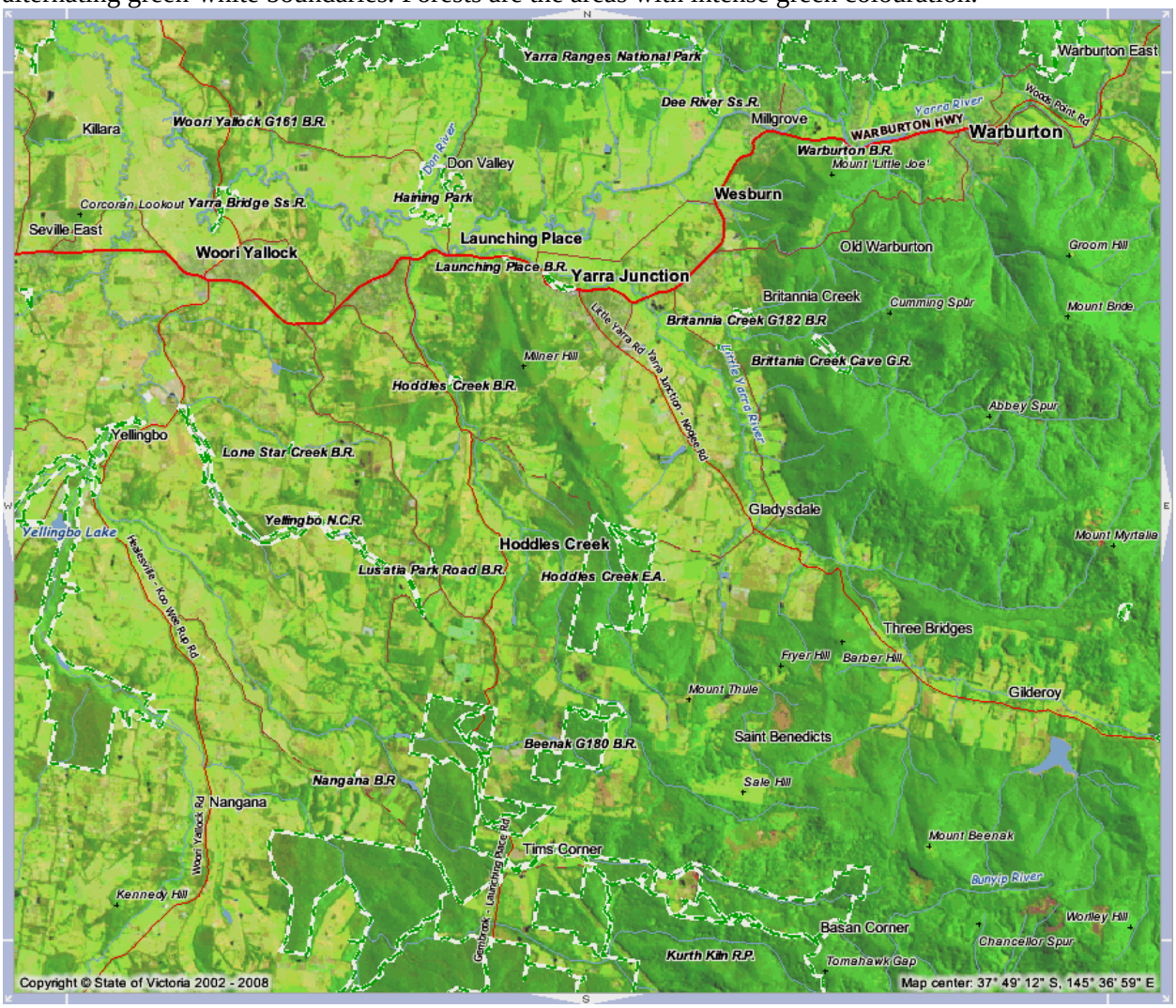

Figure 3. LandSat image of the district in summer, 1999-2000. The greenest areas have the greatest tree cover.

Figure 3 shows that there is an almost unbroken expanse of forest between Hoddles Creek Education Area and Launching Place, along a ridge that includes Milner Hill. This means that many species of indigenous fauna are likely to be able to move fairly freely along that alignment, helping them to reach seasonal feeding grounds, escape fires, disperse from parental home ranges, find mates and meet other habitat needs. Indigenous plants benefit from this mobility because some of the fauna transport pollen or seeds, which is important for successful breeding and colonisation of unoccupied habitat (e.g. following fire).

In many respects, there is even better forest connectivity south and southeast of Hoddles Creek Education Area, providing ecological links to Kurth Kiln Regional Park, Bunyip State Park and forests extending into the Yarra Ranges National Park.

Ecological research in Victoria and elsewhere has shown that streams and their fringing vegetation experience much more wildlife traffic than other parts of the landscape (e.g. Lorimer *et al.*, 2009). The

presence of streams within the Hoddles Creek Education Area considerably enhances the reserve's value for daily, seasonal and long-term movements of wildlife, pollen and seeds.

Most native fish species in the district cannot reproduce without going out to sea for part of their life cycle. Dams and retarding basins prevent or severely inhibit such movements in many Victorian streams, but I am unaware of any barrier between Hoddles Creek Education Area and Port Phillip Bay, now that a fish ladder has been installed at Dights Falls in Collingwood.

Hoddles Creek Education Area therefore appears to have good ecological connectivity and should have only mild ecological problems from habitat fragmentation.

Perhaps the greatest problem of habitat fragmentation for the reserve is that its rainforest has been reduced to a tiny patch (having been cleared where it extended onto adjacent land) and the nearest other patches are more than 6 km away (Brittania Creek and near Basan Corner). If fire, climate change or other events wipe out the reserve's rainforest species such as the rare Jungle Bristle-fern (*Cephalomanes caudatum*), there is little chance of those species being able to re-colonise from elsewhere.

5. Vegetation Types and Extent

5.1. Spatial Pattern

The Department of Sustainability & Environment has devised a system of classifying vegetation types into groups called Ecological Vegetation Classes, or EVCs. Based on the fieldwork in this study, the vegetation of the Hoddles Creek Education Area includes the following EVCs:

- Lowland Forest (EVC 16) on the infertile soil that occurs in most of the reserve;
- Riparian Scrub/Swampy Riparian Forest Complex (EVC 17) along gullies through the Lowland Forest;
- Damp Forest (EVC 29) on the reserve's more fertile soil;
- Riparian Wet Forest (EVC 972) in narrow strips along streams through the Damp Forest;
- A remarkable, narrow strip of Cool Temperate Rainforest (EVC 31) along a deep, steeply-sided gully within Damp Forest.

A map of these EVCs appears in Figure 4, compiled from the fieldwork in this project. The composition of the EVCs is described in section 5.3.

The Department of Sustainability & Environment's vegetation mapping differs substantially from Figure 4 in that it:

- Does not include the newly-discovered rainforest gully;
- Shows a quite different division of the slopes and ridges into Damp Forest and Lowland Forest;
- Shows broad strips of Riparian Forest along streams rather than narrow strips of Riparian Wet Forest on Figure 4; and
- Does not include any Riparian Scrub/Swampy Riparian Forest Complex, although it does show the closely related Riparian Thicket EVC slightly further downstream along the same gullies.

The department's vegetation mapping differs from Figure 4 due to its coarse scale and (more importantly) because it is based on modelling and assumptions with very little observational basis. Its inclusion of Riparian Forest is probably because Riparian Wet Forest is newly recognised and was not available as an option when the department's mapping was done.

Figure 4 may be imprecise in parts of the reserve that could not be surveyed in the time available for this project. This applies to the valley near Prices Rd and gullies near the western boundary's southern half (particularly the southwestern corner). Nevertheless, Figure 4 should be more reliable than the Department of Sustainability & Environment's vegetation mapping of these areas because Figure 4 is based on fieldwork within the reserve.

Figure 4's boundaries around areas of Riparian Scrub/Swampy Riparian Forest Complex are somewhat arbitrary because of the gradual transition from Lowland Forest to swampier conditions and ultimately to a swampy scrub. There are many minor drainage lines within the Lowland Forest where only a shallow layer of soil becomes swampy and only intermittently, so that the vegetation includes deeply-rooted plants such as eucalypts that are typical of Lowland Forest along with species such as ferns, sedges and Scented Paperbark (*Melaleuca squarrosa*) that thrive in soil that is intermittently wet. Such areas are included within Lowland Forest on Figure 4.

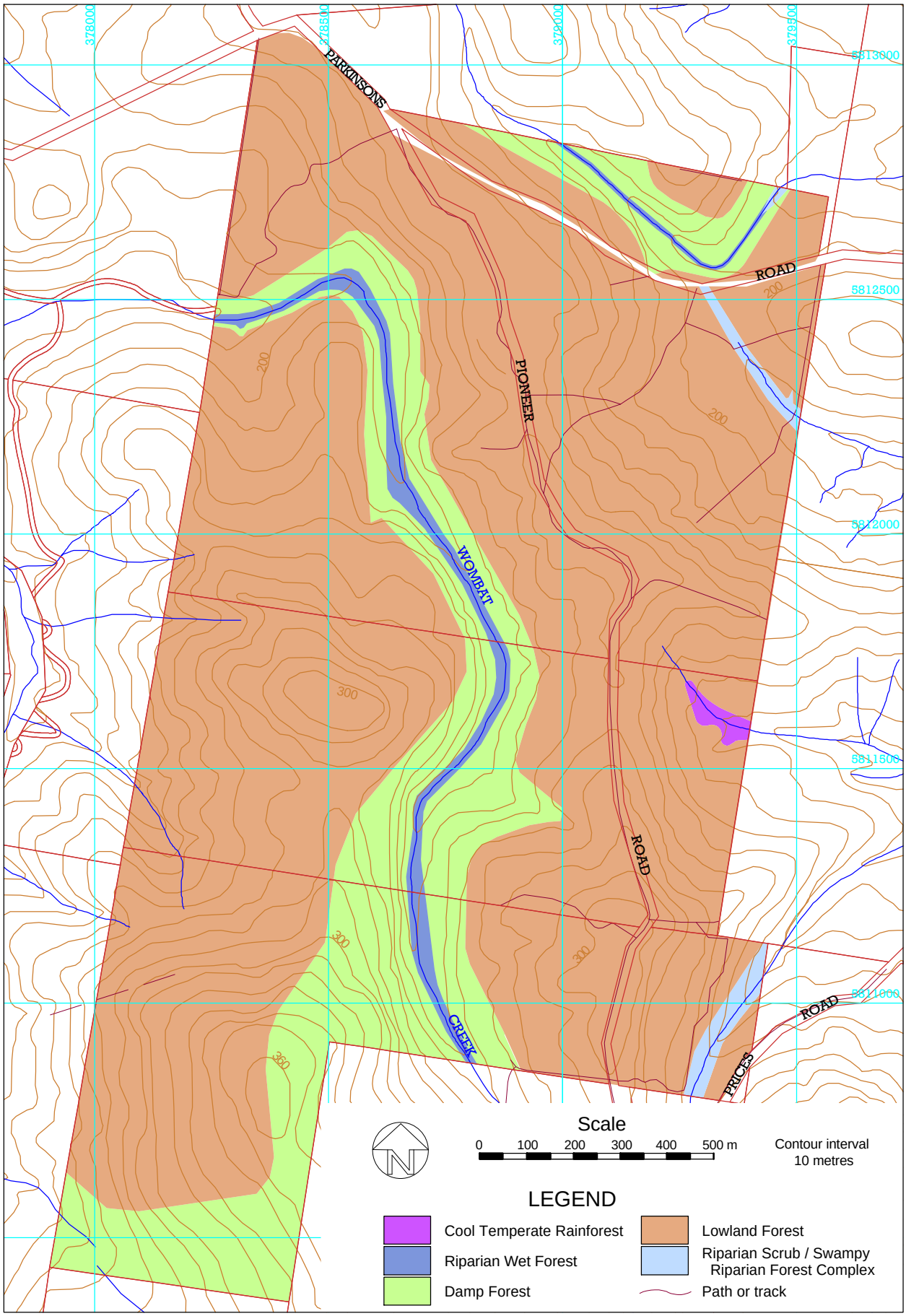

Figure 4. Vegetation Map of the Hoddles Creek Education Area.

5.2. EVC Conservation Significance

From its vegetation mapping, the Department of Sustainability & Environment has estimated the total area of each EVC – both prior to European settlement and in 2005 – for each biogeographic region of Victoria. Based largely on the fraction of each EVC's pre-European area that remained in 2005, the department has devised a set of categories of what it calls 'conservation status' (NRE 2002). The categories are:

- Presumed extinct;
- Endangered, when less than 10% of the EVC remains within the relevant biogeographic region (or an equivalent risk of disappearance due to other factors);
- Vulnerable, when 10-30% of the EVC remains within the relevant biogeographic region (or an equivalent risk, as above);
- Depleted, when 30-50% remains (or equivalent risk);
- Rare, when none of the above apply but the extent of the EVC in the bioregion is naturally very small; and
- Least Concern for all other cases.

The Hoddles Creek Education Area is in the 'Highlands – Southern Fall' biogeographic region. The conservation status of each of the reserve's EVCs has been determined by the department to be as follows:

- 'Endangered' for Cool Temperate Rainforest (EVC 31);
- Vulnerable for Riparian Scrub/Swampy Riparian Forest Complex (EVC 17); and
- 'Least Concern' for Lowland Forest (EVC 16), Riparian Forest (EVC 18) and Damp Forest (EVC 29). (Riparian Forest is a surrogate for Riparian Wet Forest, whose conservation status has not yet been determined by the Department of Sustainability & Environment.)

As a result, the reserve's remarkable occurrence of Cool Temperate Rainforest is of very high conservation significance. According to the criteria of the Department of Sustainability & Environment (Amos 2004), any site that contains a patch of an endangered EVC is a site of State significance.

The same criteria also confer State significance on any site with a patch of a vulnerable EVC whose ecological condition is fair or better[*]. Practically all of the Riparian Scrub/Swampy Riparian Forest Complex in Hoddles Creek Education area is in good ecological condition.

Hoddles Creek Education Area is therefore a site of State significance, both for its Cool Temperate Rainforest and for its Riparian Scrub/Swampy Riparian Forest Complex.

5.3. EVC Composition

Lists of plant species observed within each EVC are tabulated in Appendix A (page 33). Descriptions of the vegetation are given below. All descriptions are of the vegetation within the Hoddles Creek Education Area and will not apply to some other examples of the same EVCs elsewhere.

5.3.1. Cool Temperate Rainforest

A variant of Cool Temperate Rainforest occupies approximately 0·7 hectares at the base of a very deep, steep-sided gully near the middle of the reserve's eastern boundary, as mapped on Figure 4. The true

[*] Specifically, the vegetation's 'habitat score' under the 'Habitat Hectares' method must be at least 0.3.

steepness of the valley sides is not conveyed by the contours on Figure 4, which are the best available for the area. The vegetation is characterised by:

- Characteristic large shrub species (e.g. *Pittosporum bicolor, Hedycarya angustifolia, Olearia argophylla, Oxylobium arborescens*);
- Dense tree-ferns with many epiphytes (e.g. the characteristic species, *Cephalomanes caudatum*, *Grammitis billardierei*, *Hymenophyllum cupressiforme* and *Tmesipteris obliqua*, as well as copious mosses and liverworts);
- Dense ground-ferns (particularly *Blechnum wattsii*).

The vegetation is atypical for rainforest in this part of Victoria in that it contains no Myrtle Beech (*Nothofagus cunninghamii*) or Southern Sassafras (*Atherosperma moschatum*) and it is flanked by Damp Forest, not Wet Forest. These features arise because the gully is so steep-sided and narrow and the strip of rainforest is so small and remote from similar vegetation. The composition of the vegetation in this gully is as follows:

Eucalypts: Very tall *Eucalyptus obliqua* overhangs and shades the gully floor where the rainforest grows.

Other trees: *Acacia melanoxylon* is fairly abundant, *Pomaderris aspera* less so. *Acacia dealbata* is scarce.

Shrubs: Large, broad-leafed shrubs are fairly dense. In this category, *Olearia argophylla* dominates and *Hedycarya angustifolia* is moderately common. The narrower-leafed large shrubs, *Oxylobium arborescens* and *Pittosporum bicolor* are scarce. Among the medium-sized shrubs, *Coprosma quadrifida* is moderately abundant, and there are occasional outliers from the surrounding Damp Forest: *Cassinia aculeata*, *Kunzea ericoides*, *Polyscias sambucifolia* and *Prostanthera lasianthos*. There is also blackberry encroaching from the neighbouring private land.

Climbers: The climbing grass, *Tetrarrhena juncea*, is abundant. *Clematis aristata* is fairly abundant.

Epiphytes: Epiphytic ferns, mosses and liverworts are dense on the trunks of tree ferns and (to a lesser degree) trees and shrubs. Ferns include the characteristic species *Cephalomanes caudatum* (a remarkable outlier), *Grammitis billardierei*, *Hymenophyllum cupressiforme* and *Tmesipteris obliqua*. The most abundant liverwort is *Chiloscyphus* ?*semiteres*.

Tree Ferns: Dense, with *Cyathea australis* outnumbering *Dicksonia antarctica*.

Ground Ferns: Ground ferns dominate the ground flora, particularly *Blechnum wattsii*, *Blechnum cartilagineum* and *Calochlaena dubia*. *Histiopteris incisa* is also present.

Creepers: *Viola hederacea* is fairly abundant and *Acaena novae-zelandiae* is scarce.

Other Ground flora: The only other vascular plant species observed during my brief visit were a single plant of a bird-orchid that appeared most likely to be the rare species, *Chiloglottis jeanesii*, and a single plant of the small creeping weed, *Prunella vulgare*.

5.3.2. Lowland Forest

Figure 5. Typical Lowland Forest. The conspicuous shrubs are *Kunzea ericoides, Hakea decurrens, Persoonia juniperina, Banksia spinulosa* and *Leptospermum continentale*. The ground flora is dominated by *Austrostipa muelleri* and *Tetrarrhena juncea*.

Figure 6. The shrubby extreme of Lowland Forest, approaching Shrubby Foothill Forest. The conspicuous shrubs are *Leptospermum scoparium, Banksia spinulosa* and *Hakea decurrens.*

Figure 7. An anomalous open patch within Lowland Forest, approaching Grassy Forest.

Figure 8. A natural drainage line within Lowland Forest, dominated by ferns.

Lowland Forest (EVC 16), in various diverse forms, occupies much of Hoddles Creek Education area, as mapped on Figure 4. This EVC is so variable within the reserve that it would be subdivided into different EVCs except that there is no clear transition between distinct forms. Photographs illustrating some of the variability appear in Figure 5 to Figure 8. The following description explains the consistent features as well as the variability.

In general, Lowland Forest is characterised by:

- A tall canopy of eucalypts at maturity;
- A stratum of large shrubs (though the density is extremely variable);
- An abundance of members of the myrtle family (Myrtaceae) and particularly the Protea family (Proteaceae), e.g. *Banksia, Hakea, Lomatia* and *Persoonia*;
- Ground flora with an abundance of wiry grasses and sedges (e.g. *Tetrarrhena, Austrostipa muelleri, Gahnia*), heathy shrubs and herbs (e.g. *Dampiera,* lilies).

The composition of the vegetation in the Hoddles Creek Education Area is as follows:

Eucalypts: Dominated by various mixtures of eucalypts, depending on the availability of soil moisture and nutrients. Lower slopes are dominated by *Eucalyptus obliqua* with substantial numbers of *Eucalyptus radiata*, the latter of which is progressively replaced by *Eucalyptus dives* toward mid-slope. The abundance of *Eucalyptus obliqua* gradually diminishes uphill as it becomes progressively displaced by various mixtures of *Eucalyptus dives, Eucalyptus sieberi* and *Eucalyptus baxteri*. *Eucalyptus cephalocarpa* is localised on damp, infertile slopes, where the vegetation tends toward Damp Heathy Woodland.

Small trees: *Acacia dealbata* and (to a lesser degree) *Acacia melanoxylon* form a sparse stratum of sub-canopy trees. *Exocarpos cupressiformis* is unusually absent.

Shrubs: The density of shrubs is extremely variable, depending on elevation, aspect and how recent the last fire was. The photograph in Figure 6, taken on the ridgetop west of Wombat Creek, illustrates how, at elevations of approximately 300 m, narrow-leafed shrubs above head-high become so dense that they severely impede walking. These areas approach Shrubby Foothill Forest (EVC 45) but retain the heathy elements of Lowland Forest, and particularly the richness of species from the Protea family and the myrtle family. By contrast, immediately adjacent to the densest area of shrubs lies a remarkably open, grassy area that approaches Grassy Forest (Figure 7), but it is so small at 200 m² that it inevitably contains many species in common with the surrounding forest and so is treated here as an anomalous component of the Lowland Forest.

Despite the variability in density of shrubs, Lowland Forest is strongly characterised by its unique richness of shrub species in the Protea family (*Banksia, Hakea, Lomatia, Persoonia*) and the myrtle family (particularly *Kunzea* and *Leptospermum*). *Bauera rubioides, Acacia mucronata* and *Dampiera stricta* are characteristic species of Lowland Forest but are not always conspicuous. Lowland Forest also contains numerous other shrub species that are widespread in foothill forests, including ericoid shrubs such as *Epacris impressa* and *Dillwynia sericea*.

Climbers: The light twiner, *Billardiera mutablis*, is scarce and the parasitic twiners, *Cassytha glabella* and *Cassytha pubescens* are localised and not generally abundant. Other climbers are effectively absent.

Ferns: Dense to scarce. *Pteridium esculentum* is dense in patches. The many minor drainage lines within Lowland Forest (as in Figure 8) have abundant ferns such as *Blechnum* species, *Cyathea australis* and the characteristic species *Gleichenia dicarpa*. *Lindsaea linearis* is a characteristic species of forms of Lowland Forest on lower slopes.

Creepers: *Acrotriche prostrata* is characteristically quite abundant in most of the Lowland Forest. *Goodenia lanata* and *Platylobium formosum* are also fairly common. *Hydrocotyle hirta* occurs sporadically and *Centella cordifolia* occurs in damper areas.

Other Ground flora: Mostly dominated by the wiry grasses *Austrostipa muelleri* and *Tetrarrhena juncea* except in the drainage lines, where ferns and *Gahnia sieberiana* dominate. *Lepidosperma laterale* and *Amperea xiphoclada* are fairly abundant and widespread within the Lowland Forest. A distinctive

feature on ridge tops is an abundance of *Caustis flexuosa*, which is a regionally rare sedge, as well as *Euryomyrtus ramosissima*. *Tetratheca stenocarpa* is common, particularly on and near ridge tops. Orchids, lilies and geophytes in general were found in only low densities during this project but may well be much more conspicuous at times other than the current protracted, severe drought. *Dianella caerulea*, *Cryptostylis leptochila* and *Lepidosperma tortuosum* are not abundant but are good indicator species for Lowland Forest. *Lomandra filiformis* and *Lomandra longifolia* are typically conspicuous in Lowland Forest elsewhere, but are scarce at Hoddles Creek Education Area.

5.3.3. Riparian Scrub/Swampy Riparian Forest Complex

Riparian Scrub/Swampy Riparian Forest Complex (EVC 17) was observed along three gullies within the Lowland Forest near the eastern boundary of Hoddles Creek Education Area (Figure 4 on page 9). The necessary conditions include deposits of fine alluvium that accumulate in gullies where the topography is shallow, with enough catchment area to keep the alluvium perennially moist. This project ran out of time to inspect the gully in the vicinity of Prices Rd, but the topography and soil mapping of that area indicate that Riparian Scrub/Swampy Riparian Forest Complex should be there.

Riparian Scrub/Swampy Riparian Forest Complex is a recently introduced EVC devised to accommodate the transition between Riparian Thicket (EVC 59) and forests with similar characteristics. Riparian Thicket is common along streams of the flatter country near Hoddles Creek Education Area, and the Department of Sustainability & Environment's mapping (which pre-dates the introduction of EVC 972) shows Riparian Thicket as being the pre-European vegetation type a short distance downstream of each gully mapped here with Riparian Scrub/Swampy Riparian Forest Complex.

As described on the Department of Sustainability & Environment's website, Riparian Scrub/Swampy Riparian Forest Complex '*includes either areas of shrubland or open forest. Occurs along broad, gently sloping drainage lines where stream alluvium is present. The understorey is dominated by large sedges and amphibious herbs although species diversity is generally low due to the dense cover of shrubs*'.

The composition of this EVC in Hoddles Creek Education Area is as follows:

<u>Eucalypts</u>: Eucalypts overhang from the adjacent Lowland Forest, and some of them extend into the Riparian Scrub/Swampy Riparian Forest Complex. *Eucalyptus obliqua* and *Eucalyptus radiata* occur in the patch at the reserve's northeastern corner and *Eucalyptus dives* occurs in the nest gully south.

<u>Small trees/Large Shrubs</u>: Except for the most frequently inundated areas, there is a dense stratum dominated by various mixtures of *Leptospermum scoparium*, *Melaleuca squarrosa* and *Kunzea ericoides*. On the bed of the creek in the reserve's northeastern corner, this stratum is suppressed by frequent inundation.

<u>Smaller shrubs</u>: *Acacia verticillata*, *Bauera rubioides*, *Cassinia aculeata*, *Olearia lirata* and *Prostanthera lasianthos*.

<u>Climbers</u>: *Clematis aristata* is scattered.

<u>Ferns</u>: Abundant, including *Cyathea australis*, *Gleichenia dicarpa* and other species found in the surrounding Lowland Forest. The fern ally, *Selaginella uliginosa*, is also present. Epiphytic ferns are absent.

<u>Creepers</u>: Abundant, including species such as *Acaena novae-zelandiae*, *Centella cordifolia*, *Gonocarpus micranthus*, *Gratiola peruviana*, *Poa tenera*, *Ranunculus glabrifolius* and *Schoenus maschalinus*. The scrambling amphibious herbs, *Persicaria decipiens*, *Persicaria praetermissa* and *Myriophyllum* ?*simulans* are also present in the wettest spots.

<u>Other Ground flora</u>: Sedges and rushes are conspicuous, e.g. *Lepidosperma elatius*, *Gahnia sieberiana*, *Schoenus apogon* and *Juncus planifolius*, but they leave plenty of openings in the ground flora for creepers and forbs. The characteristic species, *Senecio minimus*, was scarce in 2008 but is probably greatly reduced in numbers due to drought. The orchids, *Chiloglottis valida* and *Pterostylis melagramma*, were found where inundation is least likely.

5.3.4. Damp Forest

Figure 9. Damp Forest of the lower slopes.

Damp Forest (EVC 29) occurs in the Hoddles Creek Education Area over large expanses where the soil is deepest and has most humus. Its distribution is mapped on Figure 4 (page 9).

The best indicator of Damp Forest in the reserve is the abundance of ground ferns (particularly *Calochlaena dubia*) over large expanses, as depicted in Figure 9. Shrubs are dense at higher elevations near Lowland Forest, where the vegetation tends toward Shrubby Foothill Forest.

The Department of Sustainability & Environment's website describes Damp Forest as *'Dominated by a tall eucalypt tree layer over a medium to tall dense shrub layer of broad-leaved species typical of wet forest mixed with elements from dry forest types. The ground layer includes herbs and grasses as well as a variety of moisture-dependent ferns'*. The composition of Damp Forest in Hoddles Creek Education Area is as follows:

Eucalypts: Tall to very tall, dominated by *Eucalyptus obliqua* and *Eucalyptus radiata*, sometimes mixed with *Eucalyptus cypellocarpa*.

Other trees: There is a well developed stratum of sub-canopy trees, including *Acacia dealbata*, *Acacia melanoxylon* and occasional *Pomaderris aspera*.

Shrubs: Variable in density (as described above). Species include *Acacia verticillata*, *Cassinia aculeata*, *Coprosma quadrifida*, *Kunzea ericoides*, *Olearia argophylla*, *Olearia lirata*, *Ozothamnus ferrugineus*, *Polyscias sambucifolia* and *Prostanthera lasianthos*.

Climbers: *Clematis aristata* is fairly abundant and *Pandorea pandorana* scattered. The climbing grass, *Tetrarrhena juncea*, is conspicuous.

Epiphytes: Epiphytic ferns are absent. Mosses are often conspicuous on tree trunks, liverworts less so except near the ground (where *Chiloscyphus semiteres* is abundant on wood in general).

Tree Ferns: *Cyathea australis* is scattered, mainly at lower elevations.

Ground Ferns: Ground ferns dominate the ground flora, particularly *Calochlaena dubia*.

Creepers: *Viola hederacea* and *Acaena novae-zelandiae* are scarce but may be more abundant outside periods of severe drought.

Other Ground flora: *Lepidosperma elatius* is abundant. *Tetratheca ciliata* is sometimes common, whereas *Tetratheca stenocarpa* is the analog in Lowland Forest. *Poa tenera* is scarce but would probably be abundant if not for severe drought.

5.3.5. Riparian Wet Forest

Figure 10. Riparian Wet Forest.
Wombat Creek flows among the ferns on the right edge of the scene.

In narrow strips along streams through the Damp Forest within the Hoddles Creek Education area, there is a type of forest that is classified here as Riparian Wet Forest (EVC 972), described on the Department of Sustainability & Environment's website as follows:

> *Tall, open forest with broad-leaved shrubs, ferns and tree-ferns indicative of Wet Forest and riparian species. Ground-layer is usually sparse, typically ferny to grassy/sedgy-ferny, sometimes with herbaceous patches. Occurs on riparian terraces of streams in higher rainfall areas from near sea-level to montane elevations*

This EVC has only recently been recognised by the department and does not appear to have been used yet in any published mapping of Victoria's vegetation. The closest EVC prior to the advent of Riparian

Wet Forest was Riparian Forest, which is normally dominated by Manna Gums (*Eucalyptus viminalis*) and includes a floodplain with fertile alluvial soil. By contrast, the vegetation discussed here is in such narrow valleys that there is generally no floodplain and it is overhung by the canopy of the surrounding Damp Forest (particularly Messmate Stringybark *Eucalyptus obliqua* and Mountain Grey Gum *Eucalyptus cypellocarpa*). These two vegetation types do not really belong in a single EVC because the ecological and hydrological functions are so different.

A photograph of the Riparian Wet Forest vegetation in Hoddles Creek Education Area appears in Figure 10 and a description of its composition follows:

Eucalypts: Dominated by *Eucalyptus obliqua*, *Eucalyptus cypellocarpa* and *Eucalyptus radiata*, in various proportions depending on the nature of the surrounding Damp Forest.

Other trees: *Pomaderris aspera* is abundant, *Acacia dealbata* somewhat less so, followed by *Acacia melanoxylon*.

Shrubs: Shrubs are moderately dense. The large, broad-leafed shrubs of wet forests, *Olearia argophylla* and *Hedycarya angustifolia*, are moderately common. Other shrubs are in common with the surrounding Damp Forest: *Coprosma quadrifida*, *Kunzea ericoides*, *Olearia lirata*, *Polyscias sambucifolia* and *Prostanthera lasianthos*.

Climbers: The climbing grass, *Tetrarrhena juncea*, and the vine, *Clematis aristata*, are abundant. *Parsonsia brownii* and *Pandorea pandorana* are less abundant, as is the scrambler, *Rubus parvifolius*.

Tree Ferns: Dense, with *Cyathea australis* outnumbering *Dicksonia antarctica*, and *Todea barbara* less abundant again.

Epiphytes: There are some mosses and liverworts on tree-fern trunks, but epiphytic fern species were not found (unlike their high density in the rainforest).

Other Ferns: Ground ferns dominate the ground flora, particularly *Blechnum nudum* and *Calochlaena dubia*. Other abundant species are *Blechnum cartilagineum*, *Blechnum wattsii* and *Histiopteris incisa*.

Creepers: *Viola hederacea* is fairly abundant and *Hydrocotyle hirta* is scarce.

Other Ground flora: *Lepidosperma elatius* is scattered where the topography is least severe. There are localised plants of either *Gahnia clarkiae* or *Gahnia sieberiana*, their identity uncertain because they were emaciated by drought and retained no fertile material (indicating failure to breed for at least two years).

Aquatic/amphibious: *Isolepis inundata* and an unidentified (apparently indigenous) species of *Callitriche* are scattered along the edge of the creeks at low-flow level.

6. Botanical Diversity

Appendix A (page 34) tabulates information about the indigenous ferns and flowering plants recorded so far within the various EVCs in the Hoddles Creek Education Area. It includes 143 indigenous species of flowering plant (one represented by two subspecies) and 19 species of fern.

Because of the scale of this project, some plants are bound to have gone undetected. Based on my fieldwork and my past experience in other locations, I expect there may be 30-50 species of flowering plants or ferns that escaped detection. Only the most conspicuous mosses and liverworts are recorded in Appendix A, and none of the fungi.

Taking into account the size of the study area and the diversity of habitat, the number of indigenous plant species indicated above is almost as many as would be expected in a pristine landscape. This reflects the vegetation's substantial area, good ecological connectivity, moderate historical disturbance (mining, recreation) and the many decades during which the vegetation has been able to recover.

Unlike bushland reserves in more fragmented landscapes, very few of the indigenous plant species found in the reserve so far are so scarce that they are at serious risk of dying out in the short or medium term. The effects of climate change that scientists are now predicting in the long term (more then twenty years) may make many more species vulnerable, as in all other natural areas globally.

6.1. Significant Plant Species

Figure 11. *Tetratheca stenocarpa* (Long Pink-bells), a globally rare species that is locally abundant.

Two plant species found during this study are listed by Walsh and Stajsic (2007) as 'rare in Victoria but not considered otherwise threatened':

- *Tetratheca stenocarpa* (Long Pink-bells – see Figure 11), which is an attractive wildflower whose population is abundant and healthy throughout most of the reserve's Lowland Forest (particularly on

and near the ridge tops). This species is only found in Victoria, so it is rare globally, not just in Victoria. Hoddles Creek Education Area should be regarded as a major stronghold for this species. The species regenerates well when ground is laid bare and it has responded well to the 2005 fires in the Hoddles Creek Education Area;

- *Cephalomanes caudatum* (Jungle Bristle-fern, formerly known as *Macroglena caudata*), which is a small epiphytic fern discovered in this study growing on *Cyathea australis* trunks in the rainforest patch. An inventory of numbers and plant health was not undertaken due to time constraints and poor light. This is an amazing outlier occurrence, as the species' Victorian population was believed before this study to be mostly in Far East Gippsland and Wilsons Promontory, with an outlier population around Beenak. The tiny area of habitat at the Hoddles Creek Education Area and the apparently small number of individuals mean that this species is very vulnerable to being wiped out by fire, drought or other possible events. The degree of isolation from the nearest known population makes it very unlikely that the species could naturally return to the reserve if its existing population dies out.

There are also plant species in the reserve that are rare or threatened within the Shire of Yarra Ranges or within the 'Highlands - Southern Fall' biogeographic region. However, there are no accepted lists of species that are rare or threatened within these areas.

6.2. Environmental Weeds

Environmental weeds are scarce and localised within the Hoddles Creek Education Area. Weeds are almost confined to the perimeter (due to infestation from adjacent properties) and along the edges of roads.

Leaving aside minor weeds confined to road gutters and recently disturbed ground, the weed species recorded in the reserve during this project were:

Scientific Name	Common Name	Details
Anthoxanthum odoratum	Sweet Vernal-grass	scarce, right next to the eastern fence
Avena species	Oat	occasional plants in horse manure
Hypochoeris radicata	Cat's Ear	scattered beside roads and on the eastern boundary
Plantago lanceolata	Ribwort	small numbers in gullies near the eastern boundary
Prunella vulgaris	Self-heal, Heal-all	a few plants in the rainforest gully near the fence
Rubus anglocandicans	Blackberry	moderate numbers entering gullies from the east
Trifolium repens	White Clover	occasional plants in horse manure
Pseudoscleropodium purum	a moss	a patch in a gully near the eastern boundary

However, note that this project's fieldwork did not extend into the reserve's southwestern corner, nor the valley along Prices Rd. Other weeds may well grow at these locations.

None of the listed weeds has yet caused significant deterioration of the reserve's habitat or ecological condition. The only ones that present a significant risk of doing so in future are Blackberry and the moss, *Pseudoscleropodium purum*, both of which might proliferate if the current period of drought ends.

Blackberry is relatively easy to control (although the rainforest gully is hard to access), and this is recommended to occur in the gullies along the reserve's eastern boundary. The Prices Rd area and the reserve's southwestern corner (where a dam has been constructed) should be also be checked.

I am unaware of any reliable control method for *Pseudoscleropodium purum*.

7. Vegetation Condition

With the exception of the road margins and the perimeter of the reserve, the vegetation of the Hoddles Creek Education Area is in very good ecological condition. As discussed in Section 6, most of the vegetation is free of weeds, there is a good diversity of plant species and hardly any species are so scarce as to raise concerns about their short- or medium-term viability. Fires have occurred at quite different times in different parts of the reserve, providing diversity of habitat and helping to maintain the diversity of plant species.

No evidence was found of eucalypt dieback or other forest diseases.

Some plant species appear to have succumbed to the prolonged, severe drought of the past decade. These include *Poa tenera*, *Platysace heterophylla*, *Viola hederacea*, most orchids and probably some species that were undetected during this project. Tree health has probably also suffered from the drought.

Historical clearing, particularly for mining, may be an additional reason for the paucity of orchids and other geophytes found in this project.

8. Fauna and Habitat

No formal fauna survey was conducted for this report but incidental observations of wildlife and habitat were recorded during the fieldwork. Fauna records were also obtained from the Department of Sustainability & Environment's 'Victorian Faunal Display' database. A composite fauna list appears in Appendix B on page 34.

Members of the Friends of Hoddles Creek or other interested people could make a valuable contribution to the accumulation of knowledge about the reserve by contributing any highly reliable observations of fauna in the reserve that have not been recorded recently. I suggest that the Ranger-In-Charge at the Gembrook office of Parks Victoria keep a fauna list (starting with the one in Appendix B) and record the date and observer's name for any new observations.

8.1. Threatened Species

Two species listed in Appendix B are listed by the Department of Sustainability & Environment as species threatened with extinction in Victoria. Both species are rated as 'Vulnerable', the lowest category of threatened species.

The more significant of the two observations is the Lace Monitor or Tree Goanna, which was seen on the field day of 19th July 2008 on Pioneer Rd near the northern gate (see at right). The reserve appears to provide an extensive area of quality habitat for this species.

The other species in Appendix B that is threatened in Victoria is the Swamp Skink, of which one individual was recorded in 1988 at a location somewhere between the reserve's northeastern corner and 2 km to the north. This species favours swampy habitat with open patches that allow them to sun themselves. The farm dam just outside the reserve's northeastern corner is potentially suitable habitat. If the Swamp Skink occurs there, it is likely that individuals sometimes enter the reserve.

According to an unpublished report for the Port Phillip and Westernport Catchment Management Authority by ecologist Dale Tonkinson in 2003, three additional species in Appendix B are vulnerable to extinction within the Port Phillip and Westernport region. Those species are:

- The Mountain Galaxias and the River Blackfish, both fish that were found in Wombat Creek in or near the reserve in 1997; and
- White-throated Nightjar, one of which appears on a 1988 list of fauna for an area that probably includes Hoddles Creek Education Area.

All three of these species would still find suitable habitat in Hoddles Creek Education Area today.

Given the intactness of the habitat in the Hoddles Creek Education Area and the paucity of faunal survey there, it appears quite likely that other threatened species have gone undetected. Bats have not been surveyed at all and invertebrates only superficially. Conical holes in the ground that were found in the reserve's southwestern corner on the field day of 19th July 2008 suggest the presence of bandicoots, possibly the nationally endangered Southern Brown Bandicoot.

8.2. Fauna Habitat

8.2.1. Aquatic

Wombat Creek appears to be a clear mountain stream with a full, natural vegetation cover and unimpeded connection to the Yarra River and the sea. This is reflected in the 1997 record of Mountain Galaxias in the reserve, a species that requires a healthy stream and access to the sea. The River Blackfish was also recorded in 1997, again indicative of a healthy mountain stream with a good cover of vegetation. If more surveys were conducted, it seems likely that both these species would be detected, along with many others. Wombat Creek is likely to have a healthy fauna of invertebrates and microorganisms, including the Southern Victorian Spiny Cray (recorded in 1997). The Platypus is quite likely to be present but there are no records of them in or near the reserve.

There is a swamp on Wombat Creek where the creek exits the reserve. There are also seasonally inundated gullies on the reserve's eastern boundary and in the northeastern corner. These wetland areas provide seasonal habitat for frogs, invertebrates, waterbirds and potentially the Swamp Skink discussed above.

A possible adverse influence on the reserve's aquatic and amphibious fauna is water contamination by agricultural chemicals used on upstream properties. There could even be lingering effects of chemicals that were used decades ago and have since been discontinued because of their high toxicity or persistence in the environment.

8.2.2. Arboreal

Hoddles Creek Education Area mostly contains regrowth of forest that must have been extensively cleared long ago, particularly for gold mining. Some fully mature eucalypts with hollows survived the clearing but their numbers are significantly less than if the clearing had not occurred. This means the reserve can support wildlife that depend on hollows for nesting or roosting, but perhaps not in densities that would once have occurred. The most affected species include owls, possums and insectivorous bats.

In other respects, the tree cover in the reserve appears suitable for all the normal arboreal fauna of foothill forests in this part of Victoria.

Much of the reserve's tree cover represents high production of the carbohydrates that enter the food chain for wildlife. There are many nectar sources such as the flowers of eucalypts, paperbarks and tea-trees. Wattles represent an important source of seeds as well as sap for fauna species such as invertebrates and the Sugar Glider.

8.2.3. Terrestrial

The variety and ecological condition of vegetation in the reserve represents suitable habitat for a high diversity of terrestrial wildlife, and it seems likely that a concerted fauna survey would uncover far more species than are presently recorded. The mosaic pattern of prescribed burning in the reserve during 2005 contributes to the diversity of habitat.

The presence of fallen logs and branches provide the sort of cover needed by a very wide range of fauna, from small invertebrates to reptiles and small mammals. For most terrestrial fauna, cover is of similar importance to food.

The high carbohydrate production of the reserve's vegetation contributes directly and indirectly to the food supply for terrestrial fauna, e.g. by seed and leaves that fall from trees. Invertebrates that process fallen leaves and other organic debris represent an important part of the food chain.

8.2.4. Introduced Animals

No sign of wild pest animals was observed during this project and no significant problem of pest animals was identified by the Friends of Hoddles Creek during the two field days in 2008.

Horses are having a moderate adverse impact on the reserve's environmental values due to:

- Pugging and trampling of vegetation in gullies on the eastern boundary, which were observed to have turned a patch of significant swamp plants into a quagmire; and (less importantly)
- Introduction of weeds via seeds in manure.

It is recommended that if horses continue to use the track along the eastern boundary from Parkinsons Rd, proper creek crossings be carefully constructed to reduce the impact on soil and vegetation.

9. Forest Management

9.1. The Rainforest Gully

The rainforest gully on the eastern boundary of the Hoddles Creek Education Area is the most precious and precarious biological asset in the reserve, because it is such a surprising outlier of an endangered, fire-sensitive vegetation community and because it contains a remarkable outlier population of the Jungle Bristle-fern, *Cephalomanes caudatum*. The following management implications immediately arise:

- The rainforest gully should be protected from bushfire and prescribed burns as a very high priority. It was within the area burned for fuel reduction in April 2005 but its dampness and topographic sheltering may have saved it from being burned. **Future prescribed burns should exclude the rainforest gully.**
- Parks Victoria and the Department of Sustainability & Environment should consult about measures that can be taken to conserve the Jungle Bristle-fern, such as propagating plants from the reserve and returning them to the rainforest gully. This should be preceded by a census of how many plants presently exist in the gully, as discussed in Section 10, to determine the degree of need for increasing the population.

9.2. Fire

In addition to the preceding recommendation about excluding fire from the rainforest gully:

- Prescribed burning in the reserve is likely to produce the best regeneration of indigenous plants and wildlife habitat if it is conducted in autumn. Spring is preferable in other areas where certain weed species are prone to benefit from autumn fires, but weeds are very scarce in Hoddles Creek Education Area. (However, this project ran out of time to inspect the Prices Rd area or the extreme southwestern corner, where there could conceivably be weeds that might affect fire management.)
- It would be ecologically desirable not to burn the narrow corridors of Riparian Wet Forest along the creek channels of Wombat Creek and north of Parkinsons Rd, because the vegetation is not as well adapted to fire as the surrounding vegetation. This affects only a tiny fraction of the reserve and should present no practical difficulties because these narrow creek channels would be much harder to set alight than their surroundings. The other gullies are not particularly sensitive to fire

9.3. Blackberry

Blackberry is relatively easy to control (although the rainforest gully is hard to access), and this is recommended to occur in the gullies along the reserve's eastern boundary. Ideally, access would be gained from adjoining private land. The Prices Rd area should be also be checked, as this project ran out of time to do so.

9.4. Horses

It is recommended that if horses continue to use the track along the eastern boundary, southward from Parkinsons Rd, proper creek crossings be carefully constructed to reduce the impact on soil and vegetation (as discussed in Section 8.2.4).

10. Gathering More Data

This project was originally titled 'Production of Vegetation Mapping for Field Day at Hoddles Creek Education Area'. It has expanded to cover far more than originally expected, but there are still outstanding matters.

It is recommended that the following further investigations be conducted:

1. Ground truth the vegetation mapping (Figure 4 on page 9) in the vicinity of Prices Rd and along the southern half of the western boundary;
2. In the same areas, check for environmental weeds and indigenous plants that have not yet been recorded in the EVCs represented there (particularly Damp Forest);
3. Conduct a census of the numbers, distribution and health of the population of Jungle Bristle-fern in the rainforest gully, in conjunction with the investigation of conservation measures discussed in Section 9.1;
4. Build up the flora and fauna lists in the appendices (particularly fauna) by accumulating observational records from rangers and visitors to the reserve;
5. A trapping survey for bats and reptiles, which would have to be done by zoologists with permits.

Items 1 and 2 require a moderate amount of botanical expertise. I believe from the experience of this project's field days that some members of the Friends of Hoddles Creek (or other interested locals) could do a reasonable job of these tasks. The results could be refined with professional help or with follow-up by a professional. An advantage of community involvement is that it would increase the level of local knowledge about the reserve. This is particularly relevant in the rarely-visited far southwestern corner, where it appears that a dam has been constructed and vegetation cleared without the knowledge of Parks Victoria staff or the local community. It is desirable for the local community to know their parks and reserves so that they are better able to keep the custodians informed of any important changes or events.

Item 3 above (the Jungle Bristle-fern census) could also be done by community volunteers. At least two people would be required for safety reasons, as the gully is remote, has very steep sides, very uneven ground and is strewn with logs hidden beneath ferns. The only technical difficulty would be learning to recognise the fern, which grows on the trunks of tree-fern trunks (principally or wholly on the Rough Tree-fern *Cyathea australis*, rather than the Soft Tree-fern *Dicksonia australis*). Recognition would be aided by botanical illustrations showing the tell-tale conical spore cases with a bristle extending from each one, e.g. in volume 2 of *Flora of Victoria*. Alternatively, a botanist could assist or conduct the proposed census, and this option should be explored as part of the proposed discussions between Parks Victoria and the Department of Sustainability & Environment about conserving the species (Section 9.1).

Item 4 above (accumulating flora and fauna records) is probably the area where contributions from the Friends of Hoddles Creek and other visitors to the reserve can be of greatest value. I suggest that the Ranger-In-Charge at the Gembrook office of Parks Victoria keep lists of flora and fauna (starting with the ones in the appendices of this report) and record the date, observer's name and location of any new observations. Contributions could be solicited through the Friends of Hoddles Creek and local people who are known to visit the reserve. Other groups such as the U3A birdwatching group and Field Naturalists Clubs may also be worth contacting.

It will be very important to ensure the reliability and traceability of all records of flora and fauna. Some records from the community will need to be added to the list provisionally at first and then confirmed by an expert or more detailed evidence. Photographs and observing notes are very valuable as supporting evidence.

11. Vegetation Monitoring

Ongoing monitoring of the reserve's vegetation could potentially identify the need to intervene in a developing ecological problem, or help forest management to respond better to the way the vegetation is found to change over time, e.g. in response to fire of different intensities or seasons. The process of monitoring change and adapting management in response is called 'adaptive management' and has a well recognised role in management of natural areas.

The present project was required to identify suitable ways for volunteers (particularly in the Friends of Hoddles Creek) to conduct useful vegetation monitoring.

Taking into account the current capacity and skills of people attending this project's field days, the types of monitoring recommended are:

- Photographs of scenes that are precisely reproduced at later times to gain a visual impression of change;
- Documentation of the structure and composition of vegetation at precisely known locations; and
- Monitoring the populations of important plant species.

Monitoring has not yet begun and the details of the numbers and locations of monitoring sites have not been decided. The following information is intended to allow the Friends of Hoddles Creek to organise a monitoring program to suit their members.

11.1. Health and Safety

Hoddles Creek Education Area has hazards such as mineshafts, steep, uneven terrain and dense vegetation in which to become lost. There are also hazards associated with outdoors work in general and fieldwork in the bush in particular. Monitoring activities should always be very mindful of health and safety matters such as not getting lost and avoiding working alone. Safety measures should be considered carefully before each monitoring activity, and volunteers should do this in consultation with Parks Victoria.

11.2. Position, Position, Position!

When establishing a monitoring site (for any of the types of monitoring), it is critical that the location be able to be found precisely into the indefinite future, even though fire, drought or dense growth may drastically change the area's appearance. Ideally, the monitoring conducted at the site will include a photograph that takes in an enduring landmark, e.g. a very large tree, but this is not usually possible in dense scrub. Documentation about the site should include detailed instructions to help find it, including precise coordinates and often some reference to distances and directions from enduring landmarks; e.g. 'twelve metres at 210° (magnetic) from the prominent, double-trunked large Messmate on the fence beside the creek'. Coordinates should be recorded as the easting and northing according to the MGA, or Map Grid of Australia, system, as found on all modern Melway maps and on the maps in this report.

A hand-held Global Positioning System device (or GPS) is very useful for recording or finding the location of any monitoring site, typically with a precision of six metres. The Gembrook office of Parks Victoria owns such devices and may make one available on loan for appropriate monitoring activities by volunteers. The GPS unit should be set to provide coordinates according to the MGA datum. A magnetic compass is also very useful for orienting the direction of photographs. Either the GPS or compass are important for navigating about the reserve, in combination with a map like the ones in this report.

Steel fence droppers are commonly used to mark monitoring sites. However, they are sometimes removed over the years (e.g. by nuisance visitors or during fire suppression activities) and sometimes

people place other steel droppers nearby for their own purposes, making it hard to work out which one is yours. Sometimes they become obscured as dense vegetation grows up around them. Therefore, if steel fence droppers are used, it is important that not too much reliance is placed on them and alternative methods are available to find the sites.

11.3. Photo Points

Photographs from precisely known locations allow qualitative assessment of changes in vegetation structure or changes that may affect the more conspicuous plant species. They are particularly useful for observing the progress or recovery of vegetation affected by burning, climate change or changed management practices. Photographs have the advantage over other monitoring methods that they are quick, cheap and require no specialist skills, and therefore more likely to be within the capacity of volunteers over the long term. They are often of limited help in monitoring rare ground flora and they rarely help with monitoring the diversity of flora at the monitoring site because many plant species are not identifiable in a photograph.

Photographs are recommended for any location where monitoring is to include documentation of the structure and composition of vegetation. In some cases, they can also be useful for monitoring the populations of highly visible plant species.

At many monitoring sites, only one photograph is needed during each visit. Sometimes people take a series of photographs (e.g. to the north, south, east and west) to compile a panorama view, but this is only warranted where it seems likely that the vegetation will change differently in the different photographs. Over the years, a monitoring project can produce so many photographs to compare and analyse that unnecessary photographs become a burden.

With this in mind, a suitable interval between consecutive photographs is every 2-5 years.

When establishing a site for photographic monitoring, the scene in the photograph should be carefully chosen to capture important features for monitoring. For example, monitoring of eucalypt dieback requires a photograph into the tree canopy rather than the usual horizontal photographs. The scene should be representative of whatever is to be monitored; e.g. a photograph to monitor the general condition of the rainforest gully should capture as many as possible of the most important features (but without expecting the individual plants to remain standing over decades of monitoring).

It is important that each monitoring photograph precisely match the scene of earlier photographs from the same location. This requires the photographer to carefully follow instructions about the location and camera orientation. For all visits to a site after the first, copies of the earlier photographs should be taken to the site to allow a precise match of the scenes.

It is sometimes necessary to move the location of a photograph point in response to changed circumstances; e.g. if a dense shrub grows up to obstruct the view of what was to be monitored.

Ideally, successive photographs from a monitoring point should be done at a similar time of year and with similar lighting, but this is sometimes impracticable. A digital camera automatically stores the date and time of each photograph, but it is very important to make sure that the camera's internal clock is properly set.

The field of view of a photograph is adjustable by a 'zoom' setting on most cameras. It should be adjusted to match the field of view of any previous photographs. Although a wide field of view is desirable in most respects, one should avoid a field of view that is so wide that many cameras will not have that capability. There are bound to be various cameras photographing the scene over the years.

If a photograph is intended to monitor the density of eucalypt foliage (e.g. to detect the effects of drought or climate change), it is best if the foliage is photographed against a blue sky. Thin cloud can lead to underexposure of the foliage unless compensation is made.

Any important features or plant species that are in a photograph but perhaps not clear enough to be recognised in the photograph should be recorded at the time the photograph is taken. For example, 'The numerous small shrubs in the foreground are *Euryomyrtus ramosissima'*.

A blank sample form for recording the details of photographs is provided in Appendix C.

As soon as practicable after the photographs have been taken, they should be annotated with captions or labels. If a photograph is stored as a JPEG file, it is possible to store a caption within the file by right-clicking the filename in Windows Explorer and choosing 'Properties'. I usually rename files to follow the convention 'Site ××, 2009-10' for photographs taken in the tenth month of 2010, and so on.

11.3.1. 'Quick Quadrats'

'Quick quadrat' is a term I use for a simplified variant of quadrat data, which is the traditional way that Victorian botanists record the composition of vegetation within a defined area of typically 100-1,000 m². The data gathered for a quick quadrat is effectively a subset of a full quadrat, retaining only the components that are quick, easy, do not require an expert botanist and are least susceptible to seasonal variability. The observer records an estimate of the abundance of only the dominant, numerous or ecologically important plant species within a radius of about ten metres, particularly focusing on the vegetation that is depicted in a photograph taken at the same location (as described in Section 11.3). There is no precise edge to the area surveyed for a quick quadrat; plants are included if they are readily visible from the reference point, which is usually where a photograph is taken.

A quick quadrat provides data about vegetation structure, fauna habitat and ecological function, but not about the full richness of the vegetation. Quick quadrats are ideally revisited every few years, although there is still value in monitoring at much longer intervals.

A blank recording sheet for quick quadrats is provided in Appendix C. Sometimes some of the entries of the sheets are hard to fill in and do not add much useful information, in which case they can be omitted.

A trial run of a quick quadrat was conducted by the whole group of people at this project's first field day in July 2008. The participants generally demonstrated a capacity to generate valuable, reproducible data. Working in a group helped with plant identification and resolving doubts or varying perceptions of the amount of cover of plant species.

When surveying a quick quadrat site, comparison should be made with information recorded at earlier inspections. While in the field, attention should be given to any changes in the vegetation and what might explain those changes.

A site can be monitored as a quick quadrat some years and as a full quadrat when a botanist is available to do so. This provides an opportunity to meld volunteers' data with those of a professional, adding value to each.

11.4. Population Monitoring

Population monitoring involves estimating or counting the size of populations of important plant species – typically those that are either rare, serious weeds or particularly favoured (e.g. orchids). It is particularly useful for providing quantitative data about increases or declines in important species. It has the advantage of being fairly easy and quick, with low skill requirements other than being very observant and thorough. In many cases, its usefulness is limited by the fact that in nature, most localised populations of plants eventually wane and new populations arise elsewhere. The decline of a known population does not necessarily mean that the species is in decline elsewhere, so it is best to combine population monitoring with periodic searches for new populations.

A blank recording sheet for population monitoring is provided in Appendix C.

It can be often be difficult to avoid double-counting or missing plants unless each one is marked. This can be overcome by initially marking each individual of the target species (e.g. with flagging tape tied to the plant or on a peg placed next to the plant) and then counting the markers on a second pass, collecting the markers on the way. Touching every individual while counting also helps.

In addition to counting plants, observers should record any observations about the apparent health of the plants and the extent of any evidence of reproduction (e.g. young plants or seed capsules).

The interval between population monitoring of a species depends on the species' biology. An orchid's detectable population often varies greatly from year to year and so monitoring should ideally be conducted every year or two. By contrast, ferns need only be monitored every few years.

The obvious candidate for population monitoring in the Hoddles Creek Education Area is the rare Jungle Bristle-fern, *Cephalomanes caudatum*, that lives on tree-fern trunks in the rainforest gully (Sections 6.1, 9.1 and 10). Two or more volunteers who become able to recognise this species would ideally check the population's size and health every two years or so. This might be done as a follow-up to baseline data that might be gathered by scientists as an outcome of the discussions proposed in Section 10 between Parks Victoria and the Department of Sustainability & Environment. A photo point could be established in conjunction with the population monitoring, with the objective of observing any changes in the structure and density of vegetation that makes up the habitat of the Jungle Bristle-fern.

As Hoddles Creek Education Area is a major stronghold for the rare Long Pink-bells (*Tetratheca stenocarpa*), there would be value in monitoring that species' population at intervals of five years or so in case climate change or other factors cause it to decline. This could be done by volunteers. The species is so widespread and abundant within the reserve that the monitoring should be based on one or more sample areas; e.g. counting the number of mature plants within two or three widely spread sampling plots measuring (say) 30 m x 30 m each. Care should be taken not to select the densest areas, because natural variability means that the densest areas in one year are probably not going to be the densest areas in years to come. If one starts monitoring in the densest area at the time, it is likely that the density of plants will decline over time and the data may convey a false impression of a decline in the species as a whole. It would be better to choose monitoring sites that are representative of the population as a whole, spanning sites that differ in how recently they were burned.

11.5. Devising the Monitoring Program

The information in this chapter should help the Friends of Hoddles Creek to decide how much monitoring they could commit to for the long term, and which kinds of monitoring suit their membership and any other volunteers who may help. It should be kept in mind that monitoring should ideally continue over more than a decade, over which time the availability and enthusiasm of group members to participate is likely to wax and wane.

Probably the highest priorities for monitoring are things directly affected by management activities or that have high importance for management, so that the information from the monitoring can feed back into future management. For example, monitoring post-fire changes in the structure and composition of vegetation using a quick quadrat and photo point could help Parks Victoria to determine how long it takes for significant structural changes to occur. This would help to determine how much time to allow between burning adjacent areas of vegetation so that a diversity of habitat is maintained. Monitoring of the Jungle Bristle-fern would be a priority because conservation of rare plants is one of Parks Victoria's management objectives.

While there are many things and locations that could potentially be monitored, this has to be tempered by the capacity of volunteers to commit resources for the long term. There is some advantage in putting a priority on the least demanding monitoring tasks because this helps to maximise the number of things that can be monitored.

Photographic monitoring is the least demanding method of monitoring. Population monitoring is not much more difficult, once the observer learns to reliably find and identify the target species and (ideally) check whether seed are successfully dispersed). Quick quadrats require a higher level of familiarity with the vegetation than photography or population monitoring, and considerably more time. Full quadrats require a botanist with experience in vegetation monitoring.

The highest priority location for photographic monitoring is rainforest gully. Other useful things to monitor with photographs are (in decreasing order of priority):

- The structure of the vegetation near the reserve's eastern boundary, in the first gully south of Parkinsons Rd. This would be representative of vegetation in the vulnerable EVC, Riparian Scrub/Swampy Riparian Forest Complex, at a location where weeds are invading from east of the reserve (with the aid of soil disturbance by horses);
- The structure of the vegetation at several representative locations within the areas that were burned in 2005 (i.e. south of Parkinsons Rd and east of Pioneer Rd), ideally in conjunction with quick quadrats;
- The structure of vegetation at representative locations within each of the other EVCs, ideally spanning different topographic aspects (i.e. slopes facing different directions) in anticipation that any bushfire is likely to burn at different intensities on these different slopes.

Quick quadrats require a higher level of familiarity with the vegetation than photography, and considerably more time.

The priorities for plant population monitoring were discussed in Section 11.4. If there are least two people willing to monitor the Jungle Bristle-fern population, that activity would be higher in priority than the quick quadrat monitoring proposed in the second bullet point above. (Two people are required for safety reasons.) Monitoring of Long Pink-bells is much less demanding in time, effort and plant identification skill and each monitoring plot would take less time than a quick quadrat. Monitoring of Long Pink-bells would have a priority comparable with the last bullet point in the list above.

I suggest that the Friends of Hoddles Creek undertake the following steps in sequence:

- In the first column of a table, compile a list of objectives or items for which monitoring would be useful (preferably with the involvement of Parks Victoria);
- In a second column, write the monitoring method(s) and intervals that would suit each item in the list, guided by the earlier sections of this chapter;
- Order the table according to the amount of benefit each item offers relative to the amount of effort required. A final order of priorities might involve some re-ordering to account for synergies between items; e.g. if someone is going around the reserve taking photographs, it is not much more effort for them to take an extra photograph even if the score for that photograph is well down the list;
- Implement the program in reducing order of priority. Sometimes it may be necessary to skip items in the list (at least temporarily) because of weather conditions, time of year or availability of the right volunteers.

11.6. Data Security

Vegetation monitoring by volunteers and Parks Victoria staff is likely to be intermittent and conducted by different people on different days, largely as voluntary activities on weekends. This carries a risk that data and monitoring photographs may go missing over the years, potentially causing the monitoring program to fail.

It is therefore important to adopt methodical handling and storage procedures for photographs and data sheets. Some useful measures are:

- Ensure that cameras used in the monitoring have their internal clocks set correctly, so that photographs will have time stamps that can be reliably matched with field data sheets when necessary;

- As soon as possible following a day's photography, transfer the photographs to a computer and give the photographs filenames that indicate their subjects, consistent with the naming convention adopted for the project (e.g. 'Site 12, 2009-09.jpg');
- As soon as possible after filling in a field data sheet, produce a digital image of the sheet with a scanner. Store the scanned image with all the pre-existing images of data sheets, preferably in the appropriate order within the Acrobat (.pdf) file;
- Make sure that newly gathered photographs and scanned images of data sheets are promptly stored in a location on Parks Victoria's computer network where they will be automatically backed up and not forgotten. The location chosen for this purpose should be clearly indicated on a piece of paper stored with the primary copy of this report at Parks Victoria's office. Ideally, a copy of the updated computer files should be periodically sent to me as a secondary repository, in case of mishap or lapse of corporate memory;
- A brief instruction sheet should be prepared for people planning to do vegetation monitoring, clearly indicating who is responsible for each of the steps above, and how quickly.

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Appendix A. Inventory of Indigenous Plants

The table below indicates the presence of indigenous species of flowering plants and ferns in the various EVCs within the Hoddles Creek Education Area. The list is bound to be incomplete because not all of the reserve's 2·9 square kilometres was examined. The reserve's southwestern corner and the vicinity of Prices Rd were not visited at all and the list for Damp Forest was compiled from only a small sample of the total area.

Species are ordered alphabetically by their scientific names, using the same nomenclature as the *Census of Vascular Plants of Victoria* (Walsh and Stajsic 2007). Species whose names are written in **bold** text are rare in Victoria (Section 6.1, page 19).

The columns in the grid correspond to different EVCs. The EVC identification numbers in the table heading represent:

16 – Lowland Forest
17 – Riparian Scrub/Swampy Riparian Forest Complex
29 – Damp Forest
31 – Cool Temperate Rainforest variant
972 – Riparian Wet Forest

Where a species occurs in a particular EVC only as an occasional outlier of a main population in an adjacent EVC, the outliers are given no entry in the table.

The symbols used for the entries within the narrow columns have the following meanings:

D Dominant (or sharing dominance) within the relevant vegetation stratum, at least in part of the EVC;
M Many individuals within the EVC but with too little foliage cover to be dominant;
✓ Present in moderate numbers, not dominant within a vegetation stratum;
– Scarce.

		EVC number				
Scientific Name	Common Name	16	17	29	31	972
Acacia dealbata	Silver Wattle	D		D	–	✓
Acacia genistifolia	Spreading Wattle	M				
Acacia melanoxylon	Blackwood			D	D	✓
Acacia mucronata subsp. *longifolia*	Narrow-leaf Wattle	M		✓		
Acacia myrtifolia	Myrtle Wattle	–				
Acacia verticillata	Prickly Moses		–	✓		
Acaena novae-zelandiae	Bidgee-widgee		–		–	
Acrotriche prostrata	Trailing Ground-berry	–		–		
Amperea xiphoclada	Broom Spurge	✓	–			
Amyema pendula	Drooping Mistletoe	✓				
Amyema quandang	Grey Mistletoe	✓				
Austrostipa muelleri	Wiry Spear-grass	D				
Baeckea – see Euryomyrtus						
Banksia marginata	Silver Banksia	✓				
Banksia spinulosa	Hairpin Banksia	✓				
Bauera rubioides	Wiry Bauera	✓	✓			
Billardiera mutabilis	Common Apple-berry	–	–			
Blechnum cartilagineum	Gristle Fern			✓	D	✓
Blechnum minus	Soft Water-fern		–			
Blechnum nudum	Fishbone Water-fern	✓	✓	✓		D
Blechnum wattsii	Hard Water-fern		–	✓	D	✓
Burchardia umbellata	Milkmaids	M	–			
Bursaria spinosa	Sweet Bursaria	–				
Caesia parviflora	Pale Grass-lily	–				
Caladenia ?carnea	Pink Fingers	–				
Callitriche sp.	Water Starwort					✓
Calochlaena dubia	Common Ground-fern	✓	✓	D	D	D

		EVC number				
Scientific Name	Common Name	16	17	29	31	972
Campylopus clavatus	Broody Swan-neck Moss	✓				
Campylopus introflexus	Heath Star Moss	✓				
Cassinia aculeata	Common Cassinia	✓	✓	✓	✓	
Cassytha glabella	Slender Dodder-laurel	–				
Cassytha pubescens	Downy Dodder-laurel	✓				
Caustis flexuosa	Curly-wig	✓				
Centella cordifolia	Centella	–	M			
Cephalomanes caudatum	**Jungle Bristle-fern**				✓	
Chiloglottis ?jeanesii	Mountain Bird-orchid				–	
Chiloglottis valida	Common Bird-orchid	✓	M			
Chiloscyphus ?semiteres	Green Worms	M	✓	M	M	
Clematis aristata	Mountain Clematis		✓	✓	✓	✓
Coprosma quadrifida	Prickly Currant-bush		–	✓	✓	✓
Cryptostylis leptochila	Small Tongue-orchid	–				
Cyathea australis	Rough Tree-fern	–	D	✓	D	M
Dampiera stricta	Blue Dampiera	M	–			
Daviesia leptophylla	Narrow-leaf Bitter-pea	–				
Deyeuxia quadriseta	Reed Bent-grass	✓				
Dianella admixta	Black-anther Flax-lily	–				
Dianella caerulea	Paroo Lily	–				
Dianella tasmanica	Tasman Flax-lily	–		✓		
Dicksonia antarctica	Soft Tree-fern				✓	✓
Dicranoloma sp.	Moss				✓	
Dillwynia ?glaberrima	Smooth Parrot-pea	–				
Dillwynia sericea	Showy Parrot-pea	✓				
Dipodium roseum	Hyacinth Orchid	–	–			
Drosera peltata subsp. *auriculata*	Tall Sundew	M				
Drosera peltata subsp. *peltata*	Pale Sundew	✓				
Drosera whittakeri subsp. *aberrans*	Scented Sundew	✓				
Epacris impressa var. impressa	Common Heath	✓				
Eucalyptus baxteri	Brown Stringybark	D				
Eucalyptus cephalocarpa	Mealy Stringybark	–				
Eucalyptus cypellocarpa	Mountain Grey Gum			✓		D
Eucalyptus dives	Broad-leafed Peppermint	D	D			
Eucalyptus obliqua	Messmate Stringybark	D	D	D	D	D
Eucalyptus radiata	Narrow-leaf Peppermint	D		D		D
Eucalyptus sieberi	Silver-top	D	✓			
Euchiton collinus	Creeping Cudweed	✓				
Euryomyrtus ramosissima	Rosy Baeckea	✓				
Gahnia clarkei/sieberiana						✓
Gahnia radula	Thatch Saw-sedge	M				
Gahnia sieberiana	Red-fruit Saw-sedge	✓	✓			
Galium gaudichaudii	Rough Bedstraw			✓		
Gleichenia dicarpa	Pouched Coral-fern	–	D			
Gompholobium huegelii	Common Wedge-pea	✓				
Gonocarpus humilis	Shade Raspwort		–			
Gonocarpus micranthus	Creeping Raspwort		M			
Gonocarpus tetragynus	Common Raspwort	M	✓	✓		
Goodenia ?elongata	Lanky Goodenia					
Goodenia lanata	Trailing Goodenia	✓				
Goodenia ovata	Hop Goodenia	✓	✓			
Grammitis billardierei	Common Finger-fern				✓	
Gratiola peruviana	Austral Brooklime		✓			
Hakea decurrens	Bushy Needlewood	✓				
Hakea nodosa	Yellow Hakea	–				
Hakea ulicina	Furze Hakea	–				
Hedycarya angustifolia	Austral Mulberry				✓	✓
Helichrysum scorpioides	Button Everlasting	–				
Histiopteris incisa	Bat's Wing Fern		–	✓	✓	✓

		EVC number				
Scientific Name	Common Name	16	17	29	31	972
Hovea heterophylla	Common Hovea	–				
Hydrocotyle hirta	Hairy Pennywort	✓	–			–
Hymenophyllum cupressiforme	Common Filmy Fern				✓	
Hypericum gramineum	Small St John's Wort		–			
Isolepis inundata	Swamp Club-rush					✓
Joycea pallida	Silvertop Wallaby-grass	✓				
Juncus planifolius	Broad-leaf Rush		✓			
Kunzea ericoides spp. agg.	Burgan	M	M	✓	✓	✓
Lagenophora stipitata	Common Lagenophora	–				
Lepidosperma elatius	Tall Sword-sedge		✓	M	–	✓
Lepidosperma filiforme	Common Rapier-sedge	–				
Lepidosperma laterale	Variable Sword-sedge	M				
Lepidosperma tortuosum	Tortuous Rapier-sedge	✓				
Leptospermum continentale	Prickly Tea-tree	✓	✓			
Leptospermum myrsinoides	Heath Tea-tree	✓				
Leptospermum scoparium	Manuka	D	D	D		
Leucopogon ericoides	Pink Beard-heath	–				
Lindsaea linearis	Screw Fern	M	–			
Lomandra filiformis subsp. *coriacea*	Wattle Mat-rush	–				
Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush	✓				✓
Lomandra longifolia	Spiny-headed Mat-rush	–				
Lomatia ilicifolia	Holly Lomatia	–				
Lycopodium deuterodensum	Bushy Clubmoss	✓	M			
Macroglena caudata – see Cephalomanes caudatum						
Melaleuca squarrosa	Scented Paperbark		D			
Microlaena stipoides	Weeping Grass	✓	M			
Muellerina eucalyptoides	Creeping Mistletoe	–		–		
Myriophyllum ?simulans	Amphibious Milfoil		✓			
Olearia argophylla	Musk Daisy-bush		–	✓	D	✓
Olearia lirata	Snowy Daisy-bush	✓	✓	✓		✓
Olearia myrsinoides	Silky Daisy-bush	–				
Olearia phlogopappa	Dusty Daisy-bush	–				
Opercularia varia	Variable Stinkweed	✓	✓			
Oxylobium arborescens	Tall Oxylobium				–	
Ozothamnus ferrugineus	Tree Everlasting	✓		✓		
Pandorea pandorana	Wonga Vine			✓		–
Parsonsia brownii	Twining Silkpod					–
?*Patersonia occidentalis*	Long Purple-flag	–				
Persicaria decipiens	Slender Knotweed		✓			
Persicaria praetermissa	Spotted Knotweed		✓			
Persoonia juniperina	Prickly Geebung	–				
Pimelea linifolia	Slender Rice-flower	–				
Pittosporum bicolor	Banyalla				–	
Platylobium formosum	Handsome Flat-pea	M		✓		
Platysace heterophylla	Slender Platysace	–				
Poa ?morrisii	Soft Tussock-grass	–	–			
Poa tenera	Slender Tussock-grass		✓	✓		
Polyscias sambucifolia	Elderberry Panax		–	✓	✓	✓
Pomaderris aspera	Hazel Pomaderris			✓	✓	D
Poranthera microphylla	Small Poranthera	✓				
Prostanthera lasianthos	Victorian Christmas-bush	M	✓	✓	✓	✓
Pteridium esculentum	Austral Bracken	D	✓			
Pterostylis melagramma	Tall Greenhood		✓	–		
Pultenaea gunnii	Golden Bush-pea	D	✓	✓		
Pultenaea hispidula	Rusty Bush-pea	M				
Ranunculus ?glabrifolius	Shining Buttercup		✓			
Rhytidosporum procumbens	White Marianth	✓				
Rubus parvifolius	Small-leaf Bramble					✓
Schoenus apogon	Common Bog-rush	–	✓			

		EVC number				
Scientific Name	Common Name	16	17	29	31	972
Schoenus maschalinus	Leafy Bog-rush		✓			
Selaginella uliginosa	Swamp Selaginella	–	–			
Senecio hispidulus	Rough Fireweed	–				
Senecio minimus	Shrubby Fireweed		–			
Sphaerolobium minus	Globe-pea	–				
Sphagnum sp.	Peat Moss		–			
Spyridium parvifolium	Australian Dusty Miller	–		–		
Sticherus tener	Silky Fan-fern			✓		
Stipa – see Austrostipa						
Stylidium armeria	Grass Trigger-plant	–				
Tetraria capillaris	Hair-sedge	–	–			
Tetrarrhena juncea	Forest Wire-grass	M	+	M	M	✓
Tetratheca ciliata	Pink-bells	–		–		
Tetratheca stenocarpa	**Long Pink-bells**	✓	**–**			
Thelymitra ?media	Tall Sun-orchid	–				
Thuidium sp.	Weft Moss		–			
Tmesipteris obliqua	Long Fork-fern				✓	
Todea barbara	Austral King-fern					–
Viola hederacea	Ivy-leaf Violet	✓	M	✓	✓	✓
Xanthorrhoea minor subsp. *lutea*	Small Grass-tree	✓				
Xanthosia dissecta	Cut-leaf Xanthosia	✓				

Appendix B. Fauna List

The following list includes all available observational records of fauna from within the reserve or within a radius of one kilometre. Those species observed within the reserve are shown in bold type. An asterisk before a species' name indicates that the species is introduced.

The list includes incidental observations by the author during 2008-9 as well as records from the Department of Sustainability & Environment's 'Victorian Faunal Display' database, which includes data from:

- Mammal trapping plus incidental observations in the north of the reserve on 19th March 1979 by Fred Baum and Ian Temby, the only uncommon species being a Swamp Rat;
- A brief session of bird observing in and near the reserve by Charles Silveira and Peter Johnson on 6th October 1988, during which they saw only a small number of common forest birds;
- Thirteen other lists (or single-species records) from within one kilometre of the reserve, of which only two are less than eleven years old.

Most of the waterbird species in the list would visit the reserve rarely if ever, mainly at the tiny section of a farm dam that extends into the reserve's northeastern corner when the dam is full. Latham's Snipe is unlikely to visit any part of the reserve.

Common Name	Scientific Name	Last Seen
Birds		
Australian Wood Duck	*Chenonetta jubata*	1998
Pacific Black Duck	*Anas superciliosa*	1988
White-faced Heron	*Egretta novaehollandiae*	1998
Brown Goshawk	*Accipiter fasciatus*	1988
Lewin's Rail	*Rallus pectoralis*	1988
Purple Swamphen	*Porphyrio porphyrio*	1988
Dusky Moorhen	*Gallinula tenebrosa*	1988
Painted Button-quail	*Turnix varia*	1971
Latham's Snipe	*Gallinago hardwickii*	1988
Masked Lapwing	*Vanellus miles*	1988
Common Bronzewing	*Phaps chalcoptera*	1988
Yellow-tailed Black-Cockatoo	***Calyptorhynchus funereus***	2009
Gang-gang Cockatoo	*Callocephalon fimbriatum*	2003
Australian King-Parrot	*Alisterus scapularis*	1988
Crimson Rosella	***Platycercus elegans***	2009
Eastern Rosella	*Platycercus eximius*	1988
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	1988
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	1988
White-throated Nightjar	*Eurostopodus mystacalis*	1988
Laughing Kookaburra	***Dacelo novaeguineae***	2009
Sacred Kingfisher	*Todiramphus sanctus*	1988
Superb Lyrebird	*Menura novaehollandiae*	2003
White-throated Treecreeper	***Cormobates leucophaeus***	2003
Superb Fairy-wren	***Malurus cyaneus***	2003
Spotted Pardalote	***Pardalotus punctatus***	1988
Striated Pardalote	*Pardalotus striatus*	1988
White-browed Scrubwren	***Sericornis frontalis***	2003
Brown Thornbill	***Acanthiza pusilla***	2003

Common Name	Scientific Name	Last Seen
Buff-rumped Thornbill	*Acanthiza reguloides*	1988
Striated Thornbill	***Acanthiza lineata***	1988
Red Wattlebird	*Anthochaera carunculata*	2003
Yellow-faced Honeyeater	*Lichenostomus chrysops*	1988
White-eared Honeyeater	*Lichenostomus leucotis*	2003
Brown-headed Honeyeater	*Melithreptus brevirostris*	1988
White-naped Honeyeater	*Melithreptus lunatus*	1988
Crescent Honeyeater	*Phylidonyris pyrrhoptera*	2003
New Holland Honeyeater	*Phylidonyris novaehollandiae*	1988
Eastern Spinebill	*Acanthorhynchus tenuirostris*	2003
Jacky Winter	*Microeca fascinans*	1988
Eastern Yellow Robin	***Eopsaltria australis***	2003
Eastern Whipbird	*Psophodes olivaceus*	2003
Varied Sittella	*Daphoenositta chrysoptera*	1988
Golden Whistler	***Pachycephala pectoralis***	2003
Rufous Whistler	***Pachycephala rufiventris***	1988
Grey Shrike-thrush	***Colluricincla harmonica***	2003
Satin Flycatcher	*Myiagra cyanoleuca*	1988
Magpie-lark	*Grallina cyanoleuca*	1988
Grey Fantail	***Rhipidura fuliginosa***	2003
Willie Wagtail	*Rhipidura leucophrys*	1988
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	1988
Dusky Woodswallow	*Artamus cyanopterus*	1988
Grey Butcherbird	*Cracticus torquatus*	2003
Australian Magpie	***Gymnorhina tibicen***	2003
Pied Currawong	*Strepera graculina*	2003
Grey Currawong	*Strepera versicolor*	2003
Australian Raven	*Corvus coronoides*	1988
Little Raven	*Corvus mellori*	2003
Red-browed Finch	*Neochmia temporalis*	1988
*European Goldfinch	*Carduelis carduelis*	1988
Mistletoebird	*Dicaeum hirundinaceum*	2003
Welcome Swallow	*Hirundo neoxena*	1988
Silvereye	*Zosterops lateralis*	1988
***Common Blackbird**	***Turdus merula***	2008
*Common Starling	*Sturnus vulgaris*	1988

Mammals

Short-beaked Echidna	***Tachyglossus aculeatus***	2008
Agile Antechinus	***Antechinus agilis***	1979
Dusky Antechinus	***Antechinus swainsonii***	1979
Common Wombat	***Vombatus ursinus***	2003
Koala	*Phascolarctos cinereus*	2003
Common Ringtail Possum	***Pseudocheirus peregrinus***	2003
Black Wallaby	***Wallabia bicolor***	2009
*House Mouse	*Mus musculus*	1988
Bush Rat	***Rattus fuscipes***	1988
Swamp Rat	***Rattus lutreolus***	1988
*Red Fox	*Canis vulpes*	2003
*European Rabbit	*Oryctolagus cuniculus*	2003

Common Name	Scientific Name	Last Seen
Frogs		
Common Froglet	*Crinia signifera*	2003
Victorian Smooth Froglet	***Geocrinia victoriana***	1979
Southern Bullfrog	*Limnodynastes dumerilii*	1988
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	1988
Southern Brown Tree Frog	*Litoria ewingii*	2003
Verreaux's Tree Frog	*Litoria verreauxii verreauxii*	1988
Reptiles		
Tree Dragon	*Amphibolurus muricatus*	1988
Lace Monitor or Tree Goanna	***Varanus varius***	2008
Swamp Skink	*Egernia coventryi*	1988
unidentified water skink	***Eulamprus sp.***	1979
Garden Skink	*Lampropholis guichenoti*	1988
McCoy's Skink	*Nannoscincus maccoyi*	1988
Southern Grass Skink	*Pseudemoia entrecasteauxii*	1988
Weasel Skink	*Saproscincus mustelinus*	1988
Tiger Snake	*Notechis scutatus*	1988
Eastern Small-eyed Snake	*Rhinoplocephalus nigrescens*	1988
Fish		
Mountain Galaxias	***Galaxias olidus***	1997
Shortfin Eel	*Anguilla australis*	1997
***Brown Trout**	***Salmo trutta***	1997
River Blackfish	***Gadopsis marmoratus***	1997
Southern Victorian Spiny Cray	***Euastacus yarraensis***	1997

Appendix C. Blank Recording Sheets

See the following pages.

Hoddles Creek Education Area – Vegetation Monitoring Dates:.....

Photographic Log

Photographer's name(s): .....

Site no.	Photo no.	Date	Time	Dir'n (°mag)	Notes
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Hoddles Creek Education Area – Vegetation Monitoring

Site number:.....
Visit number .....
Date .....

'Quick Quadrat'

The following information is for vegetation within about ten metres of the observer (or a little further for large trees), usually within the foreground of an accompanying photograph.

Recorder name(s): .....

Time taken in the field: .....

Photograph taken? .....

GPS coordinates (MGA system): .....

Location description (to allow precise revisits): .....

.....

.....

.....

Purpose(s) of Monitoring: .....

.....

Geology, soil & topographic determinants: .....

.....

Uppermost trees (species, height, density): .....

.....

.....

Lower trees or shrubs >3m tall (species, height, density): .....

.....

Vines / climbers >2m above ground (if conspicuous): .....

Shrubs <3m tall – dominant species: .....

.....

Shrubs <3m tall– other abundant species: .....

.....

Ferns: .....

Ground flora dominance – grasses *v* sedges *v* ferns *v* herbs *v* shrublets: .....

.....

Ground flora – dominant species: .....

.....

Ground flora – other abundant species: .....

.....

.....

Ground flora layer – typical depth and density: .....

Exposed ground, leaf litter or moss – rough percentage: .....

Non-dominant character spp and indicator spp: .....

.....

Visibility (typical distance within which one can readily see a person walking): .....

Notes: .....

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.....

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Hoddles Creek Education Area – Vegetation Monitoring

Site number:.....
Visit number .....
Date .....

Population Monitoring *(rare plants or weeds)*

Recorder name(s): .....

Time taken in the field: .....

GPS coordinates (MGA system): .....

Site location description (to allow precise revisits): .....

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.....

Species 1:.....

Photograph taken? .....

Spatial extent of the population: .....

Population size (e.g. no. individuals, no. stems, stem density, or no. patches and patch sizes – be consistent with previous visits):

.....

.....

Plant health & maturity: .....

.....

Flowering or seeding info: .....

.....

Threats: .....

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Notes: .....

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Species 2:.....

Photograph taken? .....

Spatial extent of the population: .....

Population size (e.g. no. individuals, no. stems, stem density, or no. patches and patch sizes – be consistent with previous visits):

.....

.....

Plant health & maturity: .....

.....

Flowering or seeding info: .....

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Threats: .....

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Notes: .....

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