cumberland ecology

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ECOLOGICAL OPINION REGARDING PRESENCE OF BLUE MOUNTAINS HEATH AND SCRUB AT 54 LUCHETTI AVENUE, HAZELBROOK

Dear Sir,

As requested, I have undertaken a review of information available with regards to the presence of *Blue Mountains Heath and Scrub* vegetation on the western portion of land at 54 Luchetti Avenue, Hazelbrook (the "subject site").

Based on the findings of my review, I am of the opinion that the subject site does not contain any *Blue Mountains Heath and Scrub*. My findings are explained below.

1. Background

The subject site was previously mapped by the Blue Mountains City Council (hereafter referred to as 'Council') as containing map unit *(5B) Blue Mountains Swamps* (BMCC, 2002). After reviewing the information contained in a geotechnical asssessment (Taylor, 2016) and an ecological assessment (Cumberland Ecology, 2016), Council agreed that the subject site did not contain map unit *(5B) Blue Mountains Swamps* (also known as 'hanging swamps').

However, Council has suggested that the subject site contains map unit *(5A) Blue Mountains Heath and Scrub*, which is recognised as a "significant vegetation community"[1] under Schedule 5A of the *Blue Mountains Local Environmental Plan 2005* (LEP 2005), Schedule 3 of the *Blue Mountains Local Environmental Plan 1991*[2] (LEP 1991), and also under Schedule 6(5)(1) of the *Blue Mountains Local Environmental Plan 2015* (LEP 2015).

[1] It is noted that *Blue Mountains Heath and Scrub* is not listed under the *Threatened Species Conservation Act 1995* (TSC Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as a threatened ecological community.

[2] Amended 12/07/2013

In an email from Mr Brian Mercer, senior planner of BMCC (dated 5 May 2016), it is stated that:

> *"Council agrees with the findings of the geotechnical assessment and flora/fauna report that the land does not contain a hanging swamp and 5B Blue Mountains Swamp community. However, the flora and fauna report assessment does not consider or assess the presence of scheduled communities other than the mapped 5B. Council's recent assessment indicates the vegetation in this area is more consistent with the scheduled community 5A – Blue Mountains Heath and Scrub, present within a smaller portion of the area mapped 5B (see prepared map below)."*

The map referred to in Mr Mercer's email is presented in **Figure 1** (**Appendix A**).

Cumberland Ecology's brief is to review relevant and available information in order to provide an opinion on whether *Blue Mountains Heath and Scrub* as described in Schedule 6(5)(1) of the LEP 2015 and Schedule 5A of the LEP 2005 is present on the subject site.

2. Description of Blue Mountains Heath and Scrub

Schedule 6(5)(1) of the LEP 2015 contains the following description for *Blue Mountains Heath and Scrub*:

> *"Blue Mountains Heath and Scrub consists of a well-developed shrub layer, with no tree layer or only a sparse layer of scattered low trees, sometimes with a mallee habit (low, multi-stemmed shrub eucalypts).*
>
> *It occurs primarily in exposed sites with very shallow soils on Narrabeen Group and Hawkesbury Sandstone geology. Typical situations are cliff tops and high, rocky ridges, especially on the* ***westerly aspect and with skeletal soils****.* [our emphasis]
>
> *The vegetation structure is typically an open-heath, less often a closed-heath, and may be interspersed with patches of open-scrub or closed-scrub formed by stands of mallees or* Leptospermum *species. It is also typically interspersed with areas of bare rock.*
>
> *It can occur on the fringes of or within so-called hanging swamps and in such situations it can also intergrade with vegetation of the Riparian Complex.*
>
> *There is also considerable intergradation between forms of woodland to open-woodland with a* Eucalyptus sclerophylla *canopy with Blue Mountains Heath and Scrub forming the understorey in such communities.*

The description contained in the LEP 2015 indicates that *Blue Mountains Heath and Scrub* has a highly variable and mixed species composition. The species assemblage is influenced by elevation, geology, local conditions (moisture and sheltered sites) and fire regimes.

The full excerpt is attached at **Appendix B**. I note that the description for *Blue Mountains Heath and Scrub* in LEP 2015 remains unchanged from that contained in Schedule 5A of the LEP 2005 and Schedule 3 of the LEP 1991.

3. Methods

In undertaking my review, I have considered the following information:

- The map referred to in Mr Mercer's email;
- An historical aerial photograph of the subject site taken in 1943;
- The description for *Blue Mountains Heath and Scrub* taken from Schedule 6 of the LEP 2015; and
- Survey findings and discussions from:
  - Cumberland Ecology (2016). *54 Luchetti Avenue, Hazelbrook. Flora and Fauna Assessment.* Cumberland Ecology, Carlingford Court;
  - John Whyte (2015). *Ecology Letter – Identification of Blue Mountains Hanging Swamp EEC at No.54 Luchetti Avenue Hazelbrook NSW (Reference number: 2015#11-05).* Enviro Ecology, Gosford;
  - John Whyte (2016). *Aesthete No 9. Pty Ltd v Blue Mountains City Council. Property: No 54 Luchetti Avenue, Hazelbrook NSW. Proceedings No. 184360 of 2016. Supplementary Ecological Assessment.* Enviro Ecology, Wyoming; and
  - Taylor, Grant (2016). *Geotechnical Letter – Geotechnical Investigation of Possible Hanging Swamp: 54 Luchetti Avenue, Hazelbrook, NSW.* Martens & Associates Pty Ltd, Hornsby.

In addition, I have also recently re-visited the subject site to collect additional data to corroborate the findings of my review. On 9 September 2016 Cecilia Phu (senior ecologist) and I attended the subject site and undertook a plot survey within the area identified in Mr Mercer's email as map unit *(5A) Blue Mountains Heath and Scrub* (see **Figure 2** in **Appendix A** for approximate location of the plot).

Geographic coordinates were recorded at each corner of one 20 x 20 metre sample plot and photographs of the vegetation in this plot were taken. All vascular plants within the sample plot were noted and an estimate of the percentage cover of each plant was recorded. Where a plant species could not be identified on site, it was collected for later identification. Notes about the height of each stratum were recorded.

Plants that were collected were identified using keys from Pellow *et al.* (2009), PlantNET (Botanic Gardens Trust, 2016), Klaphake (2010) and Robinson (2003). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as published on PlantNET (Botanic Gardens Trust, 2016). The data is provided in **Appendix C**.

4. Key Findings

Blue Mountains Heath and Scrub is a vegetation type that features a well-developed shrub layer in the absence of a canopy (tree) layer. The sites where *Blue Mountains Heath and Scrub* is typically found are generally exposed sites on thin soils, such as ridge lines and cliff tops, although some forms of *Blue Mountains Heath and Scrub* can be found on locally sheltered and moist sites.

The review of the following information is undertaken with particular reference to the above description for *Blue Mountains Heath and Scrub.*

4.1 Review of Vegetation Analysis (John Whyte, 2016)

The supplementary assessment prepared by Enviro Ecology (John Whyte, 2016) provides a detailed assessment of the vegetation shown in area 5A in Mr Mercer's email involving:

- Aerial photographic interpretation of historical aerial photographs (1946, 1958, 1975 and 2015);
- A detailed analysis of the site data against the LEP description for *Blue Mountains Heath and Scrub*; and
- Analysis of positive diagnostic species, with reference to Tozer *et al.* (2010).

The supplementary assessment concludes that the subject site does not support an existing occurrence of *(5A) Blue Mountains Heath and Scrub.*

I have carefully reviewed the data and analysis presented in John Whyte (2016) and I generally agree with the conclusions the author has drawn from this information.

4.2 Review of Field Results

The field survey data presented in Cumberland Ecology (2016) was collected for the purpose of investigating the occurrence of hanging swamps. I have re-examined this data with respect to *Blue Mountains Heath and Scrub* in conjunction with the recent survey data from 9 September 2016.

The area identified by Council as map unit *(5A) Blue Mountains Heath and Shrub* (**Figure 1**) is located on sheltered, east to north-east facing slopes, on gently sloping land with relatively moist conditions. It is not located at a west-facing, exposed site on thin, skeletal soils that most commonly characterise the habitat of *Blue Mountains Heath and Shrub.*

The vegetation within the "5A area" comprises regenerating woodland with a tall, shrubby understorey. The survey data collected in March 2016 (Cumberland Ecology, 2016) and recently on 9 September 2016 demonstrate that a well-developed regenerating canopy (12-15 metres in height) dominated by *Eucalyptus piperita* is present in this area. The understorey is comprised of a mixture of tall shrubs and large tussock ground species, particularly

Leptospermum polygalifolium, *Banksia ericifolia*, *B. spinulosa*, *Hakea salicifolia* and *Lomandra longifolia*.

The presence of a well-developed canopy layer area within the area identified by Council as map unit *(5A) Blue Mountains Heath and Shrub* is inconsistent with the description for that community and indicates that *Blue Mountains Heath and Shrub* is not present, even though there is a significant shrub layer present. Although the floristic assemblage recorded in this area has affinities to *(5A) Blue Mountains Heath and Shrub*, the dominant species recorded are also present in 11B *Eucalyptus piperita – Angophora costata* Open Forest/Woodland[3], which is a widespread open forest/woodland with a diverse, shrubby understorey (BMCC, 2002). .

The clearing history of the subject site (see **Section 4.3**), and the current floristics and vegetation structure of the woodland within the "5A area" mapped by Council, support conclusions made by Cumberland Ecology (2016) and Enviro Ecology (John Whyte, 2016; 2015) that the vegetation in this area is consistent with a regrowth form of 11B *Eucalyptus piperita – Angophora costata* Open Forest/Woodland (BMCC, 2002).

The photographs taken of the vegetation in the area mapped as *(5A) Blue Mountains Heath and Shrub* (**Table 1**) illustrate the nature of the vegetation structure throughout this area, that it is woodland with a tall, shrubby understorey.

It is noted that *Blue Mountains Heath and Shrub* can intergrade with woodland and open-woodland communities dominated by a *Eucalyptus sclerophylla* canopy, where it forms the understorey in such communities. I confirm that no such community dominated by a *Eucalyptus sclerophylla* canopy occurs on the subject site.

[3] 11B *Eucalyptus piperita – Angophora costata* Open Forest/Woodland is also consistent with map unit p136 Blue Mountains Ridge-top Forest (Tozer *et al.*, 2010). Map unit p136 Blue Mountains Ridge-top Forest is *not* equivalent to Blue Mountains Heath and Scrub (John Whyte, 2016).

Table 1 Photographic records at various locations within the area mapped by Council to be map unit *(5A) Blue Mountains Heath and Scrub*

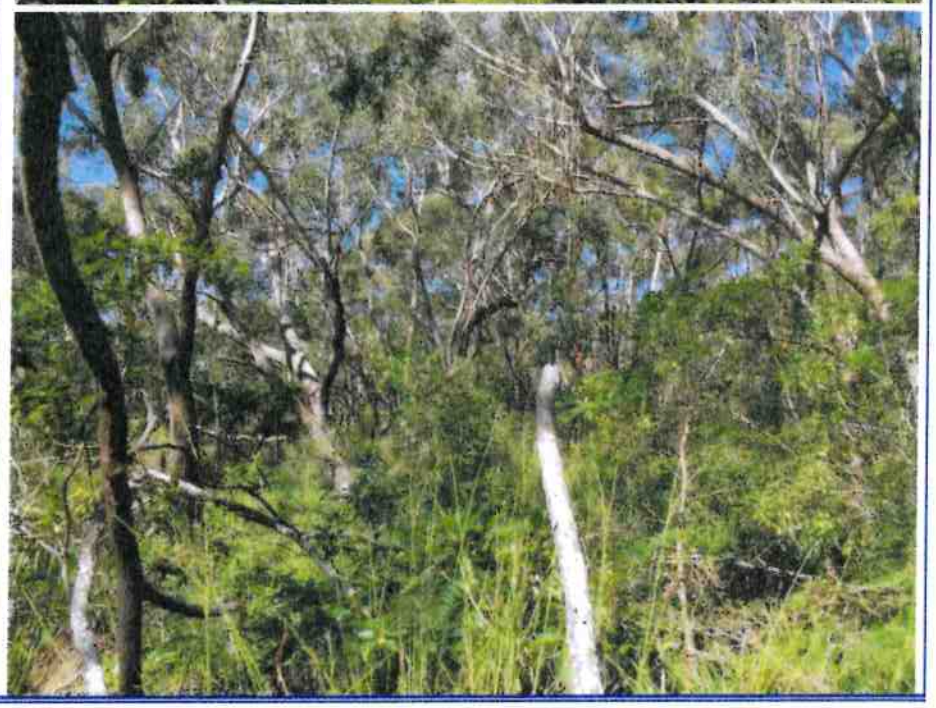
Point location (see Figure 1)	Photograph
1	
1	

Table 1 **Photographic records at various locations within the area mapped by Council to be map unit *(5A) Blue Mountains Heath and Scrub***

Point location (see Figure 1)	Photograph
28	
29	

Table 1 **Photographic records at various locations within the area mapped by Council to be map unit *(5A) Blue Mountains Heath and Scrub***

Point location (see Figure 1)	Photograph
29	
29	

4.3 Land Clearing History

The area identified by Council as map unit *(5A) Blue Mountains Heath and Shrub* shows evidence of being regenerating woodland and forest, and is not considered to be a heath and scrub community with no true canopy layer (as is described for *Blue Mountains Heath and Shrub*).

The subject site was historically cleared for cultivation and agriculture from the early 1900's. In the early 1940s the area identified by Council as map unit *(5A) Blue Mountains Heath and Shrub* was completely cleared of its original vegetation. **Figure 3** (**Appendix A**) shows an aerial of the site in 1943, where the use of the subject site for agricultural practices is clearly visible.

By 1975, portions of the subject site show evidence of substantial regeneration; however, the area identified by Council as map unit *(5A) Blue Mountains Heath and Shrub* continues to be used for agriculture and remains semi-cleared (refer to John Whyte, 2016 and historical aerial photographs contained therein). This is a likely explanation for why there is an occurrence of shrubby woodland in the area identified by Council as map unit *(5A) Blue Mountains Heath and Shrub*, with taller forest surrounding it.

Considering the above and considering the presence of a well-developed canopy layer, the extant vegetation within the "5A area" is considered to be regenerating woodland. The vegetation in this area would have once been open forest that is continuous with a larger area of 11B *Eucalyptus piperita – Angophora costata* Open Forest/Woodland occurring across the subject site. Although the thickness of the shrub understorey has affinities with the description for *Blue Mountains Heath and Shrub*, this is likely to be an expression of the clearing history and gaps in the canopy rather than a true occurrence of *Blue Mountains Heath and Shrub*.

5. Conclusion

Based on the information presented herein, in particular with regards to the vegetation structure on site being woodland with shrubs, I consider that the vegetation shown in area 5A in Mr Mercer's email does not correspond to vegetation *(5A) Blue Mountains Heath and Scrub*. The photographic evidence clearly shows the presence of trees.

Historical photography provides further evidence that the land has been cleared in the past and that the vegetation on site comprises regrowth rather than original native vegetation.

In conclusion, I am of the opinion that the subject site does not contain any *Blue Mountains Heath and Scrub*. The vegetation on the subject site comprises *Eucalyptus piperita – Angophora costata* Woodland in various conditions on historically cleared land.

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Yours sincerely,

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Director
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References Cited

BMCC (2002). *Native Vegetation Mapping in the Blue Mountains*. Blue Mountains City Council, NSW

Botanic Gardens Trust (2016). "PlantNET." from http://www.rbgsyd.nsw.gov.au/search_plant_net.

Cumberland Ecology (2016). *54 Luchetti Avenue, Hazelbrook. Flora and Fauna Assessment.* Cumberland Ecology, Carlingford Court

John Whyte (2015). *Ecology Letter – Identification of Blue Mountains Hanging Swamp EEC at No.54 Luchetti Avenue Hazelbrook NSW (Reference number: 2015#11-05).* Enviro Ecology, Gosford

John Whyte (2016). *Aesthete No 9. Pty Ltd v Blue Mountains City Council. Property: No 54 Luchetti Avenue, Hazelbrook NSW. Proceedings No. 184360 of 2016. Supplementary Ecological Assessment.* Enviro Ecology, Wyoming

Klaphake, Van (2010). *Guide to the Sedges and Rushes of Sydney and the Blue Mountains*. 5th Edition. Van Klaphake, Byabarra

Pellow, Belinda J., Henwood, Murray J. and Carolin, Roger C. (2009) *Flora of the Sydney Region*. 5th Edition. Sydney University Press, Sydney

Robinson, Les (2003). *Field Guide to the Native Plants of Sydney.* 3rd Edition. Kangaroo Press, Pymble

Taylor, Grant (2016). *Geotechnical Letter – Geotechnical Investigation of Possible Hanging Swamp: 54 Luchetti Avenue, Hazelbrook, NSW.* Martens & Associates Pty Ltd, Hornsby

Tozer, M. G., Turner, K., Keith, D. A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. and Cox, S. (2010). "Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands." *Cunninghamia* **11**(3): 359-406

Appendix A

Figures

Figure 1 Location of vegetation 5A - Blue Mountains Heath and Scrub
(source: Map included from email from Mr Bryan Mercer BMCC to Natasha Baker, 5 May 2016)

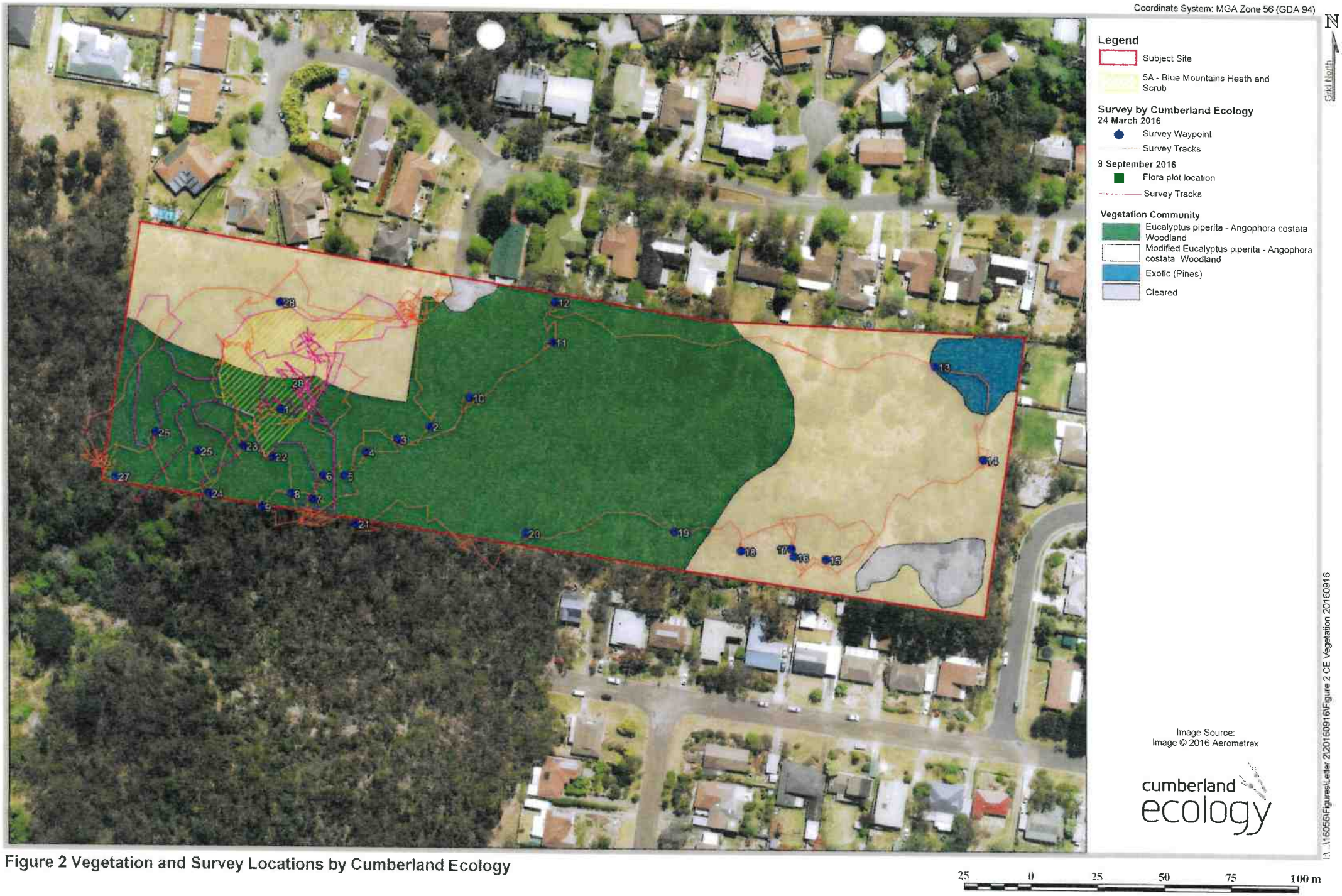

Figure 2 Vegetation and Survey Locations by Cumberland Ecology

Figure 3 Historic Aerial Photograph of Site (1943)

Appendix B

Schedule 6(5)(1) of LEP 2015: Description of Blue Mountains Heath and Scrub

Schoenus apogon; *Senecio diaschides*; *Senecio lautus*; *Senecio quadridentatus*; *Sigesbeckia orientalis*; *Solanum cinereum*; *Stackhousia viminea*; *Stellaria flaccida*; *Stephania japonica*; *Stypandra glauca*; *Themeda australis*; *Trema aspera*; *Urtica incisa*; *Veronica plebeia*; *Viola betonicifolia*; *Wahlenbergia gracilis*; *Wahlenbergia stricta*

(4) **Redgum Swamp Woodland (Eucalyptus tereticornis)**

This community is dominated by ***Eucalyptus tereticornis*** (Forest Redgum) and is known only from a small example between Megalong Creek and Nellies Glen Road in the central eastern Megalong Valley. This site is associated with a swamp ephemeral drainage line that generally defines the ecotone between the vegetation on the lower Shoalhaven Group of sediments and that on the Carboniferous Granite, which dominates the Megalong Valley. Adjoining communities include an example of Coxs River Swamp, the so-called Megalong Forest of Keith and Benson (1988) and the Megalong Granite Forest and woodland. The understorey has been modified by grazing and was probably cleared in the past to facilitate this use.

Leptospermum species are dominant along the drainage line and in the more swampy sections which lack open water. Drier areas are dominated by grasses with little or no shrub layer and a relatively sparse tree canopy. This community is threatened by small size, grazing, weed invasion, rabbits and recreational vehicle use.

Redgum swamp woodland is broadly characterised by the following assemblage of diagnostic plant species. Other species may also occur, and not all of the following species are present in every stand of the community.

Acacia floribunda; *Agrostis avenaceus*; *Callistemon* sp. *nov. Megalong Valley*; *Carex inversa*; *Centella asiatica*; Dichelachne sp.; *Dichondra repens*; *Eucalyptus tereticornis*; *Grevillea acanthifolia*; *Hydrocotyle laxiflora*; *Hypericum gramineum*; *Juncus* sp.; *Juncus usitatus*; *Leptospermum juniperinum*; *Leptospermum obovatum*; *Leptospermum polygalifolium*; *Lomandra longifolia*; *Melaleuca linariifolia*; *Microlaena stipoides*; *Notodanthonia* sp.; *Pratia purpurascens*; *Schoenus apogon*; *Stackhousia viminea*

5 Heath/scrub/sedgeland/fernland

(1) **Blue Mountains Heath and Scrub**

Blue Mountains Heath and Scrub consists of a well-developed shrub layer, with no tree layer or only a sparse layer of scattered low trees, sometimes with a mallee habit (low, multi-stemmed shrub eucalypts). It occurs primarily in exposed sites with very shallow soils on Narrabeen Group and Hawkesbury Sandstone geology. Typical situations are cliff tops and high, rocky ridges, especially on the westerly aspect and with skeletal soils. The vegetation structure is typically an open-heath, less often a closed-heath, and may be interspersed with patches of open-scrub or closed-scrub formed by stands of mallees or ***Leptospermum*** species. It is also typically interspersed with areas of bare rock. It can occur on the fringes of or within so-called hanging swamps and in such situations it can also intergrade with vegetation of the Riparian Complex. There is also considerable intergradation between forms of woodland to open-woodland with a ***Eucalyptus sclerophylla*** canopy with Blue Mountains Heath and Scrub forming the understorey in such communities.

Blue Mountains Heath and Scrub has a mixed and variable species composition. Common shrub species include ***Allocasuarina distyla***, ***A. nana***, ***Banksia ericifolia***, ***Epacris microphylla***, ***Eucalyptus stricta***, ***Hakea laevipes***, ***H. teretifolia***, ***Kunzea capitata***, ***Leptospermum trinervium*** and ***Petrophile pulchella***. Common herb and sedge species include ***Actinotus minor***, ***Platysace linifolia***, ***Lepidosperma filiforme***, ***L. viscidum***, ***Lepyrodia scariosa***, ***Ptilothrix deusta*** and ***Schoenus villosus***.

Two forms of Blue Mountains heath have been distinguished (Keith and Benson 1988, Smith and Smith 1995 a–e): montane heath above about 850–900 metres elevation and lower Blue Mountains heath below this level. The two forms intergrade between Wentworth Falls and Katoomba. Montane heath is characterised by the presence of high altitude species such as ***Allocasuarina nana***, ***Darwinia taxifolia*** and ***Phyllota squarrosa***, while lower Blue Mountains heath is characterised by the presence of low altitude species such as ***Allocasuarina distyla***, ***Darwinia fascicularis*** and ***Phyllota phylicoides***. However, most of the more common heath plants occur across the full altitudinal range.

It is also possible to distinguish two forms of lower Blue Mountains heath: a Hawkesbury Sandstone form at lower altitudes (chiefly in the Faulconbridge to Woodford area), and a Narrabeen Sandstone form at intermediate altitudes (Hazelbrook to Wentworth Falls). The Hawkesbury Sandstone form is characterised by species such as ***Acacia oxycedrus***, ***Baeckea brevifolia*** and ***Eucalyptus burgessiana*** that are absent from heath on Narrabeen Sandstone.

In the prolonged absence of fires, the heath shrubs grow taller and thicker, transforming the vegetation from an open-heath to a closed-scrub, especially in relatively moist and sheltered sites. These communities may be floristically similar to the closed heaths described above but are structurally unique. Shrubs including ***Banksia ericifolia***, ***B. serrata***, ***B. spinulosa***, ***Hakea laevipes***, ***H. teretifolia*** and a range of ***Leptospermum*** species may all attain heights of up to 8 metres over a generally grassy, herbaceous understorey. In locally moist areas, the fern ***Gleichenia dicarpa*** may become common in the ground stratum.

In the Megalong Valley, forms of heath occur which are floristically and geologically distinct from those others within the scope of the Blue Mountains Heath description. The majority of Megalong Valley Heath is associated with the Shoalhaven Group of sediments with a rare exception associated with the Carboniferous Granite. Dominant species of the heath include ***Leptospermum trinervium***, ***L. polygalifolium***, ***L. juniperinum***, ***Isopogon anemonifolius***, ***Hakea salicifolia***, ***H. sericea*** and ***Banksia spinulosa*** while the locally uncommon shrub ***Mirbelia pungens*** may also be present.

Only one example is known of heath occurring on granite within the Megalong Valley, however other examples are likely to occur outside the City, west of the Coxs River. This example is dominated by a relatively low-growing shrubby Acacia which has not been able to be identified but is apparently related to Acacia floribunda.

Considered as a whole, Blue Mountains Heath and Scrub is characterised by the following assemblage of native plant species. Other species also occur, and not all of the following species are present in every stand of heath, but the list is indicative of the species composition of the vegetation.

Acacia baueri; *Acacia floribunda*; *Acacia oxycedrus*; *Acacia suaveolens*; *Actinotus helianthi*; *Actinotus minor*; *Allocasuarina distyla*; *Allocasuarina nana*; *Angophora floribunda*; *Anisopogon avenaceus*; *Austrostipa pubescens*; *Baeckea brevifolia*; *Baeckea densifolia*; *Baeckea ramosissima*; *Banksia ericifolia*; *Banksia serrata*; *Banksia spinulosa*; *Bossiaea heterophylla*; *Bulbine semibarbata*; *Bursaria spinosa*; *Callistemon citrinus*; *Calytrix tetragona*; *Cassytha glabella*; *Caustis flexuosa*; *Cheilanthes sieberi*; *Chionochloa pallida*; *Correa reflexa*; *Corymbia gummifera*; *Cyathochaeta diandra*; *Dampiera purpurea*; *Dampiera stricta*; *Danthonia tenuior*; *Darwinia fascicularis*; *Daviesia corymbosa*; *Dianella caerulea*; *Dichelachne rara*; *Dillwynia floribunda*; *Dillwynia retorta*; *Diuris sulphurea*; *Dodonaea boroniifolia*; *Entolasia stricta*; *Epacris microphylla*; *Epacris obtusifolia*; *Epacris pulchella*; *Eriostemon obovalis*; *Eucalyptus apiculata*; *Eucalyptus burgessiana*; *Eucalyptus dalrympleana*; *Eucalyptus gregsoniana*; *Eucalyptus ligustrina*; *Eucalyptus mannifera* subsp. *gullickii*; *Eucalyptus moorei*; *Eucalyptus multicaulis*; *Eucalyptus*

rubida; *Eucalyptus sparsifolia*; *Eucalyptus stricta*; *Gahnia aspera*; *Galium propinquum*; *Gleichenia dicarpa*; *Gonocarpus teucrioides*; *Goodenia bellidifolia*; *Goodenia hederacea*; *Grevillea arenaria*; *Hakea dactyloides*; *Hakea laevipes*; *Hakea propinqua*; *Hakea salicifolia*; *Hakea sericea*; *Hakea teretifolia*; *Helichrysum scorpioides*; *Hemigenia purpurea*; *Hypericum gramineum*; *Isopogon anemonifolius*; *Kunzea capitata*; *Lambertia formosa*; *Leionema lachnaeoides*; *Lepidosperma filiforme*; *Lepidosperma urophorum*; *Lepidosperma viscidum*; *Leptocarpus tenax*; *Leptospermum arachnoids*; *Leptospermum continentale*; *Leptospermum juniperinum*; *Leptospermum parvifolium*; *Leptospermum petraeum*; *Leptospermum polygalifolium*; *Leptospermum trinervium*; *Lepyrodia scariosa*; *Leucopogon esquamatus*; *Leucopogon microphyllus*; *Lindsaea linearis*; *Lomandra glauca*; *Lomandra longifolia*; *Lomandra multiflora*; *Micromyrtus ciliata*; *Mirbelia baueri*; *Mirbelia pungens*; *Mirbelia rubiifolia*; *Mitrasacme polymorpha*; *Monotoca ledifolia*; *Monotoca scoparia*; *Patersonia sericea*; *Petrophile pulchella*; *Phyllota phylicoides*; *Phyllota squarrosa*; *Platysace lanceolata*; *Platysace linearifolia*; *Pseudanthus divaricatissimus*; *Ptilothrix deusta*; *Pultenaea elliptica*; *Restio fastigiatus*; *Schoenus apogon*; *Schoenus ericetorum*; *Schoenus imberbis*; *Schoenus villosus*; *Stipa pubescens*; *Stylidium lineare*; *Thelionema caespitosum*; *Themeda australis*; *Tricoryne elatior*; *Velleia perfoliata*; *Woollsia pungens*

(2) **Blue Mountains Swamps**

Blue Mountains Swamps are listed as a Vulnerable Ecological Community in Part 2 of Schedule 2 to the *Threatened Species Conservation Act 1995*.

Blue Mountains Swamps are included within "Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregion" listed as an Endangered Ecological Community in Part 3 of Schedule 1 to the *Threatened Species Conservation Act 1995*.

Blue Mountains Swamps are included within "Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion" listed as an Endangered Ecological Community in Part 3 of Schedule 1 to the *Threatened Species Conservation Act 1995*.

A range of swamps occurs within the City. Swamp vegetation develops on poorly drained sites where the soil is waterlogged for prolonged periods. Several variants are recognised and are described below.

In the City, swamps occur, not only in low-lying sites on valley floors ('valley swamps'), but also in the headwaters of creeks and on steep hillsides ('hanging swamps'). Some swamps represent a combination of valley swamp and hanging swamp. The upper boundary of the swamp is often clearly defined by the outcropping of a layer of claystone. Groundwater seeps along the top of the impermeable claystone layer, reaching the surface where the claystone protrudes, thus forming a swamp on the hillside below. Other swamps receive their water supply from feeder streams rather than groundwater, or from a combination of the two.

Blue Mountains Swamps vary greatly in their structure and plant species composition, ranging from closed-sedgeland or closed-fernland to open-heath or closed-heath, sometimes open-scrub or closed-scrub. The shrub-dominated swamps are similar in vegetation structure to some of the forms of Blue Mountains Heath and Scrub, but they differ in species composition and ecological function, and are more appropriately classified with the sedge and fern-dominated swamps. However, in many instances the botanical boundary between Blue Mountains Swamp and Blue Mountains Heath and Scrub communities is unclear or can only be defined at a small scale as the two vegetation types can intergrade extensively.

Common shrubs in the Blue Mountains Swamps that occur on the sandstone plateaux include ***Acacia ptychoclada***, ***Baeckea linifolia***, ***Banksia ericifolia***, ***Callistemon***

Appendix C

Site Data: 9 September 2016