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# Anvil Hill Project Watch Association

ABN 88 261 039 244

25 January 2007

Referrals Section (EPBC Act)  
Approvals and Wildlife Division  
Department of the Environment and Heritage  
GPO Box 787  
Canberra ACT 2601

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**Regards: Referral of development proposal under the EPBC Act.  
Centennial Hunter Pty Limited/Mining/near Muswellbrook/NSW/Anvil Hill Project  
coal mine. Reference Number: 2007/3228**

Dear Sir or Madam:

We wish to comment on the referral of the Anvil Hill Open Cut Coal mine development and respectfully request the Minister for the Department of Environment and Heritage call in the proposal as a controlled action. We further request the Minister for the Department of Environment and Heritage deny consent for the development.

Centennial Hunter' Pty Ltd broad statements of having no significant impact on matters of National Environmental Significance, their proposed mitigation offsets and their statements of adequacy and acceptance of the Environmental Assessment by NSW Departments of Environment and Conservation and Dept of Planning are inconsistent with statements and other documents supplied over a course of time.

Anvil Hill Project Watch Association further disputes the statements of no significant impacts on the basis that there will be significant direct and indirect impacts and cumulative impacts on matters of national significance. The following pages support our claims.

We request the opportunity to provide comments on any further information that is provided to the Minister under s76 of the Act.

If you wish to discuss any of the issues raised in this submission, please contact me on 02 6547 8011.

Yours sincerely



Christine Phelps –President

# General Description of the Conservation Values of the Project Area

## *Anvil Hill- a place of significance*

Anvil Hill has been mapped and recommended as a priority fauna habitat and for conservation by various government studies conducted over a period of years by NSW Dept Land and Water, NSW National Parks and Wildlife Service, and the Central Rivers Catchment Management Authority.

Anvil Hill was not targeted as a coal resource until 1999 at which time the NSW State owned corporation "Powercoal Pty Ltd" took out a mineral exploration license. Indeed it was not listed in the 1996 Dept of Mineral Resources Minefo Magazine as having any open cut or underground coal mining potential. This article listed all current and future open cut and underground coal resources in the Upper Hunter Valley to the year 2095. All the assets of Powercoal Pty Ltd were listed for sale by tender in the year 2000 and Centennial Coal Ltd were the successful tenderers in 2002.

## *Quotes from various reports on the Anvil Hill location:*

### **1. Danny Wotherspoon- Abel Ecology.**

#### **Regional significance of the site**

The site is at the junction of a number of bioregions and botanical divisions, and contains both flora and fauna species from east and west of the Great Dividing Range (Bell 2001). A number of the species of conservation concern are at the limits of their ranges. The high biodiversity of the area, the mature age of the vegetation, habitat diversity, the corridor connectivity, and the high number of species of conservation concern, all indicate the high conservation significance and value of the area around the survey sites. The area has been recommended by the Hunter- Central Rivers Catchment Management Authority for immediate action to conserve through conservation agreements, wildlife refuge or as a managed trust.

#### **Recommendation**

The site has a high abundance and diversity of habitat resources at both macro and micro scales. This is reflected in the high biodiversity found for both flora and fauna. The high number of threatened species of both flora and fauna indicates that the structural diversity, abiotic resources and floristic diversity provide a suitable range of resources to support such ecological specialists. In addition, the ecological communities on the site have high conservation value. As such the site has exceptionally high conservation value as well as research and educational potential.

The conservation value of the site is enhanced by the adjacent extensive natural areas of high conservation value (Peake, 2005).

The viability of the site in the long term depends on maintenance of connectivity to adjacent areas identified as having high conservation value (Peake, 2005).

The findings of this study are consistent with those of the HVRV (Peake, 2005), and I therefore support the recommendation by Peake that the site be managed for conservation purposes. *Danny Wotherspoon- Abel Ecology, Blue Mountain Wilderness Services Pty Ltd, 2005 AD*

**2. Peake, 2005, Vol. 1, p. 160-** The Wybong Uplands are botanically significant in regional terms, containing extensive remnant vegetation, high species diversity and an abundance of Threatened species (). *(Note-The landform called Anvil Hill is situated at the centre of the area titled the "Wybong Uplands", C Phelps)*

**3. HLA Envirosiences Pty Ltd Great Northern Coal Mine Flora and Flora Investigations (over 4 hectares) for Proposed Bulk Sample Pit at Anvil Hill conducted for Centennial Hunter in 2002 writes;** *"In comparison with other habitats in low lying areas of the Hunter Valley, the woodland communities in the Anvil Hill local area support a diverse bird population (pers.obs). Recent studies that have taken place in large areas of the Hunter Valley have recorded fewer woodland species. For example, near Camberwell only 43 woodland species were recorded. (HLA- Envirosiences 2001a), near Ravensworth 29 woodland species were recorded (HLA- Envirosiences 2001b), near Warkworth 23 species were recorded (HLA- Envirosiences 2000), and 49 species were recorded at Mount Arthur (Dames and Moore 2000)."Species not included are wetland dependant species, exotic species or raptors. While some of the species recorded during the present study are nomadic or migratory, the majority are likely to be present all year round. **An explanation for the diversity of resident species is likely to be a result of a combination of the extensive relatively connected vegetation cover and high habitat diversity.**" (Highlight inserted by C Phelps)*

The report further goes on to state:

“A feature of the study area and surrounding woodlands is the diversity of woodland bird species, which include those that are known to have declined in the sheep belt of NSW (Reid 1999). The study area is situated near the eastern edge of the sheep belt (Reid 1999). Twenty bird species were identified as declining in the sheep belt (Reid 1999), with 10 of those species recorded during the present field investigations. These include the Jacky Winter, Red-capped Robin, Eastern Yellow Robin, Crested Shrike-tit, Rufous Whistler, Dusky Woodswallow and the threatened Speckled Warbler, Brown Treecreeper, Hooded Robin and Diamond Firetail. The Grey-crowned Babbler was observed during recent field investigations at the southern foot slopes and ridgeline of Anvil Hill (HLA-Envirosciences unpubl.) The Speckled Warbler, Red-capped Robin and Eastern Yellow Robin were amongst the most common species observed during the present field investigations. **The reason for this diversity and abundance of threatened and declining bird species is likely to be related to the significant litter components of the extensive woodland and current low grazing regime**” (*highlight inserted by C Phelps*) HLA Envirosciences Pty Ltd Great Northern Coal Mine Flora and Fauna Investigations (over 4 hectares) for Proposed Bulk Sample Pit at Anvil Hill, Statement of Environmental Effects.

**3. Associate-Professor Paul Adam, President, Coast and Wetlands Society Pty Ltd.**

The Wybong remnant is significant not only because of its size and quality but for the vegetation communities and plants it supports, as well as the variety of fauna habitat it provides. In particular, its location between Wollemi National Park and Myambat Military Area to the south; Goulburn River National Park to the west; and Manobalai Nature Reserve and Mt Royal National Park to the north and north west; makes it critical in terms of connectivity across the Valley floor. It represents a very important corridor for plant and animal dispersal north-south and east-west through the Upper Hunter Valley. There are few, if any, other large remnants left and connectivity has become tenuous elsewhere across the Valley floor. The severing of this connectivity will have far reaching implications for biodiversity at the local, regional and state levels by limiting dispersal and gene flow, as well as restricting migration in response to changing climate conditions associated with global warming. Claims in the Environmental Assessment that rehabilitation of the mine site and replanting in the offset areas will improve connectivity in the medium to long term are spurious because they fail to acknowledge that connectivity will be lost in the short to medium-term (both directly through vegetation clearance and indirectly due to disturbance associated with mine construction and operation) and that it will be some time (if ever) before any of the replanted vegetation will reach the size or maturity to provide adequate habitat resources. In the interim, there will be local extinctions. –

**4. Dean Chapman, Catchment Manager –Land and Water, Hunter Catchment Management Trust**

described the Wybong Anvil Hill area as follows: “The area is ecologically significant as it comprises one of the largest remnants on the Hunter Valley floor in an area where over 75% of the natural vegetation has been cleared. The Hunter Catchment Blueprint identifies the valley floor as a high priority area for Vegetation and Biodiversity targets.”

**5. Blue Mountain Wilderness Services Pty Ltd** in a Flora and Fauna report on the Anvil Hill Area conducted for Anvil Hill Project Watch Association concludes: “This very brief survey produced a range of Threatened Species observations and records of vegetation communities with high structural and floristic diversity. Fauna habitat diversity is very high. Connectivity to adjacent intact habitat appears to be viable for most fauna and flora species. Under the provisions of Circular 2 (NPWS), a significant effect is possible in that it is to be anticipated that the entire area is to be mined should bulk sampling prove mining to be economical. Thus all habitats would be removed and all fauna and flora species would become extinct on the site. There is therefore likely to be a significant effect on Endangered Ecological Communities, Threatened Species and their habitats.”

## Overview of Anvil Hill

The proposed Anvil Hill mine site occurs at the intersection of 3 Biogeographical Regions and 4 Botanical Provinces. Consequently, it represents a very significant area for biodiversity. There are a number of coastal species, which are at the western limit of their distribution in this area, and there are also species that are normally found west of the Great Dividing Range which reach the eastern limit of their distribution around Wybong. Similarly, some species normally only found to the north of the Hunter Valley reach the southern limit of their distribution here and other species which occur south of the Hunter Valley are close to the northern limit of their distribution. This explains the great diversity of plants and animals located at the Anvil Hill site and their local, regional and state significance. The Anvil Hill proposal will result in the local extinction of a number of these species and a concomitant retraction of their range. *Associate-Professor Paul Adam, President, Coast and Wetlands Society Pty Ltd.*

Anvil Hill is located at the only gap found in the Great Dividing Range, the Merriwa Gap, that allows transference of species from the foothills of the Great Dividing Range, the Western Plains and Coastal Plains regions.

Many of the species found at Anvil Hill are at the limits of their range; the site is also proving to be a site of new and previously unknown species discoveries, endemic to the area.

The Anvil Hill area is a biodiversity hotspot as described by DEH Hotspots Programme Guidelines. *"Biodiversity hotspots are areas rich in native plant and animal species, especially endemic species (that is, species found nowhere else), and under threat from human related activities, such as land clearing, development pressure, salinity, weeds and feral animals. Taking action now to protect natural habitat that is in good condition will be more cost effective, and have a greater chance of success, than trying to restore it once it has been removed or degraded and plants and animals have become endangered."*

It has a high floristic diversity not seen in other locations, with a high diversity of threatened species (scheduled under the NSW Threatened Species Conservation Act and the Federal Environmental Protection and Biodiversity Conservation Act) and protected native species of flora and fauna. Some 188 native fauna and 580 of native flora species have been identified on the site.

Anvil Hills natural landscapes comprises remnant woodlands, connects valley floor with well preserved native grasslands with minimal exotic invasion, creek lines and water holes, to the gentle lower slopes of and steeper country of sandstone escarpments with their overhangs and caves. Anvil Hill's values are in the size of the habitat and the associated woodlands and native grasslands and that its largest proportion of area comprises **valley floor** habitat

These woodlands have been identified as regionally and nationally significant in that the community structure of herbs, understorey, mid storey and canopy is still intact with little exotic weed invasion and they support many listed threatened and endangered species of fauna and flora. The importance of these woodlands in connecting two large habitat areas of the Wollemi National Park (part of the Blue Mountains World Heritage Area) and Manobalia Nature Reserve has been recognised by various professionals.

Anvil Hill and the Anvil Hill mine proposal falls directly in the centre of an area recommended for conservation, titled the "**Wybong Uplands**"<sup>1</sup>.

The mine project area covers 3763 hectares and will disturb 2238 hectares which includes approximately 1300 hectares (information from Centennial Hunter Environmental Assessment Executive Summary page 6) of the total 2067 hectares of remnant vegetation and 900 plus hectares of grasslands. The area proposed for the mine is the majority of the valley floor component of the **Wybong Uplands** habitat, and includes the footslopes and associated creek lines and water bodies. The mine will leave only the rocky sandstone escarpments and a small portion of the valley floor to the north of the mine site and on the southern side of the Limb of Addy Ridgeline. These areas do not equal the habitat values of the area to be removed by the mine.

## ***Largest Valley Floor Remnant Woodland on the Central Hunter Valley Floor***

Anvil Hill currently comprises the largest remaining Central Hunter Valley Floor Remnant Woodlands and has been described as an area requiring high priority action for conservation due to its high species diversity and large remnant size.

### **Hunter Central Rivers Catchment Management Authority-The Vegetation of the Central Hunter Valley, New South Wales. A Report on the Findings of the Hunter Remnant Vegetation Project**

Excerpts from the Hunter Central Rivers Catchment Management Authority-The Vegetation of the Central Hunter Valley, New South Wales. A Report on the Findings of the Hunter Remnant Vegetation Project- Volume 1; Main report Draft 6, Travis Peake, follows:

#### **Unique Mapping Units**

Only three UMUs exceeded 1,000 ha in area, two of which were located in the Singleton Military Area, while the third was at Wybong Uplands, a relatively extensive area of remnant vegetation.<sup>1</sup>

#### **Table 6.14: Locations of Botanical Significance in the Study Area**

##### **Location Name-**

Wybong Uplands

##### **Location Description-**

Rugged sandstone escarpment and their footslopes between Wybong & Mangoola.

**Reason for Significance-** One of the largest expanses of remnant vegetation, very high species diversity, many threatened species and relatively undisturbed history achieved through careful management.

**Recommended Action** Protection through conservation agreements. Future protection as a nature reserve or as a managed trust reserve should be investigated.<sup>2</sup>

#### **3. Protection**

##### **3.1 Urgent reservation of specific areas.**

Urgent protection of five specific areas is required, followed by protection of another two areas, preferably all through gazettal as nature reserves. The five priorities are Brushy Hill, Mt. Arthur, Belford district forests, Wybong Uplands and Warkworth woodlands. The two lower priorities are Ravensworth SF and adjoining areas and Wingen Maid footslopes. Priority- Very high.<sup>3</sup>

## **EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (May 2006)**

### ***The Anvil Hill Mine proposal is a Controlled Action***

*Under the EPBC Act an action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance.*

#### **What is an action?**

'Action' is defined broadly in the EPBC Act and includes: a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things.

Actions include, but are not limited to: construction, expansion, alteration or demolition of buildings, structures, infrastructure or facilities; industrial processes; mineral and petroleum resource exploration and extraction; storage or transport of hazardous materials; waste disposal; earthworks; impoundment, extraction and diversion of water; agricultural activities; aquaculture; research activities; vegetation clearance; culling of animals; and dealings with land.

Actions encompass site preparation and construction, operation and maintenance, and closure and completion stages of a project, as well as alterations or modifications to existing infrastructure.

An action may have both beneficial and adverse impacts on the environment, however only adverse impacts on matters of national environmental significance are relevant when determining whether approval is required under the EPBC Act." EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (May 2006)

<sup>1</sup> Page 70. Hunter Central Rivers Catchment Management Authority-The Vegetation of the Central Hunter Valley, New South Wales. A Report on the Findings of the Hunter Remnant Vegetation Project- Volume 1; Main report Draft 6 Travis Peake

<sup>2</sup>Page 200. Hunter Central Rivers Catchment Management Authority-The Vegetation of the Central Hunter Valley, New South Wales. A Report on the Findings of the Hunter Remnant Vegetation Project- Volume 1; Main report Draft 6 Travis Peake.

<sup>3</sup> Page 164-165 Hunter Central Rivers Catchment Management Authority-The Vegetation of the Central Hunter Valley, New South Wales. A Report on the Findings of the Hunter Remnant Vegetation Project- Volume 1; Main report Draft 6 Travis Peake.

## **Significant Impact Criteria-DEH**

Centennial Hunter Pty Ltd states in each instance in the referral that there will be No Significant Impact on matters of national significance. In making this statement they fail to fully address the definitions of significant impact as per the EPBC Act Policy Statement 1.1.

### **What is a significant impact?**

A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance.

## **The Actions of Mining**

The Open Cut Coal Mining processes at Anvil Hill

### **Mining Process**

"In open-cut mining, or strip mining, moderate sized earth-moving equipment is first used to remove vegetation and topsoil for storage. Then heavy earth moving equipment (dozers/ trucks/ loaders) condition the surface for overburden removal which is the process of removing the rocky overburden and interburden with huge mechanical shovels that scoop both soil and coal up from the underlying deposit. The modern coal industry has developed some of the largest industrial equipment ever made, including shovels capable of holding 90+ metric tons of coal or overburden. The process of removing the overburden and interburden requires the stockpiling and separate storage of topsoils. The overburden and interburden is stored separately in piles or dumps or used to create visual bunds around the open cut workings. Depending on the hardness and depth of the exposed sedimentary rocks, these rocky layers may be shattered with explosives. To do this, workers drill blast holes into the overlying sedimentary rock, fill these holes with explosives, and then blast the overburden to fracture the rock. Once the broken rock is removed, coal is shovelled from the underlying deposit into giant earth-moving trucks for transport.

### **Environmental Issues**

Because significant volumes of earth must be displaced to mine coal, coalmines and the resulting rock waste can harm the environment. Furthermore, burning coal releases environmentally harmful chemical compounds into the air and contributes directly to the world greenhouse gases, which results in global warming.

### **Mining and Mining Waste**

Surface mining has resulted in a great deal of damage to the landscape. Many surface mines have removed acres of vegetation and altered topographic features, such as hills and valleys, leaving soil exposed for erosion. Coal and rock waste, often dumped indiscriminately during surface mining processes weathers rapidly, producing acid drainage. Acid drainage contains sulfur-bearing compounds that combine with oxygen in water vapour to form sulphuric acid. In addition, weathering of coalmine waste can produce alkaline compounds, heavy metals and sediments. Acid drainage, alkaline compounds, heavy metals and sediment leached from the mine waste into ground water or washed away by rainwater can pollute streams, rivers and lakes." Contributed by: James Speight, B.S PhD. Visiting Professor, Technical University of Denmark. Former Chief Executive Officer, Western research Institute.

The action of blasting and removal of overburden to gain access to the coal seams creates dust.

Damage to vegetation arises from the accumulation of dust on plants. If the dust is not inert then a potential problem arises from the possible toxic effects of chemicals at the plant surface. Dust deposition can also lead to the formation of layers or crusts, which physically hinder photosynthesis, slow carbon dioxide uptake and affect the rate of starch formation. In addition, the normal gas exchange between plant and atmosphere can be interrupted by the physical blocking of stomata. The toxicity and crusting problems are facilitated by moisture on the plant surface. In the first case the moisture takes toxic chemicals into solution for uptake of the plant, and in the second it may hydrate certain dusts causing crusts.

*(Air Quality and resource development- a risk assessment in the Hunter Region in Australia. A.J. Jakeman and R.W Simpson 1987)*

Another outcome of open cut mining is the production of contaminated mine water. Saline and sulphuric acids produced by oxidation of minerals exposed to the air, contaminate this water. The water is used for dust suppression, which in turn adds to the long-term contamination of the site. Excess water is stored in large storage dams and pumped into the nearest watercourse at times of high flow in accordance with the Hunter River Salinity Trading Scheme.

Acid mine drainage (AMD) represents a serious environmental problem for coal mining industry worldwide. Acid mine drainage is generated when metal sulphides in coal and the associated strata, particularly pyrite ( $\text{FeS}_2$ ), react with water and oxygen in the presence of thiobacillus bacteria to produce sulfuric acid and iron hydroxide or iron sulphate. The low pH may result in further dissolution of country rock and the subsequent leaching of metals into water, and thereby adversely impact on aquatic life and surrounding vegetation. ( Zhiyuan Cong, China University of Mining and Technology (Beijing), Key Laboratory of Coal Resources, Ministry of Education, P.R.C, XueYuan Road, Ding 11#, Haidian District, Beijing 100083, China, Fax: 86-10-62325016, Email: [zhiyuancong@hotmail.com](mailto:zhiyuancong@hotmail.com) Fenghua Zhao, China University of Mining and Technology (Beijing), Key Laboratory of Coal Resources, Ministry of Education, P.R.C, XueYuan Road, Ding 11#, Haidian District, Beijing 100083, China, Fax: 86-10-62325016, Email: [zfh@cumtb.edu.cn](mailto:zfh@cumtb.edu.cn) )

The disturbed ground on the overburden dumps, visual bunds and top soils dumps creates conditions that allows easy and rampant propagation of exotic weeds and changes the structure of native propagation to allow problematic native species to thrive at the expense of other Native Grasses and herbs.

Rehabilitation over these overburden piles is generally poor due to the contamination of the soil structure. Introduced weeds in the form of exotic grasses and fast growing crops used as stabilisers on the gradients of the overburden piles and visual bunds are difficult to control and result in a change in the soil structure.

Regeneration using native trees has not had a high success rate, due mainly to contamination of the soils and disruption of the substrata layers. Some rehabilitation areas have failed after 7 years of growth when the tree roots reach down into contaminated strata. One area of plantings failed due to the roots reaching buried coal seams that were still suffering spontaneous combustion. (*Factors Affecting the establishment and Management of tree stands on Rehabilitated Coal Mines in the Hunter Valley N.S.W – Ryan et al 1995*)

The rehabilitation plans of open cut mine sites include remaining water filled voids where the open pit was. There is little consideration given to the contaminates in the water, the leaching affect of these contaminates on the watertable or future impacts of these unnatural waterways on the biodiversity in the area.

### ***Open cut coal mining process includes these non-biological steps:***

- The removal of all existing floristic structures and habitat over large areas at a time.
- The removal of all dead timbers.
- The removal of topsoil.
- The blasting and removal of all the substrata soil and rock layers to allow access to the coal seams.
- Construction of bund walls, overburden dumps and voids.
- Storage of topsoils and seed banks in piles.
- Construction of large storage dams for contaminated mine water.
- Construction of hardstand areas.
- Construction of Infrastructure.
- Construction of coal washery and sizing plant
- Use of coal generated electricity to power draglines. Start up of a dragline creates a drain on the grid and has to be coordinated with the power generators.
- Discharges of contaminated mine water into neighbouring streams and rivers during periods of high rainfall and flow.
- Blasting and use of technical equipment to remove overburden, interburden and coal that includes but is not exclusive to, bulldozers, backhoes, Draglines, power shovels, bucket wheel excavators, large dump trucks of +240tonnes capacity, high capacity conveyors systems
- Use of diesel fuel to operate equipment. Heavy crude diesel is required by much of the equipment. A 240 tonne dump truck will use 2,400 litres in a 24hour period.
- Production of dust that will contain particulates of crystalline silica particles due to the Sandy Hollow, Lees Pinch, Wappinguy and Munghorn Plateau soils structures that dominate the area containing quartz and siliceous sands.
- Use of contaminated mine water in dust suppression on mine haul roads, bund wall building and landscaping.
- Creation of Low frequency vibrations.
- Creation of electromagnetic fields.
- Use of flood lights for night shifts and continual 24hour operations.
- Storage of coal before and after crushing and washing.

- Transport to point of sale. Export or domestic markets.
- Creation of remaining voids at completion of the coal extraction.
- Open cut mining activities are historically over a long period of time. For example Bengalla mine lease is granted in 3 x 21-year periods with the ability to apply for expansion of the open cut or for underground extraction of the deeper seams. Bengalla has recently successfully applied to increase its annual Run Of Mine Capacity and to increase the height of its bund wall another 30 metres to accommodate the extra overburden created. The bund wall will now reach 100 metres in height, creating a false sunset by a ½ hour on the area east of the bund wall. Bengalla mine, after 10 years of operation is still yet to start any rehabilitation.
- Other Hunter Valley Mines regularly applying and receiving modified and amended consent conditions to expand their current operations and annual Run of Mine capacity.
- Anvil Hill has identified further coal resource to the south and west of the current open cut proposal and does not rule out seeking further mining approvals at a later date.
- Rehabilitation of site.

### ***Open cut coal mining process includes these biological steps:***

- Extinction of viable local populations of threatened species.
- Extinction of viable local populations of endangered ecological communities.
- Total loss of habitat for threatened species and endangered ecological communities in the area.
- Fragmentation and isolation from other habitats.
- Loss of habitat rich in biodiversity and known to be significant.
- Displacement of existing fauna forcing them to relocate to shrinking neighbouring habitat causing overpopulation, habitat and food resource competition.
- The killing of all small vertebrates and invertebrates unable to evacuate the excavation area.
- The loss of an important habitat and feeding ground for many migratory bird species that return to this area each year to feed, mate and raise their young.
- The loss of and habitat for pollinating species.
- The construction of bund walls (built environment) that can be 30 to 100 metres in height or more have the potential ability to change (Natural environment) the sunlight exposure with likely changes to ground moisture and photosynthesis processes of areas going from sunlight to deep shaded or to being in shadows.
- The removal of a large central portion of a natural wildlife corridor connecting the Wollemi National Park (part of the Blue Mountains World Heritage Area) and the Goulburn River National Park to the South with the Manobalai Nature Reserve to the North.
- The storage or burial of the removed timbers in overburden dump or in designated tree dump sites.
- The removal and disturbance of all topsoils and seed banks contained within soils at the excavation site.
- The loss of the fragile topsoil important to the unique biodiversity of the area. The Sandy Hollow, Lees Pinch, Wappinguy and Munghorn Plateau soils structures dominant the area. The larger proportion of the soils structure is the \*Sandy Hollow soils which are specific to this area only covering 400 square kilometres.
- The loss of an important genetic gene pool for indigenous seed production and its dispersal
- The removal, loss and disturbance of all the topsoil and sub topsoil microbes, macropods and associated insect life.
- The compaction of earth in and around the mine site by the use of heavy earth moving equipment.
- The removal and disturbance of all the substrata soil and rock layers to allow access to the coal seams, which may alter and interfere with the natural aquifer distribution and storage.
- Impacts on the natural flow of surface, sub surface and aquifer streams.
- Impacts on current and future natural aquifer, rivers and storages both in quality, quantity and availability.
- The contamination of the sub soils and aquifers by the loss of fuels and oils from operating plant.
- Changes to the known landscape and topography for many forms of wildlife that use this area as a map for their migration each year.
- Contamination to aquifer stream and storage's by the creation of large contaminated mine water storage dams and the leach down effect through subsoils.
- The impacts to Fauna and aquatic life that migrate/ nest/ breed/ drink and feed from the large storage dams containing contaminated mine water.
- Discharges of contaminated mine water into neighbouring streams and rivers during periods of high flow causing high salinity and turbidity of the water. The increased turbidity impacts on the ability of aquatic plants to photosynthesise and results in a loss of food source and habitat.
- Increase to background noise levels from blasting and use of technical equipment.

- The increased concentration in noise levels from mining both direct and indirect due to fold back effect from this area being in a natural depression and surrounded on most sides by hills.
- The increased concentration in noise levels from mining during times of temperature inversion layers, which traps mine noise.
- The use of diesel fuels which is contributing to the greenhouse effect.
- The mining of fossil fuels that is contributing to the greenhouse effect.
- The mining/ storage/ release of coal based gases (methane, etc) and the burning of fossil fuels as an end product, which is contributing to the greenhouse effect.
- The additional carbon particulate, sulphurs and other pollutions associated with the burning of fossil fuels like diesel used for coal extraction.
- Production of dust that will contain particulates of crystalline silica particles due to the Sandy Hollow, Lees Pinch, Wappinguy and Munghorn Plateau soils structures containing quartz and siliceous sands, that dominate the area.
- The increased concentration of particulates in the air from the above crystalline silica particles/ carbon particulate, coal dust, etc due to the area being in a natural depression and surrounded on most sides by hills.
- Edge effects to the surrounding bushland and habitat.
- Dust deposition can lead to the formation of layers or crusts, which physically hinder photosynthesis, slow carbon dioxide uptake and affect the rate of starch formation. In addition, the normal gas exchange between plant and atmosphere can be interrupted by the physical blocking of stomata. The toxicity and crusting problems are facilitated by moisture on the plant surface. In the first case the moisture takes toxic chemicals into solution for uptake of the plant, and in the second it may hydrate certain dusts causing crusts.
- The increased damage to adjacent Flora/ Fauna and agricultural activities on and off mine site from the above crystalline silica particles/ carbon particulate, coal dust, etc due to the area being in a natural depression and surrounded on most sides by hills.
- Use of contaminated mine water in dust suppression on mine haul roads, bund wall building and landscaping and the leach down effect through the soil, contaminating the soil and the aquifers below.
- The spraying of contaminated water and the resulting spray drifts onto adjacent Flora on and off mine site.
- Spontaneous combustion of exposed coal seams or coal stockpiles creating sulfurous fumes and release of Greenhouse gases.
- Changes to night sky. Sky appears to be constantly at sunrise or sunset due to mine lighting.
- Changes to night sky in times of low cloud or fog that reflects mine light pollution to illuminate a larger area surrounding the mine.
- The impacts to nocturnal Fauna that require a night sky to hunt.
- Low frequency vibrations that have human health concerns. Impact on fauna unknown to writer.
- Creation of remaining voids at completion of the coal extraction that collect and store contaminated water from runoff and contact with the remaining coal seams and polluted soils.
- The associated pollution from the coal washery operations.
- Contaminate due to the leach down effect or overflow of these voids into water streams/ aquifers and aquifer storages.
- Run off from rains over mine site increase contaminations to the aquifer, and also pick up increased concentrations of ground salts, tailings and other mine wastes.
- Rehabilitation that does not return the land to its pre-existing biodiversity.
- Rehabilitation that does not return the land to its normal substrata soil and rock layers.
- Resulting contamination from high concentration of contaminants in remaining voids tailings in dams/ dumps and the resulting leaching through the soil by water into the subsoils, streams/ aquifers and aquifer storages over time.
- Rehabilitation of surface areas by the planting of Native trees species tolerant to salinity and exotic pasture grasses.
- Non return to pre-existing floristic diversity.

# EPBC Act Policy Statement 1.1 –Significant Impact Guidelines

## ***1.Are there any matters of national significance in the area of the proposed action?***

1. Are there any matters of national environmental significance located in the area of the proposed action (noting that ‘the area of the proposed action’ is broader than the immediate location where the action is undertaken; consider also whether there are any matters of national environmental significance adjacent to or downstream from the immediate location that may potentially be impacted)?

**Yes.**

### **Matters of national environmental significance at Anvil Hill;**

The following list of matters found at Anvil Hill and within the mine study area is compiled from local community based surveys, community conservation projects that incorporated independent flora and fauna surveys over a number of years and Centennial Hunter records from studies undertaken by Umwelt and HLA.

The groups and organisations involved in the community-based surveys are;

1. Australian Museum
2. National Parks and Wildlife Service (DEC)
3. Hunter Bird Observers Club
4. Frog and Tadpole Study Group
5. Newcastle Frog and Reptile Society
6. Hawkesbury Herpetological Society
7. Australasian Native Orchid Society
8. WWF Threatened Species Network
9. New England University (Steve Debus)
10. Wanaruah Local Aboriginal Land Council
11. Anvil Hill Project Watch Association Inc
12. Blue Mountain Wilderness Services Pty Ltd, trading as Abel Ecology Services
13. T.L. White Heritage Consulting Services

## ***Flora and Fauna Species occurring at Anvil Hill***

### ***Flora***

1. *Diuris tricolor* (Vulnerable TSC and Vulnerable EPBC) Final determination as an Endangered Population in the Muswellbrook LGA under NSW TSC Act) This is the largest expanse of the local population in Muswellbrook LGA and will be entirely removed by the Tailings Pits and access road and associated mine disturbance.
2. White Box, Yellow Box, Blakely's Red Gum Woodland. Also known as White Box Grassy Woodland. (Critical Endangered Ecological Community EPBC Act and Endangered Ecological Community TSC Act) **See White Box-Yellow Box -Blakeley's Redgum DEH species list and comparison on page 25 of this report, with species identified at Anvil Hill – flora species sources -Abel Ecology Envirofund Report, Flora and Fauna, Withers Property (in the Study Area) and Centennial Hunter Anvil Hill Environmental Assessment, List of Flora Species present on the site.**
3. *Lasiopetalum longistamineum* (Endangered TSC and Vulnerable EPBC)
4. Weeping Myall Woodland /*Acacia pendula* (Endangered TSC and Endangered Population EPBC)
5. *Pomaderris reperta* (Endangered TSC, accepted for final determination for listing as Endangered EPBC) endemic to 2 ridge lines in the area- this is the largest population
6. *Bothriochloa biloba* (Vulnerable EPBC)
7. *Commersonia rosea* (Endangered TSC, accepted for final determination for listing as Endangered EPBC)
8. 1 brand new species of Green hood orchid - *Oligochaetochilus (Pterostylis) sp. aff. praetermissus* (ORG5019), Wybong Rustyhood, nominated endangered EPBC Act and TSC Act- endemic to the site

9. *Prasophyllum* sp. aff. *petilum* (nominated endangered EPBC Act and TSC Act) only found on 4 sites - this is the largest population and is found in situ with the *Diuris tricolor*  
Note; *Diuris tricolor* is also known as *Diuris sheaffiana* under the EPBC Act

### **Fauna**

1. Brush-tail rock Wallaby (scat) -Endangered EPBC Act
2. Large-eared Pied Bat- Vulnerable EPBC Act and Red listed by the IUCN (International Union for Conservation of Nature)

### **EPBC Act Migratory birds and those protected under international conventions BONN and Camba /Jamba Agreements.**

**JAMBA/CABA species listed flyway in Hunter estuary, will also be potentially impacted.**

1. Pacific Black Duck
2. Australian Wood Duck
3. Black Swan
4. White-throated Needle tail
5. Masked Lapwing
6. Rainbow Bee-eater
7. Brown Goshawk
8. Wedge-tailed eagle
9. Swamp Harrier
10. Spotted Harrier
11. Black Shouldered Kite
12. White Bellied Sea Eagle
13. Whistling Kite
14. Little Eagle
15. Black Kite
16. Brown Falcon
17. Australian Hobby
18. Peregrine Falcon
19. Nankeen Kestrel
20. Square-tailed Kite
22. Stubble Quail
23. Grey Teal
24. Australian Pelican
25. Straw-necked Ibis
26. Collared Sparrow Hawk
27. Pallid Cuckoo
28. Fan-tailed Cuckoo
29. Horsfield's Bronze Cuckoo
30. Southern Boobook
31. White-throated Nightjar
32. Forest Kingfisher
33. Scared Kingfisher
34. Dollarbird
35. Crested Shrike-tit
36. Magpie-lark
37. Rufous Fantail
38. Black-faced Cuckoo Shrike
39. Richards Pipit
40. Satin Flycatcher
41. Australian Owlet-nightjar
42. Great Egret *Ardea alba*
43. Fork-tailed Swift *Apus pacificus*

### **In addition- Threatened fauna that are likely to occur and with suitable habitat on the site**

For the species to be listed as 'likely to occur', suitable habitat must occur on the site and at least one of the following criteria must be satisfied:

1. Birds with a reporting rate of greater than 40% in The Atlas of Australian Birds (Blakers, Davies and Reilly, 1984) for the 1° block which encompasses the study area;
2. Mammals and reptiles, which are listed as common or abundant in standard reference texts (Strahan, 1983 for mammals; Ehmann 1992 for reptiles) and which include the site in their known distribution;
3. Frogs which are regarded as common or abundant by the Australian Herpetological Society or the Frog and Tadpole Study Group Inc. and which include the site in their known distribution. The status of species in this group is fluctuating, so some species may be of concern in particular areas.

### **Threatened fauna species likely to occur**

- *Lathamus discolor* - Swift Parrot (endangered)
  - *Xanthomyza phrygia* - Regent Honeyeater (endangered)
  - *Polytelis swainsonii*- Suberb Parrot (endangered)
  - *Dasyurus maculatus maculatus*– Spotted tail quoll (SE mainland population endangered)
- Centennial Hunter Environmental Assessment reports a possible call heard during their fauna surveys. Quote “During fauna surveys in 2004, a call was heard that was similar to the “circular saw” call known to be made by this species, however the call was too short and too distant to be able to verify.” Page 334 Environmental Assessment, Vol 4 Appendix 9A. Plus anecdotal evidence from community members of this species presence.**
- *Hoplocephalus bungaroides* - Broad-headed snake.
  - *Pteropus poliocephalus* - Grey-headed flying fox
  - *Nyctophilus timoriensis*- Greater Long-eared bat (vulnerable)
  - *Bush-stone curlew* - Past frequent records of breeding birds present on the site. Suitable habitat still remains. HLA Fauna and Flora Report for Bulk Sample

### **Threatened flora species that are likely to occur:**

- *Cynanchum elegans* (endangered)
- *Digitaria porrecta* (endangered)
- *Diuris pedunculata* (endangered)
- *Homoranthus darwinoides* (vulnerable)
- *Kennedia retrorsa* (vulnerable)
- *Ozothamnus tessellates* (vulnerable)
- *Persoonia marginata* (vulnerable)
- *Prostanthera cineolifera* (vulnerable)
- *Prostanthera cryptandroides* (vulnerable)
- *Prostanthera discolor* (vulnerable)
- *Rulingia procumbens* (vulnerable)
- *Thesium australe* (vulnerable)

## **Wetlands**

### **Hunter Estuary Wetlands and the Macquarie Marshes Nature Reserve**

Both the Anvil Hill mine and the associated coal loader infrastructure will potentially impact Ramsar sites in the Hunter estuary with direct and indirect impacts on the Hunter Catchment.

- The Anvil Hill mine proposal is on the Wybong Creek Catchment, which is largest western Catchment of the Hunter River in the Muswellbrook local government area. It is part of the Hunter/ Goulburn River Catchment for the Hunter Estuary Wetlands and the Macquarie Marshes.

- The Anvil Hill mine will have direct and indirect impacts on water quality and availability to these wetlands.

- The Anvil Hill mine will modify or inhibit ecological processes in Ramsar Wetlands through the direct and indirect impact of Global Warming.

## ***World Heritage properties***

### **Adjoining World Heritage listed sites; – Wollemi - Blue Mountains World Heritage Area - Barrington Tops (Central Eastern Rainforest Reserve (Australia))**

Wollemi National Park to the south of Anvil Hill is part of the World Heritage listed Greater Blue Mountains World Heritage area and the Barrington Tops, part of the Central Eastern Rainforest Reserve (Australia) is to the north east. The Anvil Hill location is part of a regional corridor connecting these two sites.

The Anvil Hill mine has the potential to modify or inhibit ecological processes in these World Heritage Properties through direct and indirect impact of Global Warming.

## ***National Heritage places-***

### **Pickering House and its as outbuildings**

- Historic Pickering house and its outbuildings and surrounding lands are within the area identified by Centennial Hunter as being affected by the mining operation by noise, dust and blasting. (Known as the area of affectation)

- The Anvil Hill area has significant European and Aboriginal Heritage values.

- The Anvil Hill location has many sites of European early settlement with homes, structures and gravesites > 100 years. Two of the local families who will be displaced by the development have been in residence for 4 and 5 generations.

- The area was nominated as a Natural Heritage Landscape through Muswellbrook Shire Council. The nomination was ignored and attempts to proceed the application failed.

- Department of Environment and Conservation have raised concerns regards minimal to severe and destructive blast and vibration damage to the natural landscapes of Anvil Hill, Anvil Rock, The Book, Wallaby Rocks and the Limb of Addy.

- For further information on the European and Natural Landscape values of the area please contact Lillian Cullen- Heritage advisor and consultant on mobile 0411 828 014

- For further information on the Aboriginal Heritage values of the area please contact Trudy White, T.L. White Heritage Consulting Services on mobile 0403 534 814 or (07) 4635 0390

## ***Adjoining Commonwealth Land***

### **Myambat military camp**

Department of Environment and Conservation have raised concerns regards minimal to severe and destructive blast and vibration damage to the natural landscapes of Anvil Hill, Anvil Rock, The Book, Wallaby Rocks and the Limb of Addy. The Environmental Assessment is inadequate in its assessment of blasting impacts on the landforms in the general region. Centennial Hunter has been informed by the locals that blast vibrations from Myambat military Camp are frequently felt at Wybong. Blasting at any location along the fault lines will likely carry blast vibration and a potential for landslips in the steep ridgelines that surround the mine location and the Myambat Army Camp. The area has experienced two (2) severe landslips in the steep ridge country in 2006.

## ***Natural***

### **Goulburn River National Park NSW**

### **Wollemi National Park NSW**

### **Manobalia Nature Reserve NSW**

- The Anvil Hill mine has the potential to modify or inhibit ecological processes in these Natural listed properties through direct and indirect impact of Global Warming.

- The Anvil Hill area was nominated as a Natural Heritage Landscape through Muswellbrook Shire Council. The nomination was ignored and attempts to advance the application failed.

- Department of Environment and Conservation have raised concerns regards minimal to severe and destructive blast and vibration damage to the natural landscapes of Anvil Hill, Anvil Rock, The Book, Wallaby Rocks and the Limb of Addy.

- For further information on the European and Natural Landscape values of the area please contact Lillian Cullen- Heritage advisor and consultant on mobile 0411 828 014

## Considering the proposal action at its broadest scope, is there any potential for impacts on matters of national significance?

2. Considering the proposed action at its broadest scope (that is, considering all stages and components of the action, and all related activities and infrastructure), is there potential for impacts, including indirect impacts, on matters of national environmental significance?

**Yes.**

Centennial Hunter has failed to adequately address the broad scope of likely direct and indirect and cumulative impacts on matters of national significance.

- Centennial Hunter have failed to inform the Minister of any potential future intention or possibility to expand this current mine proposal to further allow access to the some 500 million tones of coal mineral resource identified under the exploration license. This could be by open cut and/or underground mining methods. Centennial Hunter has indicated that this it is not part of their current mine plan but do not dismiss the possibility of a future expansion to the current plan.

- In regards to Global Warming and Climate Change and the broad scope impacts, Centennial Hunter claim in their referral document to the EPBC that the proposal is likely to have negligible or extremely small and insignificant impacts from its contribution to global warming even considering 3<sup>rd</sup> party users. The following excerpts from reports found on the Department of Environment and Heritage website suggest that even a less than 1% contribution to global warming is likely a significant impact.

### United Nation's Intergovernmental Panel on Climate Change

The 2001 report of the United Nation's Intergovernmental Panel on Climate Change concluded that Australia's biodiversity is highly vulnerable to the changes in temperature and rainfall that are projected to occur over the next 100 years. This is partly because many Australian species have quite a limited range of climate in which they can survive. Climate change would pose a threat to any species found in areas that are near the upper limit of their temperature range or in areas from which they cannot migrate. Especially vulnerable areas are the Australian Alps, coral reefs, South-West Western Australia, upland tropical rainforests, arid and semiarid habitats, freshwater wetlands and riverine environments. (*National Biodiversity and Climate Change Action Plan 2004-2007*)

### National Biodiversity and Climate Change Action Plan 2004 – 2007

Natural Resource Management Ministerial Council  
Department of the Environment and Heritage, 2004

#### **Objective 3: To minimise the impacts of climate change on inland aquatic and semi-aquatic ecosystems**

Climate change may alter hydrological cycles, thus affecting species and ecosystems that are dependent on inland rivers, wetlands and groundwater systems. However, projected changes in rainfall are highly uncertain and vary from region to region (CSIRO 2001).

Lagoons and lakes can be important habitat for flora and fauna vulnerable to climate change.

Climate change projections suggest that there will be a tendency towards a reduction in rainfall over many areas of southern Australia. This tendency will be more evident in spring, winter and, for the far south, in autumn (CSIRO 2001). If these changes occur there will be consequent reductions in the mean flow of many rivers (IPCC 2001b). The projected drying may seriously affect many inland wetlands, threatening the reproduction of migratory birds that depend on wetlands for their breeding cycle (Hassall and Associates 1998).

Projections also suggest a potential increase in extreme daily rainfall in many regions, even where average rainfall will decrease (CSIRO 2001). If these trends eventuate in the north, this will increase the risk of flooding and increase sediment loads, nutrients and pollutants in northern Australian rivers (IPCC 2001b). Any of these impacts could negatively affect the biodiversity of riverine environments, as well as estuaries and coastal wetlands.

Inland aquatic and semi-aquatic species and ecosystems could also be affected by projected increases in temperature. Such changes in the climate may potentially alter the distribution of fish species lead to loss of habitat for cold- and cool-water fish, and increase the habitat of warm-water fish (IPCC 2001b). Some

freshwater invertebrate species and riparian vegetation could also potentially be threatened by temperature changes.

Current environmental stresses on aquatic and semi-aquatic ecosystems, such as modified flow regimes (from dams, weirs and irrigation), habitat destruction, altered patterns of salinity, eutrophication, algal blooms and invasive organisms, will potentially increase the vulnerability of freshwater biodiversity to climate change.

**Objective 4: To minimise the impacts of climate change on marine, estuarine and coastal ecosystems.** Changes in ocean temperature and currents affect many aspects of ocean biology. As the climate warms, it is possible that the distribution of many marine species will change, with populations contracting or expanding at the edge of their climatic range (IPCC 2001ab). In the northern hemisphere, there is evidence that the deep ocean circulation is weakening in response to recent warming (Hakkinen and Rhines 2004).

Oceanographic modelling indicates that the subsidence of cold and super-saline water in the Antarctic may reduce or cease completely with substantial global warming (Bi *et al* 2001). This would significantly change deep ocean chemistry and dynamics as well as affect marine life (IPCC 2001ab). For example, it could affect populations of species such as copepods that spend part of the year in the deep ocean and migrate seasonally to the surface where they form the basis of many marine food chains (IPCC 2001ab).

Extreme rainfall and tropical cyclones could become more intense under climate change, particularly on the coast.

Climatic and atmospheric change has the potential to directly affect the Great Barrier Reef (GBR) and other coral reefs globally, either directly or by exacerbating the effects of other pressures (Hughes 2003). There is not enough information currently available to project the impact of climate change on the productivity of Australian fisheries. However, studies that have examined the relationship between climate variation and the recruitment of some fish species indicate that Australian fisheries will be sensitive to climate change (IPCC 2001b). Recent observations of seabird population dynamics indicate that impacts on fish populations are already occurring and are having flow-on effects to marine predators (Dunlop and Wooller 1990; Dunlop 2001).

Changes to catchment hydrology, such as increases in summer rainfall in northern Australia (see Objective 3), will potentially also affect coastal wetlands and estuaries due to the increased risk of floods (IPCC 2001b). Many coastal freshwater wetlands, including wetlands in Kakadu National Park, are also at risk from saltwater inundation as sea levels rise (Mulrennan and Woodroffe 1998). Existing pressures that threaten marine, coastal and estuarine ecosystems, such as fishing, tourism, invasive organisms, pollution and coastal development, are likely to make these systems more vulnerable to the impacts of climate change.

Over the next three years, all jurisdictions will begin to identify marine, coastal and estuarine species and ecosystems that are vulnerable to climate change and consider ways to protect these species and ecosystems and to reduce the impacts of threatening processes. The coastal areas of Australia are rich with biodiversity that may be vulnerable to climate change.

**Objective 5: To minimise the impacts of climate change on native terrestrial species, communities and ecosystems.**

Climate change will potentially alter the abundance and distribution of species and the distribution and composition of terrestrial ecosystems. Indeed, the survival of some species may depend on changes to their distribution. The likelihood that these shifts will occur will be determined by the rate and degree of warming, the ability of species to disperse, and the existence of suitable alternative habitats within modified landscapes. Additionally, maintenance of populations in situ and successful establishment of new populations and assemblages will be constrained by the effects of land degradation, competition from invasive organisms and altered fire regimes.

Any increase in the duration, intensity and frequency of droughts, storms, fires and floods has the potential to negatively affect terrestrial biodiversity. For example, extended drought periods could reduce the soil moisture that is necessary to support plant growth.

Responses to individual species threatened by climate change may include translocation to new areas that are likely to be more climatically suitable. However, this is a risky and highly expensive alternative and may result in funds not being available for other actions. Therefore, for most species, the preferred and most practical option is to retain, restore and protect their existing habitat, so that the whole ecosystem becomes more resilient.

**Objective 6: To minimise the impact of invasive organisms on biodiversity in future climates**

The introduction and spread of alien invasive organisms poses a significant threat to Australia's terrestrial, marine and freshwater biodiversity.

Climate change is expected to increase the risk of invasion by alien organisms, including pests, weeds and diseases from neighbouring territories (IPCC 2001b). Climate change may also favour some established alien and native organisms that are currently restricted in range, causing them to become invasive (Baskin 1998). As climatic zones shift, invasive organisms that are capable of rapid dispersal and establishment have the potential to invade new areas, increasing the threat to native species and ecosystems.

Climate change may increase the risk of invasion by alien organisms, including weeds. An employee of Burdekin Shire, Queensland, spraying Chinese apple on a Woodhouse property, near Clare (© CSIRO Land and Water).

There is evidence that climate change is already increasing the impact of alien invasive species on biodiversity. For example, on subantarctic Macquarie Island, rats are being found in upland herb fields, where they were previously unrecorded, and are now having a negative impact on native plant species (Bergstrom 2003).

As it is almost impossible to eradicate species once they become invasive, it is critical that species that could potentially become invasive with climate change are not introduced into Australia. Introductions that could pose such a problem include ornamental plants, fish or other animals; commercial species; diseases or pathogens.

**Objective 7: To factor the impacts of climate change on biodiversity into natural resource management and land-use planning**

Australia's biodiversity conservation and natural resource management policies aim to reduce the decline in biodiversity from current threatening processes and enhance ecosystem resilience and sustainable use of natural resources. The extent to which these policies and programs address the potential effects of climate change varies.

A major aspect of this Action Plan is the need to include the consideration of the impact of climate change as a component of core business for all biodiversity conservation initiatives.

The rationale for this approach is two-fold.

Integrating climate change considerations into biodiversity programs is the most cost-effective way to deal with climate change, as these programs already have the infrastructure, mandate and encapsulated knowledge to address the issues.

There is a need to reassess biodiversity program goals, given the potential for climate change to undermine conservation effort (ie by increasing the opportunity for the spread of invasive species).

As a starting point, it may be necessary to review biodiversity programs (and natural resource programs generally) in order to ensure the short-term preservation of species and ecosystems, and to facilitate the long-term adaptation to climate change of biodiversity components. *National Biodiversity and Climate Change Action Plan 2004 – 2007*-Natural Resource Management Ministerial Council Department of the Environment and Heritage, 2004

***All stages and components of the action, and all related activities and infrastructure and Considering Cumulative Impact***

There is inadequate consideration of the Anvil Hill proposals cumulative contribution to global warming and climate change and inadequate considering all stages and components of the action, and all related activities and infrastructure. As follows;

1. The Anvil Hill Open Cut Coal Mine Project is linked to the expansion of the coal export capacity of Newcastle Port via the NCIG (Newcastle Coal Infrastructure Group) Project, which will increase port capacity, by another 66 million tonnes per annum. (Centennial Hunter Pty Ltd is a wholly owned subsidiary of Centennial Coal Ltd). An excerpt from their 2005 Annual report follows:

*“Pleasingly, the NSW Government recently announced that it had agreed to grant NCIG the right to develop and operate a new coal-loader at the Port of Newcastle, adding a further 30 million tonnes export*

capacity. Australian Rail Track Corporation has also committed \$270 million to upgrade the necessary railway infrastructure. **Together, these two developments are a significant boost to Centennial's growth plans, providing greater certainty that adequate port capacity should be available to support plans to commence exporting from Mandalong and Anvil Hill.**" CENTENNIAL COAL COMPANY LIMITED ANNUAL REPORT 2005 (highlighted by C Phelps)

2. The Anvil Hill proposal is one of a consortium of coal mining development proposals and existing mine capacity expansions planned in the Hunter Valley that are linked and dependent on the development of the NCIG coal loader.

3. NCIG is a consortium of six coal companies including: Hunter Valley Energy Coal Limited; Centennial Coal Company Limited; Donaldson Coal Pty Ltd; Excel Coal Limited; Felix Resources Limited; and Whitehaven Coal Mining Pty Ltd. Indeed the justification for the NCIG Project from the Executive Summary of the Environmental Assessment demonstrate this point, as follows;

#### **ES4 STRATEGIC PLANNING AND JUSTIFICATION FOR THE PROJECT** **Export Demand and Supply of Hunter Valley Coal to the Port of Newcastle**

*The ability for NSW coal producers to export coal through Newcastle is constrained by the capacity of the Hunter Valley coal supply chain.*

*As part of an Australian Government initiative, the Federal Department of Industry, Tourism and Resources commissioned the Australian Bureau of Agricultural and Resource Economics (ABARE) to assess:*

- the current and future demand for coal from the Hunter Valley;*
  - the capacity of coal producers to meet current and expected future demand for coal from the Hunter Valley;*
  - whether current rail and port infrastructure is sufficient to support estimated coal exports from the Hunter Valley over the medium term;*
- and*
- the potential economic costs of infrastructure constraints in the Hunter Valley coal supply chain.*

*The ABARE study found that demand for Hunter Valley coal is strong and predicted that, as a medium case, potential demand for coal exports from the Hunter Valley will increase at an annual rate of 2.8% per annum from the 2004 level of 78 Mtpa to 122 Mtpa in 2015. Further, ABARE estimates that at a coal price of US\$35/t, producers could supply between 130 Mtpa and 140 Mtpa of coal by 2015 if unconstrained by the coal supply chain. If coal prices were US\$50/t then the ABARE report indicates coal producers could supply over 200 Mtpa of coal by 2015 if unconstrained by the coal supply chain. The 2006 ARTC Hunter Valley Corridor Capacity Improvement Strategy indicates that the ARTC planning for export demand rises from approximately 104 Mtpa in 2006 to 145 Mtpa in 2011, and possibly as high as 157 Mtpa by 2015.*

*These demand predictions are based on consultation with the coal mining industry.*

*The ability of individual Hunter Valley coal producers to meet potential market demand for their coal depends on there being sufficient capacity in the coal supply chain (i.e. railway and port infrastructure) to facilitate export. The estimated coal supply chain capacity in 2005 was 85 Mtpa. This included the capacity of PWCS (Kooragang Island and Carrington) at 89 Mtpa and the rail system capacity of approximately 85 Mtpa. Export of coal through the Port of Newcastle totalled approximately 81 Mtpa in 2005. PWCS has an existing approval to expand the combined capacity of its Kooragang Island and Carrington coal terminals to 102 Mtpa. Similarly, the ARTC has a planned programme of rail infrastructure improvements to maintain rail capacity ahead of anticipated coal export demand.*

*Consideration of the ABARE and the ARTC coal demand and supply scenarios indicates that even with the planned increase in PWCS port capacity to 102 Mtpa, **the ability for coal producers to meet potential export demand through the Port of Newcastle is expected to be constrained if the Project were not to be developed.** (ES-36-37) (Highlighted by C Phelps)*

#### **Role of the Project**

*While there is uncertainty around future coal prices and export demand, it is evident that there are potentially very significant economic benefits to the Australian economy that would be foregone if port capacity limits the ability of Hunter Valley coal producers to meet export demand.*

*The Project, when constructed to an initial capacity of 33 Mtpa would provide significant additional port capacity to meet the expected increases in coal export demand in the short to medium term. The Project would also provide the ability to expand export capacity up to 66 Mtpa to meet further growth in demand and therefore realise the potential economic benefits. **Executive Summary of the NCIG Environmental Assessment pages 36 and 37***

## *Cumulative Impacts and case law.*

- The use of coal as a fossil fuel is the main causation of the continued rise in greenhouse gases and the resulting climate change that fuels extended droughts, changes in rainfall patterns, increases in average temperature, changes in seasons, increases in extreme weather events and rising sea levels.
- In regards to the direct, indirect and cumulative impacts such as extinction of localised populations, loss of genetic diversity, habitat removal and loss of corridor connectivity, stream and watercourse diversion and stream and aquifer contamination; Centennial Hunter fail to adequately consider the broad scope considerations.

As found in the;

### **Brown v Forestry Tasmania, Commonwealth of Australia and State of Tasmania (No. 4) FCA 1729 (19 December 2006) ["Wielangta case"]**

Cumulative impacts should often be taken into account in assessing significant impact.

### **Gray v the Minister for Planning and Ors [2006] NSWLEC 720**

Justice Pain said:

"In *Minister for Environment and Heritage v Queensland Conservation Council Inc* (2004) 139 FCR 24 the full Federal Court held at [53] that "impact" in its ordinary meaning can readily include the "indirect" consequences of an action and may include the results of acts by people other than the principal actor. The court also held that the EPBC Act required consideration of:

... effects which are sufficiently close to the action to allow it be said, without straining the language, that they are, or would be, the consequences of the action on the protected matter.

[91] While that finding on "effects" is focused on the relevant protected matter as referred to in the EPBC Act, it is equally applicable to consider effects which may harm the environment in NSW, whether these be direct or indirect.

### **Queensland Conservation Council Inc v Minister for the Environment and Heritage [2003] FCA 1463**

In that decision Kiefel J quoted from a NZ case:

"The New Zealand Court of Appeal has cautioned against site-specific limitations being applied to environmental impacts. In *Environmental Defence Society Inc v South Pacific Aluminium Ltd (No 4)* (1981) 1 NZLR 530 at 534, the Court said:

Obviously there must be a real and sufficient link between the less direct effects likely to flow from projected works if they are to be regarded as relevant. But it could not be Parliament's intention that in every context a discussion limited to site-specific environmental implications will satisfy an applicant's responsibility to provide a realistic impact report. If that were the case the 'green light' could well be given to some major industrial project which involved insignificant environment implications considered by reference only to the site itself, but manifold and adverse effects when assessed against the further construction of another undertaking which alone could give it industrial meaning and with which it would clearly be inextricably involved."

These cases strongly suggest that the question whether there are likely to be significant effects upon the environment requires a wide consideration of the consequences which will follow if a proposed activity proceeds. The question for the Environment Minister under the EPBC Act is to the same effect. In considering whether an action is 'controlled' by a provision of Pt 3 the Environment Minister is to determine whether the proposed action is likely to have a 'significant impact' on an area or species. One would think that when the EPBC Act was prepared it would have been known that an enquiry as to any likely significant effects of an action had been regarded by the courts as one requiring a full examination.

The words used in s 75 and the process to be undertaken also support a wider enquiry than the Environment Minister undertook. In arriving at the ultimate conclusion, that an action is or is not a 'controlled action', one which is likely to have a significant impact on an area or species, the Environment Minister is first to consider 'all adverse impacts' the action is likely to have. This suggests that the widest possible consideration is to be given in the first place, limited only by considerations of the likelihood of it happening. By that means the Environment Minister will exclude from further consideration those possible impacts which lie in the realms of speculation. The Environment Minister would then determine whether they were significant. 'Likely' and 'significant' are sufficiently clear in their meaning. In any event there is no issue about their meaning in the present case. That the Environment Minister's enquiry under s 75 is a wide one, is I consider, consistent with the high public policy apparent in the objects of the Act. No narrow approach should be taken to the interpretation of legislation having objects of this kind: *Marks v GIO Australia Holdings Ltd* (1998) 196 CLR 494 at 515, 528, 537. In my view the Environment Minister did not undertake the full enquiry required by

s 75. The ground for review is made out. There will be declarations in terms of the orders sought in paras 1, 2 and 3 of the application.

**Minister for Environment v Queensland Conservation Council (2004) 139 FCR 24; (2004) 134 LGERA 272.**

[57] As mentioned previously, it is undesirable in the circumstances for this Full Court to attempt to paraphrase the expression in s 75(2) to which we have just drawn attention. Nor is it appropriate to essay an exhaustive definition of "adverse impacts" which an "action" within the meaning ascribed by s 523 may be likely to have. It is sufficient in this case to indicate that "all adverse impacts" includes each consequence which can reasonably be imputed as within the contemplation of the proponent of the action, whether those consequences are within the control of the proponent or not.

## **Are there any proposed measures to avoid or reduce impacts on matters of national environmental significance?**

3. Are there any proposed measures to avoid or reduce impacts on matters of national environmental significance (and if so, is the effectiveness of these measures certain enough to reduce the level of impact below the 'significant impact' threshold)?

***Yes – no open cut mine development approval.***

Centennial Hunter refer to mitigations measures in the EPBC referral as Rehabilitation, Revegetation and Regeneration of post mining landscape and Biodiversity offsets that are reliant on the purchase of properties that are under no obligation to sell to them, on revegetating areas that are currently agricultural lands, and on management plans that at this stage do not exist and no-one can review for adequacy.

Department of Environment and Conservation raised many concerns with Centennial Hunter's mitigation and offset strategies, in their submission to the Independent Hearing and Assessment Panel (IHAP); an outline of these concerns follows;

### **DEC Submission to IHAP on the Anvil Hill Project Environmental Assessment Page 11-12- (Full Submission attached as appendix.)**

#### **3. Threatened Species**

**3.1 Key Impacts** A major direct impact on biodiversity will be the progressive clearing of all treed vegetation. Approximately 1304 hectares, within the proposed disturbance area. In total , more than 2250 hectares of vegetation will be removed.

The loss of this vegetation is likely to have a significant impact on the two threatened flora species and thirteen threatened fauna species that have been recorded in the Proposed Disturbance Area.

**3.2** There is little opportunity to significantly ameliorate the direct impacts described [above]. Consequently, a Biodiversity Offset Strategy has been proposed to reduce the severity of the impacts of the Project on threatened species, populations, communities and their habitats.

#### **3.2.1 Biodiversity Offset Strategy**

There is lack of clarity regarding the short term (mine-life) and long-term (post-mine closure) land use/management objectives, land ownership and management of most of the lands proposed for inclusion in the various land management strategies and categories. Some lands appear to fall into more than one land management category. ... It is not clear whether all or only some of the lands identified within the conceptual corridor are proposed to be acquired by Centennial. ....It is also unclear what Centennials approach will be to a situation where a landholder refuses to sell land that falls within these areas, particularly where it forms an important link between previously acquired lands.

.....The EA also lacks detailed information regarding the short and long-term proposed management of the various land use/ management categories. (and so on.....)

Lastly there is also a lack of information regarding the short and long-term funding of the proposed management of the various land use/management categories. (and so on.....)

#### **3.2.2 Proposed Biodiversity Offsets**

.....Although virtually all of the mine area and more than 500 hectares of the Proposed Offset (Biodiversity) Areas will be rehabilitated with treed vegetation, totaling almost 1300 hectares of such vegetation, the

number of species to be employed is small and mostly restricted to trees. 597 plant species have been recorded from the study area. Consequently, the revegetation will re-introduce only a fraction of the original floristic diversity and it will be many years before the fauna and flora diversity of the revegetated areas approaches the biodiversity of the treed vegetation, particularly the possible old growth areas around Limb of Addy

### 3.2.3. Principles for achieving biodiversity offsets

The EA lists the offset principles identifies in the DEC 2005 Bio-banking Working Paper and state these principles have been considered in the development of the Biodiversity Offsets Strategy for the Project.

DEC outlines four (4) offset principles that it feels have not been adequately addresses in the EA.

For example .....**Offsets must be enduring- they must offset the impact of the development for the period that the impact occurs (as impacts on biodiversity are likely to be permanent, the offset should also be permanent). While land management is donated to a public authority or a private conservation organization and managed as a biodiversity offset, it should be accommodated by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the require actions.**"

DEC does not consider this principle has been adequately addresses in the EA.and seeks: .....and so on.....

### Anvil Hill Project Watch Association also say:

- Centennial Hunter fails to address the indirect impacts of the project.
- Centennial Hunter underestimates the impacts of the loss of local populations and connectivity of the regional corridor.
- Centennial Hunters proposed offset strategy is inadequate in that it is not like for like. The proposed offset area is largely made up of sandstone outcrops and ridgelines and their immediate footslopes immediately adjoining the open cut mine.
  - The offset strategy does not counter the impacts of habitat and food source competition between threatened species and the more dominant and common native species in high numbers and diversity already inhabiting the proposed off set areas in.
  - The offset strategy does not adequately consider edge effects on the proposed offset areas.
  - The offset strategy does not adequately consider the implications of climate change and a continued reduction in regional rainfall on the viability of the site and of their rehabilitation proposals or mining operation dust suppression viabilities.
  - The offset strategy does not adequately consider the water drawdown from the mining operation on the localised water table, the changes in aquifer hydrology and the implications of that on the proposed offset areas.
  - The offset strategy does not adequately consider the implications of the remaining permanent drawdown to the sink created by the mine void and the gradual increase in salinity from this void on the offset and rehabilitated areas.
  - The proposed Wybong Upland Land Management Strategy does not mitigate the loss of the Wybong Uplands as identified and valued in the Hunter Remnant Vegetation Report (HRVR) but transfers the name to other areas of unlike values. This use of the Wybong Uplands name could potentially mislead those assessing the impacts, to assuming or believing that the Wybong Uplands with the conservation values (HRVR) are being retained.

## Are any impacts of the proposed action on matters of national significance likely to be significant impacts?

Are any impacts of the proposed action on matters of national environmental significance likely to be significant impacts (important, notable, or of consequence, having regard to their context or intensity)?

Yes.

- Disruption of local viable populations of species that are likely to be placed at risk of extinction.
- A significant area of known habitat of threatened species will be modified and removed.
- Removal and isolation of populations through loss of interconnectivity.
- Loss of species at the limits of their known distribution.
- The direct and indirect cumulative contribution to global warming and climate change.

- The actions and scale of open cut mining are unavoidably destructive. See “Open cut coal mining process includes these non-biological steps and these biological steps on pages 7 and 8 of this document.”
- The mine will operate 4 pits consecutively over a 21-year period. (in the first application)
- Removal of a large area of White Box-Yellow Box- Blakely’s Wood gum Critically Endangered Ecological Community
- Removal of a largest proportion of the valley floor woodland, associated grasslands, food sources, habitat, and water sources that support a high diversity of threatened species (EPBC) as well as other native species.
- Disturbance is over a 21-year period with a real and likely potential for extensions and expansions on the current application.
- Edge effects.
- Changes in stream and aquifer water quantity and quality and the direct and indirect impacts on the Hunter Catchment and downstream Ramsar Wetlands.
- Permanent drawdown on regional water table and changes to hydrology of the aquifers.
- Removal of the largest population (Endangered population TSC Act) of *Diuris tricolor* in the Muswellbrook LGA.
- Removal of the largest known population of *Prasophyllum* sp. aff. *petilum* (nominated endangered EPBC Act) in known existence.
- Rehabilitation plans that do not return the area to pre mining floristic diversity.
- Dust distribution. Dust deposition on plants can also lead to the formation of layers or crusts, which physically hinder photosynthesis. (Air Quality and resource development- a risk assessment in the Hunter Region in Australia. A.J. Jakeman and R.W Simpson 1987)
- Blasting and vibration disturbance on offset areas;

## Specific Notes on Species

### *Chalinolobus dwyeri*

In the case of *Chalinolobus dwyeri* (Large-eared Pied Bat). This species is cave and overhang dependant for roosting habitat. The mine places this entire habitat at risk.

NSW Department of Environment and Conservation (DEC) found that blasting from the mine would have a direct impacts on the rock structures, caves, over hangs etc on Anvil Hill, Limb of Addy, Wallaby Rocks etc in the proposed offset areas. These are the roosting habitat of the *Chalinolobus dwyeri* (Large-eared Pied Bat.)

The NSW Department of Environment and Conservation submission to the Independent Hearing and Assessment Panel on the Anvil Hill Mine proposal raised these concerns as follows;

*“DEC Notes that the geotechnical report prepared by RCA Australia states that there are multiple blast related impacts that could occur to rock shelters as a result of mining activities, ranging from potential cosmetic or minor damage to rock shelters in the vicinity of the mine (all sites vulnerable) to major damage. Dec also notes that the range of ‘Estimated Significant Thresholds’ varies from 90mm/s at Anvil Rock to 210-270mm/s at many of the remaining rock shelters and that in year 15 of operations, vibration levels are predicted to exceed significant damage thresholds for four rock structures including the land mark Anvil Rock and The Book.”*

It is noted that damage would be incurred in these various cave and rock formations. This impact on the roosting habitat of the species *Chalinolobus dwyeri* (Large-eared Pied Bat) has not been considered.

### *Diuris tricolor*

Centennial Hunter appears to have difficulty deciding if they will or won’t have a significant impact on a local population of *Diuris tricolor*. Initially in the Environmental Assessment, they identified only one specimen of this species on the road side verge out of the Project Area. On the basis of this and likely habitat, they identified potential **significant impacts** on this species in the Project Area.

In early October 2006 and prior to the IHAP hearing Centennial Hunter and Umwelt was informed that a large population of *Diuris tricolor* and *Prasophyllum* sp. *Aff.petilum* (the largest known population) was identified in grasslands on the location of their proposed tailings pits. Centennial and Umwelt were sent all the GPS points, descriptions and maps identifying the species locations. In addition to this, they were informed that the species had a maximum of likely 4 days of flowering period left, so they could go out and confirm these finds themselves. They did not go out to the site for near on 3weeks later and only found one specimen.

Then in their Response to Submissions PART B page 2.11– November 2006 they have gone from stating a significant impact on a local viable population to stating that the Project is not expected to cause local or regional extinction of the species.

In their referral to the EPBC January 2007 (page 14) they state it is not likely that the Project will result in a significant impact on an important population of this species.

Using the approach of Centennial Hunter it would seem the larger and more important the local population you disconnect, remove and /or make locally extinct, the less impact you will have this species despite the complete removal by the Project of the largest extant population known in the Muswellbrook local government area

They have not mentioned the *Prasphylum sp. Aff. petilum* at all in their EPBC referral, and while we are aware that it is not yet accepted as an endangered species, it has been nominated and this population is a very important find. Centennial Hunter and Umwelt were made aware of this , being forwarded all the information as it came to hand to Anvil Hill Project Watch Association (AHPWA). If they were putting forward a detailed and truthful referral we contend they would have included this information in their EPBC Referral.

Follows are excerpts from the Anvil Hill Environmental Assessment followed by an excerpt from the Centennial Hunter Response Part B to submissions to the IHAP hearing. Note the inconsistencies in the opinion of impacts.

### **Anvil Hill Environmental Assessment**

Centennial Hunter's Anvil Hill Environmental Assessment Vol 4-Appendix F- pages 72-73.makes the following statements in the case of *Diuris tricolor* (*Painted diuris*, *Diuris Shaffeanna*), on the basis that they found one single specimen in the roadside and off the mine site.

#### **a) Whether the life cycle of the species is likely to be disturbed such that a local viable population of the species is likely to be placed at risk of extinction**

*The study area provides some habitat for this species, mainly within the proposed disturbance area. As this species is particularly difficult to identify, it is likely that this species would be present more abundantly than recorded within the Proposed Disturbance Area. If this were so, there is the potential that a (possibly) large population of this species could be removed as a result of the Anvil Hill Project*

*The Anvil Hill Project will require the removal of a large area of vegetation within the Proposed Disturbance Area. There is a moderate chance that this species could occur within the Proposed Disturbance Area as a large population, there is a reasonable chance that the Anvil Hill Project could place a (potential) population of this species at risk of extinction. It is likely that the Anvil Hill Project will disrupt the life cycle of this species, such that a local viable population of this species may be placed at risk of extinction.*

#### **b) In relation to regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or, removed, or isolated from currently interconnecting or proximate areas.**

*There are only a small number of records of this species from the Hunter Valley, with the majority of these records being from a small cluster around Muswellbrook. An outlying record exists from Gungal.*

*There is the potential that a population of this species could be placed at risk of extinction. In particular, the Anvil Hill Project would have the potential to fragment a population of this species, thus further increasing the risk of local extinction. It is likely that the Anvil Hill Project could cause a significant area of potential habitat to be modified or removed, or isolated from currently interconnecting or proximate areas of known habitat for this species. ."*

#### **d)Whether the species is at the limit of its known distribution.**

*The Muswellbrook local government area is the eastern limit of the species range and the only recorded occurrence of painted diuris (*Diuris tricolor*) in the Sydney Basin Bioregion. The record of this species from the Study Area is likely to be at, or approaching, the eastern limit of the known distribution of this species.*

## **Centennial Hunter Response Part B to Submissions**

Response Part B to submissions to the IHAP -Page 2.11

*Diuris tricolor* was recorded on a single occasion within the POA. Further records of this species occurring in the PDA were provided by Anvil Hill Project Watch Association (AHPWA). The Ecological Assessment acknowledged that this species was likely to occur more extensively within the PDA , and the POA, and assessed the impact on this species based on that likelihood. The Study Area records from part of a larger known population of this species located within the Wybong District, which is known to contain may hundreds

of plants (*T Peake unpubl. data*). The outcome of the assessment was, that the Project was not expected to cause local or regional extinction of the species.

## Inconsistency of information

*I draw to your attention that under s.489 of the EPBC Act it is an offence to recklessly or negligently provide information that is false or misleading in a material particular when seeking approval.*

**On page 27 of Centennial Hunter's EPBC Referral it is asked;**

For information given in sections 3 and 4 of this referral, please indicate

- (a) the source of the information
- (b) how recent the information is; and
- (c) how the reliability of the information was tested; and
- (d) any uncertainties in the information.

**Centennial Hunter infers the information within the Environmental Assessment document was found to be adequate because the NSW Department of Planning (DOP) and Department of Environment and Conservation (DEC) accepted the document for exhibition and assessment.**

We dispute the claim by Centennial Hunter that the document is adequate for exhibition and make these comments.

As noted already in this document, DEC in their submission to the IHAP, has found the Environmental Assessment inadequate in a number of key requirements, as is noted in the following comments excerpted from that document.

**DEC Submission to IHAP on the Anvil Hill Project Environmental Assessment (EA) Page 11-12- (Full Submission attached as appendix.)**

- There is lack of clarity regarding the short term (mine-life) and long-term (post-mine closure) land use/management objectives, land ownership and management of most of the lands proposed for inclusion in the various land management strategies and categories. Some lands appear to fall into more than one land management category. ...
  - It is not clear whether all or only some of the lands identified within the conceptual corridor are proposed to be acquired by Centennial. ....
  - It is also unclear what Centennials approach will be to a situation where a landholder refuses to sell land that falls within these areas, particularly where it forms an important link between previously acquired lands.
  - The EA also lacks detailed information regarding the short and long-term proposed management of the various land use/ management categories. (and so on.....)
  - Lastly there is also a lack of information regarding the short and long-term funding of the proposed management of the various land use/management categories. (and so on.....)
  - DEC does not consider this principle has been adequately addressed in the EA.and seeks:

**Centennial Hunter infers that the EA document has been reviewed and found adequate by an Independent Hearing and Assessment Panel (IHAP).**

The IHAP has not yet tabled its findings on the Anvil Hill application and it is unknown what opinion they may have formed on the adequacy of the information in the Environmental Assessment

**Centennial Hunter states in their EPBC referral that there is no significant impact on any matters of National Significance.**

This is inconsistent with statements made in their Environmental Assessment, examples of some of these statements, as follows;

- **Vol 1- Sec 3 – page 3.4**

The Project is likely to or may have a significant impact on two listed flora species , as discussed further in Section 5.4. The Project will be referred to the DEH to determine whether the Project is a controlled action under the EPBC Act.

- **Vol 4 Appendix 9A- page 8.13**

From these, and based on the Test for Ecological Significance, it is considered that the Project .....may have a significant impact on painted diuris (*Diuris tricolor*)..... The dominant cause of the significant impacts on these two flora species arises from the loss of.....large areas of predicted habitat.....

- **Vol 4 Appendix 9A-page 8.16**

From these, and based on the Test for Ecological Significance, it is considered that the Project is likely to or may have a significant impact on the following key threatened fauna species.

.....Large-eared Pied Bat.....

### **Centennial state mitigation measures will ameliorate the potential of any significant impacts.**

The NSW Department of Environment and Conservation raised many concerns with the viability of the mitigation and offset strategies proposed by Centennial Hunter in their Environmental Assessment, including the comments, as follows:

*The loss of this vegetation is likely to have a significant impact on the two threatened flora species and thirteen threatened fauna species that have been recorded in the Proposed Disturbance Area.*

*There is little opportunity to significantly ameliorate the direct impacts described.*

### **Centennial Hunter Statement of Commitments on their Environmental Mitigation Strategies**

Abel Ecology responses to Centennial Hunter Statement of Commitments (lodged DoP in January 2007) regards offset and mitigation measures for significant impacts, for the Environmental Assessment for Anvil Hill. These can be found

on [http://www.planning.nsw.gov.au/asp/pdf/06\\_0014\\_revised\\_statement\\_of\\_commitments\\_jan\\_07.pdf](http://www.planning.nsw.gov.au/asp/pdf/06_0014_revised_statement_of_commitments_jan_07.pdf)

Ecologist, Danny Wotherspoon found these responses were still inadequate.

His responses are;

6.8.1 where is the offset proposal - lets see a map

6.8.2 tenure of offset is not clearly indicated, and so is not confidently permanent.

6.8.3 allows the proposal in 6.8.1 to be avoided

6.8.4 corridor location is not final because they have no confidence that they can secure the land

6.8.5 allows Centennial to avoid the commitment in 6.8.4

6.8.6 it is clearly inappropriate to commence without a Biodiversity Management Plan as a master plan as a guide for progressive works

6.8.8 A mine closure plan is required before approval is granted in order to assess the viability of the mine in its entirety. Performance criteria are to be established before consent is granted.

6.14.4 The role and authority of the independent environmental audit is to be specified in advance, to enable enforcement of compliance with biodiversity and other controls. A penalty structure for non-compliance is to be specified in advance.

6.14.5 The role and authority of the community consultative committee is to be specified in advance, to enable enforcement of relevant consent conditions. A penalty structure for non-compliance is to be specified in advance.

### **Centennial Hunter states that the White box- Yellow Box -Blakely's Redgum Critically Endangered Ecological Community is not present on the site.**

This is inconsistent with flora lists contained in Centennial Hunter Pty Ltd Environmental Assessment and HLA Statement of Environmental Effects. Both these documents were used to support the application for the proposed mining activities at Anvil Hill. Further more, Centennial Hunter uses the comparison of woodland communities as defined by Peake to determine the existence or not of EEC'S rather than a comparison with the DEH species lists.

- The Forest Redgum Riparian Woodland is used by Centennial Hunter to infer that the White Box – Yellow Box- Blakely's Redgum Critically Endangered Ecological Community (EPBC) and the Hunter Lowland Red Gum Forest Endangered Ecological Community ((TSC) ,in the Environmental Assessment to DEC and DOP, are not present on the Project Site. In both instances, Centennial Hunter uses the Forest Redgum Riparian Woodland to negate the presence of two (2) EEC'S. The Forest Redgum Riparian Woodland Complex according to Peake meets the DEH (2006) criteria for listing as critically endangered.

- A site specific report, titled "Flora and Fauna Investigations for Proposed Bulk Sample Pit at Anvil Hill conducted for Centennial Hunter Pty Ltd" covering 4 hectares for a bulk coal States the following; *"Slaty Box Woodland at a structural and floristic level, shares many similarities with the final determination for White Box, Yellow Box, Blakely's Red Gum Woodland Endangered Ecological Community. In line with the precautionary principle as outlined in Schedule 2 of the EPA Regulation 2000, the Slaty Box Woodland should be considered part of the White Box, Yellow Box, Blakely's Red Gum Woodland Endangered Ecological Community."* (Quote from HLA Envirosiences Pty Ltd Great Northern Coal Mine Flora and Fauna Investigations for Proposed Bulk Sample Pit at Anvil Hill.)

- A comparison with the species lists of flora identified at Anvil Hill (the Study Area) by Centennial Hunter and Abel Ecology (Envirofund Project) with the DEH White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List and the DEH EPBC Act Policy Statement flow chart (on page 5) confirm the critically endangered ecological community is present (List starts on page 25 of this report)

- Associate-Professor Paul Adam, President, Coast and Wetlands Society Pty Ltd states in his submission to NSW DoP on the Anvil Hill Environmental Assessment. The Environmental Assessment also discounts the presence of a further three endangered ecological communities, Hunter Lowland Redgum Woodland and Swamp Oak Forest (listed under the TSC Act) and White Box-Yellow Box-Blakely's Red Gum Woodland (listed under both the TSC Act and Commonwealth's Environment Protection and Biodiversity Conservation Act) at the Anvil Hill site on the basis of a comparison between the diagnostic species present in these listed communities and those mapped by Peake (2006) in the Upper Hunter. The Environmental Assessment does not provide a detailed quantitative list of the plant species recorded in the vegetation plots at Anvil Hill which most closely resemble the descriptions in the Final Determinations for these three EECs. Consequently, it is not possible to independently verify the conclusion that none of these EECs are present on the Anvil Hill site. The DEC's guidelines for identifying the White Box-Yellow Box-Blakely's Red Gum Woodland recognise that variants of this EEC exist at the margins of its geographic distribution, such as the Upper Hunter Valley. They describe these variants and advise that they are part of this EEC. They also advise that, in agricultural landscapes, components of this EEC may be absent due to preferential clearing of canopy species for but that despite this the modified vegetation still qualifies as an EEC. Given the above, it is possible that there are four EECs, which will be impacted by the Anvil Hill mine proposal

## DEH Species List

### White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community -

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community **Species List**  
This species list is designed to provide information about plant species that can be found in the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community listed under the *Environment Protection and Biodiversity Conservation Act 1999*. The species list was developed to complement the Listing Information Guide, and should be read in that context.

It provides information on scientific and common names of the species, the kind of plant the species is, whether it is an 'important' species for the purposes of this ecological community and whether it is exotic or native, perennial or annual.

The list is not exhaustive and not all of the species listed will occur in every patch of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. If there are any species that you think should be added to the list, removed from the list, or that are categorised incorrectly, please contact Peter.Komidar@deh.gov.au. As such, this document may change over time and you should check that you are referring to the most recent version of the list.

Pictures and distribution maps can be found at <http://plantnet.rbgsyd.nsw.gov.au/search/simple.htm>

**Caveat:** This list has been compiled from a range of sources. While reasonable efforts have been made to ensure the accuracy of the information, no guarantee is given, nor responsibility taken, by the Commonwealth for its accuracy, currency or completeness. The Commonwealth does not accept any responsibility for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the information contained in this list. The information contained in this list does not necessarily represent the views of the Commonwealth. The list is not intended to be a complete source of information on the species it deals with.

### White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species present at Anvil Hill

#### COLOUR KEY

Green – from Centennial Hunter Flora lists

Yellow- from Abel Ecology Envirofund Project flora list

Blue – species identified in both lists

Red- important- species important to determine EEC in accordance with DEH Policy

*Asplenium flabellifolium* Necklace Fern Fern Native perennial Aspleniaceae ferns

*Botrychium australe* Parsley Fern Fern Native perennial Ophioglossaceae ferns

*Cheilanthes austrotenuifolia* Rock-fern Fern Native perennial Adiantaceae maidenhair fern

*Cheilanthes distans* Bristly Cloak Fern Fern Native **important** perennial Adiantaceae maidenhair fern

*Cheilanthes sieberi* Narrow Rock Fern Fern Native perennial Adiantaceae maidenhair fern

*Pteridium esculentum* Common Bracken, Gurgi (Cadigal), AustralBracken, Bracken Fern Native perennial Dennstaedtiaceae bracken ferns

**Grass**

*Aristida behriana* Brush Wiregrass, Bunch Wiregrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Aristida calycina* Dark Wire-grass, Branched Wiregrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Aristida ramosa* Purple Wiregrass, Kerosene Grass, Prickly Threeawn Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrodanthonia auriculata* Lobed Wallaby-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrodanthonia bipartite* Bandicoot Grass, Wallaby Grass, LeafyWallaby Grass Grass Native perennial Poaceae grass, bamboo, spinifex *Austrodanthonia caespitosa* Ringed Wallaby-grass, Common Wallabygrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrodanthonia carphoides* Short Wallaby-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrodanthonia eriantha* Hill Wallaby-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrodanthonia laevis* Wallaby Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrodanthonia monticola* Small-flower Wallaby Grass Grass Native perennial Poaceae grass, bamboo, spinifex *Notodanthonia monticola*, *Rytidosperma monticola*

*Austrodanthonia pilosa* Velvet Wallaby Grass, Smooth-flowered Wallaby-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrodanthonia racemosa* Clustered Wallaby-grass, Slender Wallaby Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrodanthonia setacea* Bristly Wallaby Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrofestuca eriopoda* Snow Fescue Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrostipa bigeniculata* Tall Speargrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrostipa blackii* Crested Spear-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrostipa densiflora* Dense Spear-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrostipa nodosa* Knotty Speargrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrostipa rudis* Veined Speargrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Austrostipa scabra* Corkscrew, Corkscrew Speargrass, Rough Spear-grass, Rough Needle-grass, Speargrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Bothriochloa macra* Redgrass, Redleg Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Chloris truncata* Windmill Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Chloris ventricosa* Tall Windmill Grass Grass Native Poaceae grass, bamboo, spinifex

*Cymbopogon refractus* Barbed Wire Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Deyeuxia quadrisetata* Reed Bent-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Dichanthium sericeum* Queensland Blue-grass Grass Native Important perennial Poaceae grass, bamboo, spinifex

*Dichelachne crinita* Longhair Plumegrass Grass Native Important perennial Poaceae grass, bamboo, spinifex

*Dichelachne hirtella* Slender Plumegrass Grass Native Important annual Poaceae grass, bamboo, spinifex

*Dichelachne inaequiglumis* Plume Grass Grass Native Important perennial Poaceae grass, bamboo, spinifex

*Dichelachne micrantha* Short-hair Plumegrass Grass Native Important perennial Poaceae grass, bamboo, spinifex

*Dichelachne parva* Plume Grass Grass Native Important perennial Poaceae grass, bamboo, spinifex

*Dichelachne rara* Plume Grass Grass Native Important annual Poaceae grass, bamboo, spinifex

*Echinopogon caespitosus* Tufted Hedgehog-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Echinopogon cheelii* Long-flowered Hedgehog Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Echinopogon ovatus* Forest Hedgehog-grass, Hedgehog Grass, Rough-bearded Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Elymus scaber* Common Wheat-grass, Wheatgrass, Rough Wheatgrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Enneapogon nigricans* Black-head Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Glyceria australis* Australian Sweetgrass Grass Native perennial Poaceae grass, bamboo, spinifex

*Imperata cylindrica* Blady Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Joycea pallida* Silvertop Wallaby Grass, Redanther Wallaby Grass Grass Native Important perennial Poaceae grass, bamboo, spinifex *Chionochloa pallida*, *Danthonia pallida*

*Microlaena stipoides* Microlaena, Weeping Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Panicum effusum* Hairy Panic, Poison Panic Grass Native perennial Poaceae grass, bamboo, spinifex

*Poa labillardierei* Tussock Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Poa meionectes* Fine-leaved Snow Grass, Fine-leaved Tussock-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Poa petrophila* Rock Tussock-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Poa sieberiana* Snow Grass, Fine-leaved Tussock-grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Rytidosperma nudiflorum* Alpine Wallby Grass Grass Native perennial Poaceae grass, bamboo, spinifex *Danthonia nudiflora*, *Notodanthonia nudiflora* *Sorghum leiocladum* Wild Sorghum Grass Native Important perennial Poaceae grass, bamboo, spinifex

*Sporobolus creber* Western Rat-tail Grass, Slender Rat's Tail Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Sporobolus elongatus* Slender Rat's-tail Grass Grass Native perennial Poaceae grass, bamboo, spinifex

*Themeda australis* (syn. *Themeda triandra*) Kangaroo Grass Grass Native Important perennial Poaceae grass, bamboo, spinifex

*Themeda triandra* (syn. *Themeda australis*) Kangaroo Grass Grass Native Important perennial Poaceae grass, bamboo, spinifex

*Triopogon loliformis* Fiveminute Grass Grass Native Important annual Poaceae grass, bamboo, spinifex

**Herb**

*Acaena agnipila* Sheep's Burr, Bidgee-widgee Herb Native perennial Rosaceae roses, blackberries, apples

*Acaena echinata* Sheep's Burr Herb Native perennial Rosaceae roses, blackberries, apples

*Acaena novae-zelandiae* Bidgee-widgee, Biddy Biddy Herb Native perennial Rosaceae roses, blackberries, apples

*Acaena ovina* Sheep's Burr, Bidgee-widgee Herb Native perennial Rosaceae roses, blackberries, apples

*Ajuga australis* Australian Bugle, Austral Bugle Herb Native Important perennial Lamiaceae mints, sages, mintbush

*Alternanthera nana* Hairy Joyweed, Downy Pigweed Herb Native Important annual Amaranthaceae cockscombs, mulla-mullas, pussytails

*Ammobium alatum* Tall Ammobium Herb Native Important perennial Asteraceae daisies, sunflower

*Ammobium craspedioides* Yass Daisy Herb Native Important perennial Asteraceae daisies, sunflower

*Aphanes australiana* Australian Piert Herb Native annual Rosaceae roses, blackberries, apples

*Arachnorchis* spp. Spider Orchids Herb Native Important perennial Orchidaceae orchids *Caladenia*

*Arthropodium milleflorum* Vanilla-lily, Pale Vanilla-lily Herb Native Important perennial Anthericaceae lilies

*Arthropodium minus* Small Vanilla Lily Herb Native Important perennial Anthericaceae lilies

*Asperula conferta* Common Woodruff Herb Native Important perennial Rubiaceae gardenias, coffee

*Asperula scoparia* Prickly Woodruff Herb Native Important perennial Rubiaceae gardenias, coffee

*Billardiera scandens* Appleberry, Snotberry, Apple Dumplings Climber Native perennial Pittosporaceae native frangipani

*Brachyscome aculeata* Hill Daisy Herb Native Important perennial Asteraceae daisies, sunflower *Brachyscome aculeata*

*Brachyscome decipiens* Field Daisy Herb Native Important perennial Asteraceae daisies, sunflower *Brachyscome decipiens*

*Brachyscome diversifolia* Large-headed Daisy Herb Native Important perennial Asteraceae daisies, sunflower *Brachyscome diversifolia*

*Brachyscome graminea* Grass Dairy Herb Native Important perennial Asteraceae daisies, sunflower *Brachyscome graminea*

*Brachyscome heterodonta* Lobe-seed Daisy Herb Native Important perennial Asteraceae daisies, sunflower *Brachyscome heterodonta*, *Brachyscome dentata*, *Brachyscome dentata*

*Brachyscome multifida* Cut-leaved Daisy Herb Native Important annual Asteraceae daisies, sunflower *Brachyscome multifida*

*Brachyscome rigidula* Leafy Daisy Herb Native Important perennial Asteraceae daisies, sunflower *Brachyscome rigidula*

*Brachyscome scapigera* Tufted Daisy Herb Native Important perennial Asteraceae daisies, sunflower *Brachyscome scapigera*

*Brachyscome spathulata* Spoon Daisy Herb Native Important perennial Asteraceae daisies, sunflower *Brachyscome spathulata*

*Brunnea australis* Pincushion, Blue Pincushion Herb Native Important perennial Brunoniaceae brunonias

*Brunoniella australis* Blue Trumpet Herb Native perennial Acanthaceae bear's britches *Ruellia australis*

*Bulbine bulbosa* Bulbine Lily, Native Onion, Native Leek, Golden Lily Herb Native Important perennial Asphodelaceae lilies

*Bulbine glauca* Rock Lily Herb Native Important perennial Asphodelaceae lilies

*Burchardia umbellata* Milkmaids Herb Native Important perennial Colchicaceae lilies

*Caesia calliantha* Blue Grass-Lily Herb Native Important perennial Anthericaceae lilies  
*Calocephalus citreus* Lemon Beautyheads Herb Native Important perennial Asteraceae daisies, sunflower  
*Alcohols robertsonii* Purplish Beard Orchid Herb Native Important perennial Orchidaceae orchids plus other  
*Calochilus* species  
*Calotis cuneifolia* Purple Burr-daisy Herb Native Important perennial Asteraceae daisies, sunflower  
*Calotis glandulosa* Mauve Burr-daisy Herb Native Important perennial Asteraceae daisies, sunflower  
*Calotis lappulacea* Yellow Burr-daisy, Yellow Daisy-burr Herb Native Important perennial Asteraceae daisies, sunflower  
*Calotis scabiosifolia* Rough Burr-daisy Herb Native Important perennial Asteraceae daisies, sunflower  
*Carex inversa* Knob Sedge, Common Sedge Herb Native perennial Cyperaceae sedges  
*Centella asiatica* Pennywort Herb Native Important perennial Apiaceae carrots, parsley, fennel  
*Centella cordifolia* Centella Herb Native perennial Apiaceae carrots, parsley, fennel  
*Centrolepis strigosa* Hairy Centrolepis Herb Native annual Centrolepidaceae sedges  
*Chamaesyce drummondii* Caustic-weed Herb Native perennial Euphorbiaceae spurges  
*Chenopodium pumilio* Clammy Goosefoot, Small Crumbweed Herb Native annual  
Chenopodiaceae saltbushes, bluebushes, samphires, chenopods  
*Chrysocephalum apiculatum* Yellow Buttons, Common Everlasting Herb Native Important perennial Asteraceae daisies, sunflower  
*Chrysocephalum semipapposum* Clustered Everlasting, Yellow Buttons Herb Native Important perennial Asteraceae daisies, sunflower  
*Clematis microphylla* Small-leaved Clematis Climber Native perennial Ranunculaceae buttercups, anemones  
*Convolvulus erubescens* Australian Bindweed, Blushing Bindweed Herb Native perennial Convolvulaceae morning glory, bindweed  
*Correa reflexa* Common Correa, Native Fuchsia Herb Native perennial Rutaceae boronias, citrus, native fuchsias  
*Cotula australis* Common Cotula, Carrot Weed Herb Native annual Asteraceae daisies, sunflower  
*Craspedia canens* Billy Buttons, Grey Billybuttons Herb Native Important perennial Asteraceae daisies, sunflower  
*Craspedia variabilis* Billy Buttons Herb Native Important perennial Asteraceae daisies, sunflower  
*Crassula colorata* Annual Stonecrop, Dense Crassula, Dense Stonecrop Herb Native annual Crassulaceae stonecrops  
*Crassula helmsii* Swamp Stonecrop Herb Native annual Crassulaceae stonecrops  
*Crassula sieberiana* Australian Stonecrop, Sieber Crassula Herb Native perennial Crassulaceae stonecrops  
*Cullen microcephalum* Dusky Scurf-pea, Mountain Psoralea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Psoralea adscendens*  
*Cullen tenax* Emu-foot, Emu Grass, Tough Scurf-pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea *Psoralea tenax*  
*Cymbonotus lawsonianus* Bear's Ear, Austral Bears-ears, Bears-ears Herb Native perennial Asteraceae daisies, sunflower  
Maybe be syn *Cymbonotus preissianus*  
*Cymbonotus preissianus* Austral Bear's Ear Herb Native perennial Asteraceae daisies, sunflower Maybe be syn *Cymbonotus lawsonianus*  
*Cynoglossum australe* Australian Forget-me-not, Australian Hound's-tongue Herb Native perennial Boraginaceae heliotropes, forget-me-nots, borage  
*Cynoglossum suaveolens* Sweet Hound's-tongue Herb Native perennial Boraginaceae heliotropes, forget-me-nots, borage  
*Daucus glochidiatus* Australian Carrot, Native Carrot, Austral Carrot Herb Native Important annual Apiaceae carrots, parsley, fennel  
*Derwentia perfoliata* Digger's Speedwell Herb/Shrub Native perennial Scrophulariaceae foxgloves, snapdragons, witchweeds  
*Desmodium brachypodium* Large Tick-trefoil Herb Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Desmodium varians* Slender Tick-trefoil Herb Native Important annual Fabaceae peas, eg. sturt desert pea  
*Dianella longifolia* Smooth Flax Lily Herb Native Important perennial Phormiaceae lilies  
*Dianella revolute* Blueberry Lily, Black-Anther Flax Lily, Spreading Flax Lily Herb Native Important perennial Phormiaceae lilies  
*Dichondra repens* Kidney Grass, Kidney Weed Herb Native perennial Convolvulaceae morning glory, bindweed  
*Dichopogon fimbriatus* Chocolate Lily, Nodding Chocolate Lily Herb Native Important perennial Anthericaceae lilies  
*Dichopogon strictus* Chocolate Lily Herb Native perennial Anthericaceae lilies  
*Dipodium punctatum* Hyacinth Orchid, Pink Hyacinth Orchid Herb Native Important perennial Orchidaceae orchids  
*Diuris aequalis* Buttercup Doubletail Herb Native Important perennial Orchidaceae orchids  
*Diuris behrii* Golden Cowslips Herb Native Important perennial Orchidaceae orchids  
*Diuris chryseopsis* Common Golden Moths Herb Native Important perennial Orchidaceae orchids  
*Diuris dendrobioides* Long-tail Purple Diuris, Wedge Diuris Herb Native Important perennial Orchidaceae orchids  
*Diuris maculate* Leopard Orchid, Nanny Goats, Leopard Diuris, Spotted Doubletail Herb Native Important perennial Orchidaceae orchids  
*Diuris monticola* Highland Golden Moths Herb Native Important perennial Orchidaceae orchids  
*Diuris ochroma* Pale Golden Moths Herb Native Important perennial Orchidaceae orchids  
*Diuris pedunculata* Small Snake Orchid, Two-leaved Golden Moths, Golden Moths, Cowslip Orchid, Snake Orchid Herb Native Important perennial Orchidaceae orchids Annual or perennial?  
*Diuris punctata* Purple Donkey-orchid, Purple Double-tails, Purple Diuris, Purple Cowslip, Dotted Double tails Herb Native Important perennial Orchidaceae orchids  
*Diuris semilunulata* Donkey-ears Herb Native Important perennial Orchidaceae orchids *Diuris maculate*  
*Diuris sulphurea* Tiger Orchid, Hornet Orchid Herb Native Important perennial Orchidaceae orchids  
*Drosera peltata* Hairy Climbing Sundew, Pale Sundew Herb Native perennial Droseraceae sundews  
*Drosera pygmaea* Pigmy Sundew, Tiny Sundew Herb Native perennial Droseraceae sundews  
*Einadia nutans* Climbing Saltbush, Nodding Saltbush Herb Native perennial Chenopodiaceae saltbushes, bluebushes, samphires, chenopods  
*Eriochilus cucullatus* Parson's Bands Herb Native Important perennial Orchidaceae orchids  
*Erodium crinitum* Native Crowfoot, Blue Storks-bill, Blue Crowfoot, Blue Herons-bill Herb Native annual Geraniaceae storksills, cranesbills, geraniums  
*Eryngium ovinum* Blue Devil Herb Native Important annual Apiaceae carrots, parsley, fennel  
*Eryngium rostratum* Blue Devil Herb Native annual Apiaceae carrots, parsley, fennel  
*Eryngium vesiculosum* Prostrate Blue Devil, Prickfoot Herb Native Important perennial Apiaceae carrots, parsley, fennel  
*Euchiton gymnocephalus* Creeping Cudweed Herb Native perennial Asteraceae daisies, sunflower  
*Euchiton involucreatus* Star Cudweed Herb Native perennial Asteraceae daisies, sunflower  
*Euchiton sphaericus* Annual Cudweed, Star Cudweed Herb Native annual Asteraceae daisies, sunflower  
*Euphrasia collina* Eyebright Herb Native perennial Scrophulariaceae foxgloves, snapdragons, witchweeds  
*Galium gaudichaudii* Rough Bedstraw Herb Native Important perennial Rubiaceae gardenias, coffee  
*Gastrodia sesamoides* Cinnamon Bells, Potato Orchid Herb Native Important perennial Orchidaceae orchids  
*Genoplesium* Midge Orchids Herb Native Important perennial Orchidaceae orchids  
*Geranium antrorsum* Antorse Geranium Herb Native Important perennial Geraniaceae storksills, cranesbills, geraniums  
*Geranium graniticola* Granite Cranesbill Herb Native Important perennial Geraniaceae storksills, cranesbills, geraniums  
*Geranium neglectum* Swamp Cranes-bill Herb Native perennial Geraniaceae storksills, cranesbills, geraniums  
*Geranium retrorsum* Common Cranes-bill Herb Native perennial Geraniaceae storksills, cranesbills, geraniums  
*Geranium solanderi* Native Geranium Herb Native perennial Geraniaceae storksills, cranesbills, geraniums  
*Glossodia major* Wax-lip Orchid, Parson-in-the-pulpit Herb Native Important perennial Orchidaceae orchids  
*Glycine claudestina* Twining Glycine Herb Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Glycine tabacina* Glycine Pea, Variable Glycine Herb Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Gonocarpus elatus* Hill Raspwort Herb Native perennial Haloragaceae raspworts, milfoils  
*Gonocarpus tetragynus* Common Raspwort Herb Native perennial Haloragaceae raspworts, milfoils  
*Goodenia bellidifolia* Daisy-leaved Goodenia, Rocket Goodenia Herb Native perennial Goodeniaceae goodenias, dampieras  
*Goodenia hederacea* Forest Goodenia, Ivy Goodenia Herb Native Important perennial Goodeniaceae goodenias, dampieras  
*Goodenia humilis* Swamp Goodenia Herb Native perennial Goodeniaceae goodenias, dampieras  
*Goodenia pinnatifida* Scrambled Eggs, Cut-leaf Goodenia Herb Native Important perennial Goodeniaceae goodenias, dampieras  
*Goodenia stelligera* Spiked Goodenia Herb Native perennial Goodeniaceae goodenias, dampieras  
*Gratiola nana* Creeping Brooklime Herb Native Important perennial Scrophulariaceae foxgloves, snapdragons, witchweeds  
*Gratiola pedunculata* Brooklime Herb Native Important perennial Scrophulariaceae foxgloves, snapdragons, witchweeds

*Gratiola peruviana* Austral Brooklime Herb Native Important perennial Scrophulariaceae foxgloves, snapdragons, witchweeds  
*Gypsophila tubulosa* Annual Chalkwort Herb Native annual Caryophyllaceae carnations *Gypsophila australis*  
*Helichrysum collinum* Hill Daisy Herb Native perennial Asteraceae daisies, sunflower  
*Helichrysum scopioides* Button Everlasting Herb Native perennial Asteraceae daisies, sunflower  
*Hydrocotyle laxiflora* Stinking Pennywort Herb Native perennial Apiaceae carrots, parsley, fennel  
*Hymenochilus bicolor* Bicolor Greenhood Herb Native Important perennial Orchidaceae orchids *Pterostylis bicolor* annual or perennial?  
*Hymenochilus cycnocephalus* Swan Greenhood Herb Native Important perennial Orchidaceae orchids *Pterostylis cycnocephala*  
*Hymenochilus muticus* Midget Greenhood, Blunt Greenhood, Dwarf Greenhood Herb Native Important perennial Orchidaceae orchids  
*Pterostylis mutica* annual or perennial?  
*Hypericum gramineum* Small St John's Wort Herb Native Important perennial Clusiaceae garcinias  
*Hypericum japonicum* Small St John's Wort, Matted St John's Wort Herb Native Important perennial Clusiaceae garcinias  
*Isotopsis graminifolia* Grass Cushion Herb Native Important annual Asteraceae daisies, sunflower  
*Isotoma axillaris* Rock Isotome Herb Native perennial Lobeliaceae lobelias  
*Kennedia prostrata* Running Postman, Scarlet Running Pea, Scarlet Coral-pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Lagenophora stipitata* Blue-bottle Daisy, Common Lagenophora Herb Native Important perennial Asteraceae daisies, sunflower  
*Lagenifera stipitata*  
*Laxmannia gracilis* Slender Wire-Lily Herb Native Important perennial Anthericaceae lilies  
*Leptorhynchus elongatus* Lanky Buttons, Hairy Buttons Herb Native Important perennial Asteraceae daisies, sunflower *Leptorrhynchus elongatus*  
*Leptorhynchus squamatus* Scaly Buttons Herb Native Important perennial Asteraceae daisies, sunflower *Coryza squamata*, *Chrysocoma squamata*,  
*Leptorhynchus squamatus*  
*Leucochrysum albicans* Hoary Sunray Herb Native Important perennial Asteraceae daisies, sunflower *Helipterum albicans*  
*Limosella australis* Australian Mudwort Herb Native perennial Scrophulariaceae foxgloves, snapdragons, witchweeds  
*Linum marginale* Wild Flax, Native Flax Herb Native Important perennial Linaceae flaxes  
*Lobelia dentata* Toothed Lobelia, Wavy Lobelia Herb Native perennial Lobeliaceae lobelias perennial?  
*Lobelia gibbosa* Tall Lobelia Herb Native perennial Lobeliaceae lobelias perennial?  
*Lomandra bracteata* Mat-rush Herb Native perennial Lomandraceae lomandras  
*Lomandra filiformis* Wattle Mat-rush Herb Native perennial Lomandraceae lomandras  
*Lomandra longifolia* Spiny-headed Mat-rush, Honey Weed Herb Native perennial Lomandraceae lomandras  
*Lomandra multiflora* Many-flowered Matrush Herb Native perennial Lomandraceae lomandras  
*Lotus australis* Austral Trefoil, Australian Trefoil Herb Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Lythrum salicaria* Purple Loosestrife Herb Native perennial Lythraceae loose strifes, crepe myrtles  
*Mentha diemenica* Slender Mint Herb Native perennial Lamiaceae mints, sages, mintbush  
*Mentha saturoioides* Creeping Mint, Native Pennyroyal Herb Native perennial Lamiaceae mints, sages, mintbush  
*Microseris lanceolata* Yam Daisy, Murnong Herb Native Important perennial Asteraceae daisies, sunflower  
*Microtis parviflora* Slender Onion-orchid Herb Native Important perennial Orchidaceae orchids  
*Microtis unifolia* Common Onion-orchid, Onion-orchid Herb Native Important perennial Orchidaceae orchids  
*Mimulus repens* Creeping Monkey-flower Herb Native annual Scrophulariaceae foxgloves, snapdragons, witchweeds annual or perennial  
*Opercularia diphylla* Stinkweed Herb Native perennial Rubiaceae gardenias, coffee  
*Opercularia hispida* Hairy Stinkweed Herb Native perennial Rubiaceae gardenias, coffee  
*Ophioglossum lusitanicum* Adder's Tongue Herb Native Important perennial Ophioglossaceae ferns  
*Oreomyrrhis argentea* Silvery Caraway Herb Native perennial Apiaceae carrots, parsley, fennel  
*Oreomyrrhis eriopoda* Australian Caraway Herb Native Important perennial Apiaceae carrots, parsley, fennel  
*Oxalis exilis* Shady Wood Sorrel, Indian Sorrel Herb Native perennial Oxalidaceae wood sorrels, soursob  
*Oxalis perennans* Grassland Wood Sorrel, Grass Wood-sorrel, Creeping Yellow Sorrel Herb Native perennial Oxalidaceae wood sorrels, soursob  
*Paterosonia sericea* Silky Purple-flag Herb Native perennial Iridaceae irises, paterosonias  
*Pelargonium australe* Native Storks-bill, Austral Storks-bill, Wild Geranium Herb Native Important perennial Geraniaceae storksills, cranesbills, geraniums  
*Pelargonium inodorum* Scentless Storks-bill Herb Native Important perennial Geraniaceae storksills, cranesbills, geraniums annual or short-lived perennial  
*Pelargonium rodneyanum* Magenta Storks-bill Herb Native Important perennial Geraniaceae storksills, cranesbills, geraniums  
*Plantago debilis* Shade Plantain, Slender Plantain Herb Native perennial Plantaginaceae plantains  
*Plantago euryphylla* Plantain Herb Native perennial Plantaginaceae plantains  
*Plantago gaudichaudii* Narrow-leaf Native Plantain, Narrow Plantain Herb Native Important perennial Plantaginaceae plantains  
*Plantago varia* Variable Plantain, Small Plantain, Sagoweed Herb Native Important perennial Plantaginaceae plantains  
*Podolepis hieracioides* Tall Copper-wire Daisy Herb Native Important perennial Asteraceae daisies, sunflower  
*Podolepis jaceoides* Showy Copper-wire Daisy Herb Native Important perennial Asteraceae daisies, sunflower  
*Polygala japonica* Dwarf Milkwort Herb Native Important perennial Polygalaceae milkworts  
*Poranthera microphylla* Small Poranthera, Small-leaved Poranthera Herb Native Important annual Euphorbiaceae spurges  
*Portulaca oleracea* Common Pigweed, Common Purslane, Munyeroo Herb Native annual Portulacaceae purslanes, pigweeds  
*Prasophyllum petilum* Tarengo Leek Orchid Herb Native Important perennial Orchidaceae orchids plus other *Prasophyllum* species  
*Pratia purpurascens* Whiteroot Herb Native perennial Lobeliaceae lobelias annual or perennial?  
*Pseudognaphalium luteoalbum* Jersey Cudweed Herb Native annual Asteraceae daisies, sunflower  
*Ptilotus erubescens* Hairy Tails, Hairy Heads Herb Native Important perennial Amaranthaceae cockscombs, mulla-mullas, pussytails  
*Ranunculus graniticola* Granite Buttercup Herb Native perennial Ranunculaceae buttercups, anemones  
*Ranunculus lappaceus* Common Buttercup, Australian Buttercup Herb Native Important perennial Ranunculaceae buttercups, anemones  
*Ranunculus pachycarpus* Thick-fruited Buttercup Herb Native perennial Ranunculaceae buttercups, anemones  
*Rhodanthe anthemoides* White Sunray, Chamomile Sunray Herb Native Important perennial Asteraceae daisies, sunflower *Helipterum anthemoides*  
*Rhodanthe pygmaea* Pigmy Sunray Herb Native annual Asteraceae daisies, sunflower *Helipterum pygmaeum*  
*Rostellaria adscendens* Pink-tongues, Bearded Anthem, Dwarf Justicia Herb Native Acanthaceae bear's britches annual or perennial?  
*Rumex brownii* Swamp Dock, Slender Dock Herb Native perennial Polygonaceae docks, buckwheat  
*Rumex dumosus* Wiry Dock Herb Native Important perennial Polygonaceae docks, buckwheat  
*Rumex tenax* Shiny Dock Herb Native perennial Polygonaceae docks, buckwheat  
*Rutidosia leirolepis* Monaro Golden Daisy Herb Native Important perennial Asteraceae daisies, sunflower  
*Rutidosia leptorhynchoides* Button Wrinklewort Herb Native Important perennial Asteraceae daisies, sunflower  
*Rutidosia multiflora* Small Wrinklewort Herb Native Important annual Asteraceae daisies, sunflower  
*Scleranthus biflorus* Spiny Mat-plant, Knawel, Cushion-bush, Two-flowered Knawel Herb Native Important perennial Caryophyllaceae carnations  
*Scleranthus diander* Tufted Knawel Herb Native perennial Caryophyllaceae carnations  
*Scutellaria humilis* Dwarf Skullcap Herb Native perennial Lamiaceae mints, sages, mintbush  
*Sebaea ovata* Yellow Centaury Herb Native Important annual Gentianaceae gentians  
*Selliera radicans* Swamp Weed Herb Native perennial Goodeniaceae goodenias, dampieras  
*Senecio hispidulus* Hill Fireweed Herb Native perennial Asteraceae daisies, sunflower annual or perennial?  
*Senecio quadridentatus* Cotton Fireweed Herb Native perennial Asteraceae daisies, sunflower  
*Senecio tenuiflorus* Woodland Groundsel, Narrow Groundsel, Cotton Groundsel, Slender Fireweed Herb Native annual Asteraceae daisies, sunflower  
annual or biennial  
*Sida corrugata* Corrugated Sida Herb Native Important perennial Malvaceae cotton, hibiscus  
*Solenogyne dominii* Smooth Solenogyne Herb Native Important perennial Asteraceae daisies, sunflower  
*Solenogyne gunnii* Hairy Solenogyne Herb Native Important perennial Asteraceae daisies, sunflower  
*Spiranthes sinensis* Austral Ladies' Tresses Herb Native Important perennial Orchidaceae orchids annual or perennial?  
*Stackhousia monogyne* Creamy Candles, Creamy Stackhousia Herb Native Important perennial Stackhousiaceae stackhousiaceae  
*Stackhousia viminea* Slender Stackhousia Herb Native perennial Stackhousiaceae stackhousiaceae  
*Stellaria angustifolia* Swamp Starwort Herb Native perennial Caryophyllaceae carnations  
*Stellaria filiformis* Thread Starwort Herb Native Important annual Caryophyllaceae carnations

*Stellaria multiflora* (Back Creek) Back Creek Many Flowered Starwort, Back Creek Rayless Starwort Herb Native annual Caryophyllaceae carnations uncertain taxonomy, categorised based on *Stellaria multiflora*

*Stellaria pungens* Prickly Starwort Herb Native perennial Caryophyllaceae carnations

*Stuartina hamata* Crooked Cudweed, Hooked Cudweed Herb Native Important annual Asteraceae daisies, sunflower

*Stuartina muelleri* Spoon Cudweed Herb Native Important annual Asteraceae daisies, sunflower

*Stalinism despectum* Dwarf Triggerplant Herb Native annual Stylidiaceae triggerplants, styleworts

*Stylidium graminifolium* Grass Triggerplant Herb Native Important perennial Stylidiaceae triggerplants, styleworts

*Stypandra glauca* Nodding Blue Lily Herb Native Important perennial Phormiaceae lilies

*Swainsona behriana* Behr's Swainson-pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea

*Swainsona monticola* Mountain Swainson-pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea

*Swainsona oroboides* Variable Swainson-pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea

*Swainsona queenslandica* Smooth Darling Pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea *Swainsona galegifolia*

*Swainsona recta* Mountain Swainson-pea, Small Purple-pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea

*Swainsona reticulata* Knead Swainson-pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea

*Swainsona sericea* Silky Swainson-pea Herb Native Important perennial Fabaceae peas, eg. sturt desert pea

*Tetradlea spp.* Black-eyed Susans Herb Native perennial Tremandraceae black-eyed susans

*Thelymitra ixioides* Spotted Sun-orchid, Dotted Sun-orchid Herb Native Important perennial Orchidaceae orchids annual or perennial?

*Thelymitra malvina* Mauve-tuft Sun-orchid, Mauve-tufted sun orchid Herb Native Important perennial Orchidaceae orchids annual or perennial?

*Thelymitra pauciflora* Slender Sun-orchid, Few-flowered Sunorchid Herb Native Important perennial Orchidaceae orchids annual or perennial?

*Thelymitra rubra* Pink Sun-orchid, Salmon Sun-orchid, Red Sun-orchid Herb Native Important perennial Orchidaceae orchids annual or perennial?

*Thesium australe* Austral toadflax, Austral Toad-flax, Australian Toadflax Herb Native Important perennial Santalaceae sandalwood

*Thysanotus patersonii* Twining Fringe-lily Herb Native Important perennial Anthericaceae lilies

*Thysanotus tuberosus* Common Fringe-lily Herb Native Important perennial Anthericaceae lilies

*Trachymene humilis* Alpine Trachymene Herb Native perennial Apiaceae carrots, parsley, fennel

*Tricornis elatior* Yellow Rush-lily, Yellow Autumn-lily Herb Native Important perennial Anthericaceae lilies

*Triptilodiscus pygmaeus* Austral Sunray Herb Native Important annual Asteraceae daisies, sunflower

*Urtica incisa* Stinging Nettle Herb Native perennial Urticaceae stinging nettles

*Velleia montana* Velleia Herb Native Important perennial Goodeniaceae goodenias, dampieras

*Velleia paradoxa* Spur Velleia Herb Native Important perennial Goodeniaceae goodenias, dampieras

*Veronica calycina* Hairy Speedwell Herb Native perennial Scrophulariaceae foxgloves, snapdragons, witchweeds

*Veronica gracilis* Slender Speedwell Herb Native Important perennial Scrophulariaceae foxgloves, snapdragons, witchweeds

*Veronica plebeia* Trailing Speedwell, Creeping Speedwell Herb Native perennial Scrophulariaceae foxgloves, snapdragons, witchweeds

*Viola betonicifolia* Showy Violet, Arrow-head Violet, Native Violet, Purple Violet Herb Native Important perennial Violaceae violets

*Viola caleyana* Swamp Violet Herb Native perennial Violaceae violets

*Viola hederacea* Native Violet, Ivy-leaf Violet, Ivy-leaved Violet Herb Native perennial Violaceae violets

*Viola sieberiana* Diamond Violet Herb Native perennial Violaceae violets

*Vittadinia cuneata* Fuzzweed Herb Native annual Asteraceae daisies, sunflower can be annual or perennial

*Vittadinia muelleri* Narrow-leaf New Holland Daisy Herb Native perennial Asteraceae daisies, sunflower

*Wahlenbergia ceracea* Waxy Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia communis* Tufted Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia densiflora* Fairy Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia gracilentia* Annual Bluebell Herb Native annual Campanulaceae wahlenbergias, bluebells

*Wahlenbergia gracilis* Australian Bluebell, Sprawling Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia granitcola* Granite Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia littoralis* Edge Bluebell, Coast Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia luteola* Yellow-wash Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia multicaulis* Tadgell's Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia planiflora* Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wahlenbergia stricta* Tall Bluebell, Austral Bluebell, Australian Bluebell Herb Native perennial Campanulaceae wahlenbergias, bluebells

*Wurmbea dioica* Early Nancy Herb Native Important perennial Colchicaceae lilies

*Xerochrysum bracteatum* Golden Everlasting Herb Native annual Asteraceae daisies, sunflower *Bracteantha bracteata*

*Xerochrysum subundulatum* Orange Everlasting, Alpine Everlasting Herb Native annual Asteraceae daisies, sunflower *Bracteantha subundulata*,

*Helichrysum acuminatum*

*Xerochrysum viscosum* Sticky Everlasting Herb Native annual Asteraceae daisies, sunflower *Bracteantha viscosa*

*Zornia dyctiocarpa* Zornia Herb Native Important perennial Fabaceae peas, eg. sturt desert pea

#### Sedge/Rush

*Isolepis cernua* Nodding Club-rush Sedge/Rush Native perennial Cyperaceae sedges

*Isolepis hookeriana* Grassy Club-sedge, Grassy Club-rush Sedge/Rush Native annual Cyperaceae sedges

*Isolepis inundata* Swamp Club-sedge, Swamp Club-rush Sedge/Rush Native perennial Cyperaceae sedges

*Juncus australis* Austral Rush Sedge/Rush Native perennial Juncaceae rushes *Juncus communis*

*Juncus bufonius* Toad Rush Sedge/Rush Native annual Juncaceae rushes

*Juncus flavidus* Yellow Rush Sedge/Rush Native perennial Juncaceae rushes

*Juncus fockei* Slender Joint-leaf Rush Sedge/Rush Native perennial Juncaceae rushes

*Juncus homalocaulis* Wiry Rush Sedge/Rush Native perennial Juncaceae rushes

*Juncus sarophorus* Broom Rush Sedge/Rush Native perennial Juncaceae rushes

*Juncus subsecundus* Finger Rush Sedge/Rush Native perennial Juncaceae rushes

*Lepidosperma laterale* Sword Sedge, Variable Swordsedge Sedge/Rush Native perennial Cyperaceae sedges

*Luzula densiflora* Dense Woodrush Sedge/Rush Native perennial Juncaceae rushes

*Luzula meridionalis* Common Woodrush Sedge/Rush Native perennial Juncaceae rushes

*Luzula modesta* Southern Woodrush Sedge/Rush Native perennial Juncaceae rushes

*Luzula ovata* Clustered Woodrush Sedge/Rush Native perennial Juncaceae rushes

*Schoenus apogon* Common Bog Sedge, Fluke Bogrush Sedge/Rush Native annual Cyperaceae sedges

#### Shrub

*Acacia brownie* Prickly Moses, Golden Prickly Wattle, Heath Wattle Shrub Native perennial Mimosaceae wattles (acacias)

*Acacia dawsonii* Poverty Wattle, Dawson's Wattle, Mitta Wattle Shrub Native Important perennial Mimosaceae wattles (acacias)

*Acacia deanei* Deane's Wattle, Green Wattle Shrub/Tree Native perennial Mimosaceae wattles (acacias)

*Acacia decora* Western Silver Wattle, Showy Wattle, Western Golden Wattle, Pretty Wattle Shrub Native Important perennial Mimosaceae wattles (acacias)

*Acacia decurrens* Black Wattle, Early Black Wattle, Green Wattle, Queen Wattle, Sydney Green Wattle Shrub/Tree Native perennial Mimosaceae wattles (acacias)

*Acacia doratoxylon* Currawang, Lancewood, Spearwood, Cooriwan, Hickory, Brown Lancewood Shrub/Tree Native perennial Mimosaceae wattles (acacias)

*Acacia falcate* Sickle Wattle, Burra, Sickle-shaped Acacia, Sally, Hickory Wattle, Silver-leaved Wattle Shrub Native perennial Mimosaceae wattles (acacias)

*Acacia genistifolia* Spreading Wattle, Early Wattle, Wild Irishman Shrub Native Important perennial Mimosaceae wattles (acacias)

*Acacia gunnii* Ploughshare Wattle, Dog's Tooth Wattle Shrub Native perennial Mimosaceae wattles (acacias)

*Acacia mearnsii* Black Wattle, Green Wattle, Late Black Wattle Shrub/Tree Native perennial Mimosaceae wattles (acacias)

*Acacia paradoxa* Prickly Acacia, Acacia Hedge, Kangaroo Thorn, Hedge Wattle, Kangaroo Acacia, Prickly Wattle, Paradoxa Wattle Shrub Native perennial Mimosaceae wattles (acacias)

*Acacia parramattensis* Sydney Green Wattle, Parramatta Wattle, Parramatta Green Wattle Shrub/Tree Native perennial Mimosaceae wattles (acacias)

*Acacia rubida* Red-stem Wattle, Red-leaved Wattle Shrub/Tree Native perennial Mimosaceae wattles (acacias)

*Acacia sicutiformis* Dagger Wattle Shrub Native perennial Mimosaceae wattles (acacias)

*Acacia ulicifolia* Prickly Moses, Juniper Wattle Shrub Native perennial Mimosaceae wattles (acacias)

*Acacia verniciflua* Varnish Wattle Shrub/Tree Native perennial Mimosaceae wattles (acacias)  
*Acrotriche serrulata* Honeypots Shrub Native perennial Epacridaceae southern heaths or epacrids  
*Astroloma humifusum* Native Cranberry, Cranberry Heath Shrub Native Important perennial Epacridaceae southern heaths or epacrids  
*Astrotricha ledifolia* Common Star-hair Shrub Native perennial Araliaceae ginseng  
*Banksia marginata* Silver Banksia, Honeysuckle Banksia, Dwarf Honeysuckle, Warrock Shrub/Tree Native perennial Proteaceae waratahs, banksias, grevilleas, proteas  
*Boronia algida* Alpine Boronia Shrub Native perennial Rutaceae boronias, citrus, native fuchsias  
*Bossiaea buxifolia* Box-leaved Bitter-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Bossiaea prostrata* Creeping Bossiaea, Prostrate Bitter-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Bossiaea riparia* River Leafless Bossiaea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Brachyloma daphnoides* Daphne Heath Shrub Native perennial Epacridaceae southern heaths or epacrids  
*Bursaria spinosa* Australian Blackthorn, Bursaria, Blackthorn, Native Blackthorn, Sweet Bursaria (Native Box), Whitethorn, Christmas Bush, Prickly Pine, Prickly Box Shrub/Tree Native perennial Pittosporaceae native frangipani  
*Callistemon sieberi* Alpine Bottlebrush, River Bottlebrush Shrub/Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Calytrix tetragona* Fringe Myrtle, Common Fringe-myrtle, Heath Myrtle Shrub Native perennial  
*Cassinia aculeate* Common Cassinia, Chinese-scrub, Sifton Bush, Dogwood, Dolly Bush Shrub Native perennial Asteraceae daisies, sunflower  
*Cassinia arcuata* Drooping Cassinia, Chinese Tea-scrub, Sifton Bush, Chinese Shrub Native perennial Asteraceae daisies, sunflower  
*Cassinia longifolia* Shiny Cassinia, Cauliflower Bush, Long-leaf Dogwood Shrub Native perennial Asteraceae daisies, sunflower  
*Cassinia quinquefaria* Rosemary Cassinia Shrub Native perennial Asteraceae daisies, sunflower  
*Cheiranthra cyanea* Finger Flower Shrub Native perennial Pittosporaceae native frangipani  
*Comesperma ericinum* Heath Milkwort, Heath-leaved False-pea, Pyramid Flower Shrub Native perennial Polygalaceae milkworts  
*Cryptandra amara* Bitter Cryptandra Shrub Native perennial Rhamnaceae blueblossom  
*Daviesia genistifolia* Spiny Bitter-pea, Broom Bitter-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Daviesia latifolia* Hop Bitter-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Daviesia leptophylla* Narrow-leaf Bitter-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Daviesia mimosoides* Narrow-leaf Bitter-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Daviesia ulicifolia* Gorse Bitter-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Dillwynia cinerascens* Grey Parrot-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Dillwynia glauca* Michelago Parrot-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Dillwynia prostrata* Matted Parrot-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Dillwynia retorta* Heathy Parrot-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Dillwynia sericea* Showy Parrot-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Discaria pubescens* Australian Anchor-plant Shrub Native Important perennial Rhamnaceae blueblossom  
*Dodonaea procumbens* Trailing Hop-bush Shrub Native Important perennial Sapindaceae hop bushes  
*Dodonaea viscosa* Sticky Hop-bush, Giant Hop-bush Shrub Native perennial Sapindaceae hop bushes  
*Einadia hastate* Saloop, Berry Saltbush Shrub Native perennial Chenopodiaceae saltbushes, bluebushes, samphires, chenopods  
*Epacris* spp. Native Heaths Shrub Native perennial Epacridaceae southern heaths or epacrids  
*Eremophila debilis* Winter Apple, Creeping Boobialla, Amulla Shrub Native perennial Myoporaceae emu bush  
*Exocarpos cupressiformis* Cherry Ballart, Native Cherry, Wild Cherry, Cherry Wood Shrub/Tree Native Important perennial Santalaceae sandalwood  
*Exocarpos strictus* Pale Ballart, Pale-fruit Ballart, Dwarf Cherry Shrub Native Important perennial Santalaceae sandalwood  
*Geijera parviflora* Wilga Shrub/Tree Native perennial Rutaceae boronias, citrus, native fuchsias  
*Gompholobium huegelii* Pale Wedge-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Grevillea iaspiculata* Wee Jasper Grevillea Shrub Native Important perennial Proteaceae waratahs, banksias, grevilleas, proteas  
*Grevillea lanigera* Woolly Grevillea Shrub Native Important perennial Proteaceae waratahs, banksias, grevilleas, proteas  
*Grevillea ramosissima* Fan Grevillea, Branching Grevillea, Prickly Parsley Bush Shrub Native Important perennial Proteaceae waratahs, banksias, grevilleas, proteas  
*Grevillea rosmarinifolia* Rosemary Grevillea Shrub Native Important perennial Proteaceae waratahs, banksias, grevilleas, proteas  
*Grevillea wilkinsonii* Tumut Grevillea Shrub Native Important perennial Proteaceae waratahs, banksias, grevilleas, proteas  
*Hakea microcarpa* Small-fruit Hakea, Small-fruited Needlebush Shrub Native Important perennial Proteaceae waratahs, banksias, grevilleas, proteas  
*Hardenbergia violacea* False Sarsparilla, Purple Coral-pea, Native Lilac Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Hibbertia calycina* Lesser Guinea-flower Shrub Native Important perennial Dilleniaceae hibbertias  
*Hibbertia obtusifolia* Hoary Guinea-flower Shrub Native Important perennial Dilleniaceae hibbertias  
*Hibbertia riparia* Stream Guinea-flower, Erect Guinea-flower Shrub Native Important perennial Dilleniaceae hibbertias  
*Hibbertia stricta*  
*Hovea linearis* Creeping Hovea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Hovea heterophylla*  
*Hymenanthera dentata* Tree Violet Shrub Native perennial Violaceae violets  
*Indigofera adesmifolia* Tick Indigo, Leafless Indigo, Broad-leaved Indigo Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Indigofera australis* Austral Indigo, Australian Indigo, Native Indigo, Hill Indigo Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Jacksonia scoparia* Winged Broom-pea, Dogwood, Broom Shrub/Tree Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Jasminum suavissimum* Native Jasmine, Sweet Jasmine Shrub Native perennial Oleaceae olives  
*Kunzea ericoides* Burgan, Kanuka Shrub/Tree Native Important perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Kunzea parvifolia* Violet Kunzea, Tickbush Shrub Native Important perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Leptospermum myrtifolium* Swamp Myrtle, Swamp Tea-tree, Myrtleleaved Tea-tree, Grey Tea-tree Shrub Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Leptospermum obovatum* River Tea-tree, Blunt-leaf Tea-tree Shrub Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Lespedeza juncea* Perennial Lespedeza Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Leucopogon fletcheri* Pendant Beard Heath Shrub Native Important perennial Epacridaceae southern heaths or epacrids  
*Leucopogon fraseri* Beard Heath Shrub Native Important perennial Epacridaceae southern heaths or epacrids  
*Leucopogon virgatus* Common Beard Heath Shrub Native Important perennial Epacridaceae southern heaths or epacrids  
*Leucopogon virgatus* Peach Heath Shrub Native perennial Epacridaceae southern heaths or epacrids  
*Maireana microphylla* Eastern Cottonbush, Small-leaf Bluebush, Bluebush Shrub Native perennial Chenopodiaceae saltbushes, bluebushes, samphires, chenopods  
*Melaleuca parvistaminea* Honey-myrtle Shrub/Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Melaleuca ternifolia*  
*Melichrus urceolatus* Um Heath Shrub Native perennial Epacridaceae southern heaths or epacrids  
*Mirbelia oxylobioides* Mountain Mirbelia Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Muehlenbeckia axillaris* Wire Plant, Matted Lignum Shrub Native perennial Polygonaceae docks, buckwheat  
*Muehlenbeckia tuggeranong* Tuggeranong Lignum Shrub Native Important perennial Polygonaceae docks, buckwheat  
*Olearia elliptica* Sticky Daisy-bush Shrub Native perennial Asteraceae daisies, sunflower  
*Ozothamnus* spp. Everlastings Shrub Native perennial Asteraceae daisies, sunflower  
*Pimelea curviflora* Curved Rice-flower Shrub Native Important perennial Thymelaeaceae thymelias  
*Pimelea glauca* Shrubby Rice-flower Shrub Native Important perennial Thymelaeaceae thymelias  
*Pimelea pauciflora* Poison Pimelea, Poison Rice-flower Shrub Native Important perennial Thymelaeaceae thymelias  
*Pomaderris pallida* Pale Pomaderris Shrub Native perennial Rhamnaceae blueblossom  
*Pomaderris* spp. Pomaderris Shrub/Tree Native perennial Rhamnaceae blueblossom  
*Pultenaea fasciculata* Bush-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Pultenaea microphylla* Spreading Bush-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Pultenaea procumbens* Heathy Bush-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Pultenaea spinosa* Bush-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea  
*Pultenaea cunninghamii*  
*Pultenaea subspicata* Low Bush-pea Shrub Native Important perennial Fabaceae peas, eg. sturt desert pea

*Rhytidosporum procumbens* White Marianth Shrub Native perennial Pittosporaceae native frangipani *Pittosporum procumbens*, *Billardiera procumbens*  
*Rubus parvifolius* Small-leaf Raspberry, Small-leaved Raspberry, Native Raspberry Shrub Native perennial Rosaceae roses, blackberries, apples  
*Rulingia prostrate* Dwarf Kerrawang Shrub Native Important perennial Sterculiaceae kurrajongs, bottletrees  
*Solanum linearifolium* Mountain Kangaroo-apple, Kangaroo-apple Shrub Native perennial Solanaceae tomato, potato, tobacco  
*Styphelia triflora* Pink Five-corners Shrub Native perennial Epacridaceae southern heaths or epacrids  
*Templetonia stenophylla* Leafy Templetonia, Leafy Mallee-pea Shrub Native **Important** perennial Fabaceae peas, eg. sturt desert pea  
*Vittadinia gracilis* Woolly New Holland Daisy Shrub Native perennial Asteraceae daisies, sunflower  
*Westringia eremicola* Slender Westringia Shrub Native perennial Lamiaceae mints, sages, mintbush  
*Wilsonia rotundifolia* Round-leaf Wilsonia Shrub Native perennial Convolvulaceae morning glory, bindweed  
*Wilsonia rotundifolia* Grass Tree Grass Tree Native perennial Xanthorrhoeaceae grass trees

**Tree**

*Acacia dealbata* Silver Wattle Tree/Shrub Native perennial Mimosaceae wattles (acacias)  
*Acacia implexa* Lightwood, Hickory Wattle, Black Wattle, Hickory, Sally Wattle, Scrub Wattle, Screwpod Wattle, Bastard Myail, Lignum Vitae, Fish Wattle  
Broad-leaf Wattle Tree Native perennial Mimosaceae wattles (acacias)  
*Acacia melanoxylon* Blackwood, Black Wattle, Hickory, Mudgerabah, Paluma Blackwood, Sally Wattle Tree Native perennial Mimosaceae wattles (acacias)  
*Acacia obliquinervis* Mountain Hickory Wattle Tree Native perennial Mimosaceae wattles (acacias)  
*Allocasuarina littoralis* Black Sheoak Tree Native perennial Casuarinaceae cassuarinas, she-oaks  
*Allocasuarina luehmannii* Buloke, Bull Oak, Bullock, Bull Sheoak Tree Native perennial Casuarinaceae cassuarinas, she-oaks  
*Allocasuarina verticillata* Drooping Sheoak, Coast She-oak, Hill-oak, Sheoak Tree Native perennial Casuarinaceae cassuarinas, she-oaks *Casuarina stricta*  
*Angophora floribunda* Rough-barked Apple, Roughbark Apple, Apple Box (Qld), Apple, Boondah, Gum Myrtle, Rusty Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Brachychiton populneus* Kurrajong Tree Native perennial Sterculiaceae kurrajongs, bottletrees  
*Callitris endlicheri* Black Cypress Pine, Black Cypress, Red Cypress, Black Pine, Mountain Pine, Black Callitris, Red Cypress Pine Tree Native perennial Cupressaceae cypress pines  
*Callitris glaucophylla* White Cypress-pine, White Cypress, White Pine Tree Native perennial Cupressaceae cypress pines  
*Eucalyptus aggregata* Black Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus albens* White Box Dominant tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
**Note - T Peake determines species at Anvil Hill are intergraded between Albens/moluccana and albens/microcarpa**  
*Eucalyptus amplifolia* Cabbage Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus blakelyi* Blakely's Red Gum Dominant tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus bridgesiana* Apple Box, But-but Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus caliginosa* New England Stringybark Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus camaldulensis* River Red Gum, Red Gum, Murray Red Gum, River Gum (WA) Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus cinerea* Argyle Apple, Silver-leaved Stringybark Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus conica* Fuzzy Box Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus dalrympleana* Mountain Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus dives* Broad-leaved Peppermint, Peppermint, Blue Peppermint (Vic) Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus goniocalyx* Long-leaved Box, Bundy, Olive-barked Box Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus macrorhyncha* Red Stringybark Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus mannifera* Brittle Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus melliodora* Yellow Box, Yellow Jacket, Honey Box (Qld), Yellow Ironbark (Qld) Dominant tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
\* *Eucalyptus microcarpa* Grey Box, Narrow-leaved Box, Inland Grey Box, Western Grey Box Dominant tree (in Nandewar) Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
\* **Western and coastal grey box only relevant in the Nandewar region**  
\* *Eucalyptus moluccana* Grey Box, Gum-topped Box Dominant tree (in Nandewar) Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus nortonii* Mealy Bundy, Large-flowered Bundy Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus ovata* Swamp Gum, Black Gum (southern Tas), White Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus pauciflora* Snow Gum, Cabbage Gum (Tas), Weeping Gum (Tas), White Sally Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus polyanthemus* Red Box Tree/Mallee Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus populnea* Bimble Box, Poplar Box, Bimbil Box Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus rossii* Scribbly Gum, Snappy Gum, White Gum, Inland Scribbly Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus rubida* Candlebark, Ribbon Gum, White Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus sideroxylon* Red Ironbark, Mugga, Mugga Ironbark Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus stellulata* Black Sally Tree/Mallee Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Eucalyptus viminalis* Manna Gum, Ribbon Gum Tree Native perennial Myrtaceae gum trees, paper barks, bottle brushes, guavas  
*Notelaea microcarpa* Native Olive Tree Native perennial Oleaceae olives

## Additional Information on Anvil Hill

### Species Scheduled under the New South Wales State Threatened Species and Conservation Act

#### Flora scheduled under the NSW TSC Act

1. Pomaderris queenslandica (Endangered TSC Act )
2. Hunter Lowland Redgum Forest Endangered Ecological Community TSC Act
3. Cymbidium canaliculatum - Endangered Population in Hunter Catchment

4. *Goodenia macbaronii* - vulnerable TSC Act – the Anvil Hill site is the eastern limit of this species range.

### **Mammals Scheduled Threatened under TSC Act**

1. Koala (scat and scratch marks)
2. Squirrel Glider
3. Eastern Cave Bat
4. Large Bent Wing Bat
5. Large-footed Myotis Bat
6. Greater Broad-nosed Bat

### **Birds Scheduled Threatened TSC Act**

1. Brown Treecreeper
2. Diamond Firetail Finch
3. Speckled Warbler
4. Hooded Robin
5. Turquoise Parrot
6. Powerful Owl
7. Masked Owl
8. Barking Owl
9. Painted Honeyeater
10. Black-chinned Honeyeater
11. Glossy Black Cockatoo
12. Grey-crowned Babbler
13. Square-tailed Kite

## **Species that meet IUCN and/or DEH criteria for listing under the EPBC Act.**

### **IUCN Criteria for Species that are endemic to the site and immediate area, are;**

Critically Endangered species applying IUCN criterion B

Specifically: the extent of occurrence is less than 100 km<sup>2</sup>; the area of occupancy is less than 10 km<sup>2</sup>; the population is known to exist at only a single location; and due to a range of threats including open cut coal mining the population is projected to decline in terms of area, extent and quality of habitat.

Critically Endangered species applying IUCN criterion C.

Specifically: the population size is estimated to number fewer than 250 mature individuals; due to a range of threats including open cut coal mining the population is projected to decline in terms of number of mature individuals; and at least 90% of mature individuals are in one population.

Critically Endangered species applying IUCN criterion D

Specifically: the population size is estimated to number fewer than 50 mature individuals.

- ***Commersonia rosea*** (nominated endangered EPBC, Scientific Committee has advertised preliminary acceptance as an endangered species).

- ***Pomaderris reperta*** (nominated endangered EPBC, Scientific Committee has advertised preliminary acceptance as an endangered species).

- ***Oligochaetochilus (Pterostylis) sp. aff. praetermissus*** (ORG5019) (nominated endangered species EPBC Act and NSW TSC Act) The known population - the only known population of this taxon - consists of approximately 40 individuals (in two subpopulations approximately 40m apart) on Limb of Addy Hill.

***Oligochaetochilus sp. aff. praetermissus* (ORG5019) is a Critically Endangered species applying IUCN criterion D** i.e. the population size is estimated to number fewer than 50 mature individuals.

- **3 species of native camaenid land snail** yet to be named or nominated<sup>4</sup>. As follows “*I am currently engaged in a Masters Degree survey of non marine molluscs from the Hunter Region at the University of Newcastle. I am particularly concerned about the effects of the Anvil Hill open cut coalmine in the upper*

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<sup>4</sup> Information provided by email from Michael Shea, Malacology, Australian Museum

*Hunter/Goulburn River areas. There are at least three species of endemic undescribed camaenid land snails in the area that would be affected by such a development – one or two possibly severely.*<sup>5</sup> “

### **Woodland Communities that meet DEH criteria for listing under the EPBC Act**

- Central Hunter Box Ironbark Woodland (MU 10), which occupies a substantial area of the site, is given a preliminary coding of “2 (L) and probably 1 (V)” while variants of remaining on-site woodland either qualify as or are very close to this community or to others in the table. Its present known extent is estimated at 14,800 ha (= 31.6% of original); however, modelling limitations have led to the adoption of the ‘Precautionary principle” (extent of occurrence is about 1,600 km<sup>2</sup>) and therefore it meets criterion 2(R) DEH criteria:

- Forest Red Gum Riparian Woodland (MU 13) is restricted to Anvil Creek and Clark’s Gully, all within the Proposed Disturbance Area. It covers 51 hectares, with the most extensive occurrence being along the southern east–west flowing part of Anvil Creek. No other occurrences are known in the local area. This woodland meets the DEH criteria for listing as critically endangered and is regionally significant.

### **The following taxa on and/or near the site (local area) were listed on the Hunter Regionally Significant Plant Database as at 27th August 2004.**

Codes marked by \* are the recommendations of HRVR (Peake, 2005).

Botanical Name Regional Significance Code

Acacia binervia N  
Acacia decora U\*  
Acacia falcata W  
Acacia piligera N  
Acianthus apprimus D  
Allocasuarina gymnanthera E?W?  
Aristida ramosa var. ramosa W?  
# Bothriochloa biloba E? R\*  
Brunoniella pumilio N  
# Canthium buxifolium R  
# Cymbidium canaliculatum S E R\* T\*  
# Diuris tricolor E U R\*  
Enchylaena tomentosa U  
Eremophila deserti N  
Eucalyptus albens.moluccana intergrade E?  
Eucalyptus dawsonii N E  
Eucalyptus microcarpa E?  
Eucalyptus punctata NW  
Grevillea montana L?  
Lepidium hyssopifolium E? W?  
Lotus australis U  
Notelaea microcarpa var. microcarpa S  
# Pimelea latifolia subsp. elliptifolia L  
Pomaderris queenslandica  
Pomaderris reperta L  
# Ptilotus semilanatus D E R  
# Rostellularia adscendens subsp. adscendens var. latifolia S  
Notes: D = disjunct occurrence.  
E = eastern limit of distribution.  
L = endemic to the Hunter Region.  
N = northern limit of distribution.  
R = rare in the Hunter region.  
S = southern limit of distribution.  
T = threatened in the Hunter Region.  
U = uncommon.  
W = western limit of distribution.  
? = code is uncertain.  
\* = code recommended in the HVRV (Peake, 2005).  
# = taxa of highest regional significance.

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<sup>5</sup> Copy of the email and snail descriptions attached as Appendix 1

Peake recommendations. Hashed (#) entries represent those taxa that are considered to be of the highest level of regional significance. All other entries are considered to be of a lower level of regional significance (Peake, 2005, Draft 6 Vol. 1, p. 114-121).

The small herb-like *Halgania brachyrhyncha* was recorded in disturbed woodland margins. This is a regionally significant species and is uncommon in the State.

Abel Ecology - Fauna and Flora Investigations, Withers Property – Envirofund Report- 2005

## **Rare or Threatened Flora Species on or near the proposed site (as determined within the HVRV (Peake 2005, Draft 6 Vol 1, p 97-))**

1. *Acianthus apprimus* 2R - - Mt. Arthur near Muswellbrook
2. *Bothriochloa biloba* 3V V - Throughout the local area, but mostly in Muswellbrook district.
3. *Diuris tricolor* 3K V V Muswellbrook & Wybong
4. *Grevillea johnsonii* 2RCi - - Myambat Army Depot
5. *Isotropis foliosa* 3KC- - - Brushy Hill, Dry Creek, Myambat, Denman
6. *Macrozamia concinna* Rec. 2K - - Upper Hunter, north of Muswellbrook
7. *Pomaderris precaria* Rec. 2EC- - - Myambat Army Depot
8. *Pomaderris queenslandica* Rec. 3VCi - E Myambat Army Depot, Wybong Uplands, Towarri NP
9. *Pomaderris reperta* - - E Myambat Army Depot & near Denman
10. *Prasophyllum* sp. aff. *petilum*(undescribed) Rec. 2E - - Muswellbrook
11. *Prostanthera cryptandroides* 2RC-t; rec. 2VC-V V Myambat Army Depot

Notes: E = endangered (under both TSC Act 1995 and EPBC Act 1999).

EPBC = Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

ROTAP = Rare or Threatened Australian Plants database.

TSC = NSW Threatened Species Conservation Act 1995.

V = vulnerable (under both TSC Act 1995 and EPBC Act 1999).

= ROTAP Code (refer to Briggs and Leigh 1996 for definitions of codes).

(Peake, 2005, Draft 6 Vol. 1, p 97-98).

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- Zhiyuan Cong, *China University of Mining and Technology (Beijing)*, Key Laboratory of Coal Resources, Ministry of Education, P.R.C, XueYuan Road, Ding 11#, Haidian District, Beijing 100083, China, Fax: 86-10-62325016, Email: [zhiyuancong@hotmail.com](mailto:zhiyuancong@hotmail.com)
- Fenghua Zhao, *China University of Mining and Technology (Beijing)*, Key Laboratory of Coal Resources, Ministry of Education, P.R.C, XueYuan Road, Ding 11#, Haidian District, Beijing 100083, China, Fax: 86-10-62325016, Email: [zfh@cumtb.edu.cn](mailto:zfh@cumtb.edu.cn)
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