

# APPENDIX P1

## BASELINE FAUNA ASSESSMENTS 2005 AND 2006

# ANGAS PROCESSING FACILITY

MISCELLANEOUS PURPOSES LICENSE APPLICATION

2019/0826



ABN | 67 062 576 238

Unit 7 / 202-208 Glen Osmond Road | Fullarton SA 5063

# Assessment of the Fauna at the Proposed Angas Zinc Project:

For inclusion in the Mining and Rehabilitation Program

Donato Environmental Services

**ABN: 68083 254 015**

**September 2005**

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**Citation**

Donato, D.B., 2005, Assessment of the Fauna at the Proposed Angas Zinc Project: For inclusion to the Mining and Rehabilitation Program (MARF), Donato Environmental Services, Darwin.

## Scope of Brief

Donato Environmental Services has been contracted to provide an assessment of the vertebrate fauna component of the Angas Zinc project. The objective of this report is to provide input into the Mining and Rehabilitation Program (MARF), provide a list of expected vertebrate fauna and identify potential risks and risk management strategies.

## Introduction

Terramin Australia Limited is investigating the development of its Angas Prospect in South Australia. A feasibility study is currently underway and expressions of interest are being sought from interested engineering groups to provide the preliminary design and capital estimating capability for the project. The ability to provide the ongoing engineering and project management is also being canvassed.

The Angas Zinc Project is situated about 60 km southeast of Adelaide, South Australia, and 2.7 km from the township of Strathalbyn (latitude 138° 54' longitude -35° 15'). It is located on the southern end of Australia's first active mining area comprising many old mines and prospects mined in the period from 1846 to 1970. The Strathalbyn Lead Mine, 1 km to the north of Angas, was the first mine, commencing in 1846. The last mining ceased in 1970 with the closure of the Kanmantoo Copper Mine. Copper, lead, zinc, silver and some gold deposits occur throughout the zone.

The mineral zone lies on the western limb of the Monarto Syncline, a large fold structure bisected by the Bremer Fault. The host unit for the ore deposits is characterised by garnet rich alteration. Recently, PIRSA geologists have identified a possible repetition of the zone on the eastern side of the syncline. The project takes its name from the Angas River, which flows through Strathalbyn, then through a valley south of the project area. The deposit outcrops under sewage effluent treatment ponds for the town, and plunges south under a limestone quarry.

The current drilling program for the Feasibility Study is expected to achieve a probable reserve of 1.8M tonnes. The potential to quickly add significant additional resources is high, as the orebody remains open at depth and a large, untested DHEM conductor has been recognised within a fault off-set repetition of the host unit approximately 200m west of the down plunge orebody extensions. Both of these targets have the potential to add several million tonnes or more to the resource.

## **Mining**

The ore will be mined using underground mining methods due to the ore reserve having a thickness range of 3-12m, averaging approximately 7m, as well as being located near the town of Strathalbyn, under the local grey water ponds and a main arterial road. The current design was undertaken using the Rankin shoot resource model only.

The design approach for the mine is to:

- Maximise the potential to recover the largest proportion of economic ore;
- Minimise waste development;
- Provide suitable infrastructure for production operations while minimising capital expenditure on mine development; and
- Provide access for drilling of targets to define resources and reserves.

The current mine design is conceptual and aimed at allowing adequate development to facilitate reasonable access and servicing of stoping areas. It will be refined as drill information updates the orebody, geological structure and geotechnical models.

## **Milling**

Run of mine ore will be delivered by 50 or 30 tonne trucks to the mill. The ore will be crushed to minus 12mm directly to the ball mill at 50 dtph. Water is added into the ball mill feed chute to produce a 70wt%ss slurry. Ball mill discharge will be pumped into a hydrocyclone to produce a cyclone overflow (lead flotation feed) at P80 of 106 $\mu$  and 40wt%ss. The flotation plant consists of four flotation columns two in series to produce lead concentrate and two in series to produce zinc concentrate.

Lead and zinc concentrate will be collected into separate holding tanks. One filter will alternate between lead and zinc concentrate filtering. Filtered concentrate will be placed on concrete pads of 1000 tonne capacity for each lead and zinc concentrate. Filtered concentrate will be loaded into trucks for transport of zinc concentrate to Port Adelaide, and lead concentrate to Port Pirie. Concentrate transport trucks will be B Doubles with a 50 tonne payload capacity. Lead concentrate will require 320 truck trips per annum (6 trips per week) to Port Pirie and Zinc concentrate will require 1,307 truck trips per annum (25 trips per week) to Port Adelaide. Zinc flotation tailings will be pumped directly to the tailings dam.

## Tailings Disposal

The tailings will contain high levels of pyrrhotite and pyrite, nevertheless the tails are expected to slightly alkaline (J. Trewartha pers. com.). At elevated pH metals are likely to precipitate and not be bio-available by ingestion or absorption by wildlife from solution. The limestone quarry may be a suitable location for tailings deposition, the limestone could be utilised to control acid rock drainage from tailings and waste from underground.

After review of all metallurgical test work results, for the selected flow sheet, a zinc recovery of 90% producing 55% concentrate and for lead a recovery of 85% producing a 70% concentrate has been chosen for financial evaluation of the project.

## Existing Land Use

The mineral exploration licence (EL) includes a number of features, the Strathalbyn to Callington Road, the Strathalbyn wastewater lagoons (referred to as a wetland) and a prominent ridge trending approximately east west, an extractive minerals quarry and an industrial waste dump located on this ridge. Several houses are also located on the ridge. Portions of land to the north and south of the lagoons, ridge and quarry are currently used for cereal cropping and grazing, as well as a model aeroplane club airstrip and clubrooms.

## Habitat Provisions

There are two primary habitat provisions on the EL. The first is where the mining activity will be conducted, in open fields of introduced grasses with some remnant individual trees of Dryland Teatree (*Melaleuca sp.*).

This habitat is severely degraded and is impoverished in indigenous vertebrate fauna species.

The second is the artificially constructed River Red Gum (*Eucalyptus camaldulensis*) with Lignum (*Muldenbeckia florulenta*) understory wetland.

The waters are derived from effluent overflow. This habitat provides refuge for water birds and associated vertebrate fauna. This habitat is isolated from other similar habitat.

No mining activity is expected on the surface in the vicinity of the wetland.

Microhabitat provisions are provided by the presence of truck and car wrecks abandoned on site. These provide primarily shelter for introduced fauna, such as feral cat and fox.

## Site Visit

A one-hour site visit was conducted on 12 August 2005 to assess habitat provisions. No fauna surveying was conducted.

## Vertebrate Fauna

A list of expected vertebrate fauna to be recorded on the Angas Zinc EL is provided in Appendix 1. The expected list is derived from a habitat assessment, Birds Australia atlas database and the Southern Mount Lofty Biological Survey report (Armstrong, et al., 2001).

Of the Thirty-one species of native mammals known to reside in the Southern Mount Lofty Ranges (SMLR) at the commencement of European settlement in 1836, only twenty-two can now be confirmed as currently resident. The habitats of the Angas Zinc EL have been extensively cleared for some time and have rendered the site uninhabitable for most native fauna, except for the artificial wetland. Only those species that are contiguous with human habitation are likely to be present.

The Southern Mount Lofty Ranges supports two-thirds of the State's bird taxa including four endemic subspecies. The region is also an important zoogeographic outlier of the Bassian faunal zone that encompasses the subhumid regions of east and southeast Australia. Many of the Mount Lofty Ranges bird populations of Bassian forms are geographically isolated from their nearest populations in the south east of Australia. The Mount Lofty Ranges is one of 18 regions in Australia for which a coordinated conservation plan was recommended under The Action Plan for Australian Birds (Armstrong, et al., 2001).

The site, other than the wetland, is severely cleared of native vegetation and would not support the vast majority of native mammals of the Southern Mount Lofty Ranges. Avifauna likely to be present is those associated with an agricultural landscape of open fields with introduced grasses. Remnant trees do not provide any measurable habitat resource.

The nearby wetland houses many species of birds including water birds and migratory waders listed under international treaties such as Japan and Australia Migratory Bird Agreement (JAMBA) and the People's Republic of China and Australia Migratory Bird Agreement (CAMBA). These species may interact with the tailings storage facilities and are recognised as at-risk species on tailings dams (Donato, 1999).

Possibly up to nine bat species could be present in the region and are likely to be confined to the wetlands.

They will at times use the airspace above the active mine site and do access supernatant on tailings dams and associated liquor ponds. No hollows in remnant trees that would house roosting bats were observed at the quarry area although they may be present elsewhere on the lease. There is no habitat present on the EL that would house the endangered Southern Emu-wren Mount Lofty Ranges subspecies.

Six species of frog are known in the South Mount Lofty Ranges (Armstrong, et al., 2001), although not all are likely at the EL. Frog habitat exists at the wetland.

Two species of freshwater fish proposed as endangered under the *National Parks and Wildlife Services Act 1972*, being Southern Pygmy Perch (*Nannoperca australis*) and River Blackfish (*Gadopsis marmoratus*) are known from the southern Mount Lofty Ranges (Brown, 2001). Both species require permanent freshwater habitat (Brown, 2001, Carter, (n.d.)) which do not exist on the EL. The artificial wetland contains effluent overflow and is unlikely to contain any native fish species.

**Table 1: Potential risks to wildlife from proposed mining activities**

Potential Risks	Type of Event	Likely Consequences
<b>Environmental</b>	Disturbance to existing open fields habitat	Loss of some wildlife, but probably no loss of overall biodiversity. <b>Likelihood:</b> Virtually certain <b>Severity:</b> Low <b>Risk:</b> Low
	Wildlife interaction with operational tailings dam (if toxic)	Fauna loss by acute or chronic effect of tailings solutions and liquor. Impact predominantly on avifauna and bats. High level of connectiveness between nearby water bodies and liquor on the tailings storage facility. Wildlife species that will interact with the tailings liquor include those listed under the EPBC Act such as migratory waders. Long term impact and significant in numbers are possible. The impact will depend on toxicity, if any, of tailings solutions. <b>Likelihood:</b> low <b>Severity:</b> Severe effect <b>Risk:</b> Medium
	Removal of microhabitats (eg truck and car wrecks)	Probably loss of feral cat, fox, house mouse and some reptile habitat. <b>Likelihood:</b> Virtually certain <b>Severity:</b> Low <b>Risk:</b> Low
	Revegetation of bund areas	Revegetation will increase wildlife presence. Increase wildlife interaction (primarily birds) with mine infrastructures. Animal injury and death by collision with infrastructure and vehicles. Displacement of open field wildlife species. Increase of overall biodiversity.



Potential Risks	Type of Event	Likely Consequences
		<p><b>Likelihood:</b> Virtually certain  <b>Severity:</b> Low  <b>Risk:</b> Low</p>
	Traffic increases and resultant road kills (on-site and off-site)	<p>Predominantly exotic wildlife species, although nocturnal birds at risk. Loss probably not measurable to background road kill rate.  <b>Likelihood:</b> Virtually certain  <b>Severity:</b> Low  <b>Risk:</b> Low</p>
	Chemical spill on-site	<p>Local wildlife impact on the active mine site. Any spill is likely to be contained quickly. Impact to occur if wildlife drink or interact with toxicants. Localised and short-term.  <b>Likelihood:</b> Likely  <b>Severity:</b> Minor  <b>Risk:</b> Medium</p>
	Acid mine drainage	<p>Long-term impact on fauna (aquatic and terrestrial) possible by metal accumulation and biomagnification in ecosystem.  <b>Likelihood:</b> ?  <b>Severity:</b> Major  <b>Risk:</b> Medium/High</p>
	Off-site chemical spill (in transit)	<p>Fauna impact unknown as location not known. Probably short-term and localised. Acute and chronic affects not known.  <b>Likelihood:</b> Rare  <b>Severity:</b> Major  <b>Risk:</b> Medium</p>
	Groundwater contamination	<p>Wider impact, possibly to groundwater and surface waters. Impact may be off-site including on aquatic fauna in temporal streams  Difficult and expensive to detect impact on wildlife. Impact on terrestrial fauna interacting with contaminated waters. Impact longer term, chronic and bio-accumulative affects possible.  <b>Likelihood:</b> Unlikely  <b>Severity:</b> Major  <b>Risk:</b> Medium</p>
	Surface water contamination	<p>Localised impact on fauna or widespread downstream impact off-site. Impact on invertebrate and vertebrate aquatic fauna. Consideration needed for metal or bio-accumulative effects.  <b>Likelihood:</b> Rare  <b>Severity:</b> Major  <b>Risk:</b> Medium</p>
	Permanent disposal system contributing to groundwater contamination (incl. tails dam)	<p>As for ground water contamination.</p>
	Collision with infrastructure	<p>Loss on some individuals of some species by accidental collision (telecommunication towers)  <b>Likelihood:</b> Rare  <b>Severity:</b> Negligible  <b>Risk:</b> Low</p>
	Theft	<p>Chemical spills resulting from thief would have a local impact. Local fauna impact or widespread with spills into waterways.</p>

Potential Risks	Type of Event	Likely Consequences
		Species at-risk not known as location not known. <b>Likelihood:</b> Rare <b>Severity:</b> Major <b>Risk:</b> Medium
	Dust from transporting materials	Contaminants within dust entering the food chain by direct ingestion or plant uptake. <b>Likelihood:</b> Likely <b>Severity:</b> Minor <b>Risk:</b> Medium

## Risk Management

Risk management strategies are given in the table below. These strategies are only proposed to identify potential risks. Other risks may occur that will not be evident until the mining activities proposed are detailed.

**Table 2: Potential risk management strategies to reduce or eliminate the risk to wildlife from proposed mining activities**

Potential Risk	Risk Management Strategies
Disturbance to existing open fields habitat	No specific management required as open field habitats are extensive and provide poor resources to native fauna.
Wildlife interaction with operational tailings dam	Tailings disposal is to be slightly alkaline and therefore likely not toxic to wildlife (J. Trewartha pers. com). Tailings chemistry will need to be predicted through the entire ore profile. Resultant tailings chemistry and toxicity will also need to be predicted. Tailings storage facilities can be designed as not to attract wildlife species irrelevant of toxicity thereby reducing the risk. Contingency planning will be required if tailings present a risk to wildlife. Hazing techniques (scaring devices) are not a recommended management strategy, as they have repeatedly proven ineffective in mining applications.
Removal of microhabitats (eg truck and car wrecks)	Eventual increase in habitat provisions for native fauna with revegetation at the detriment of introduced fauna. No specific management strategies required.
Revegetation of bund areas	Net environmental gain and not specific management strategies required.
Traffic increases and resultant road kills (on-site and off-site)	No specific management strategies required. Impact immeasurable to background roadkill rate. Transport contractors may maintain a wildlife roadkill logbook.
Chemical spill on-site	Develop and implement best practise standards for on-site chemical containment and spills management.
Acid mine drainage	Develop modelling to determine the possibility of acid mine drainage occurring and the associated chemistry of any runoff. Implement management strategies to minimise, contain and deny wildlife access to acid solutions.
Off-site chemical spill (in transit)	Develop and implement best practise standards for on-site chemical containment and spills management.
Groundwater contamination (including tailings dams)	Manage such containment structures including tailings dams to best practise standards. Establish and monitor groundwater bores. Develop contingencies in the event of contamination.
Collision with infrastructure	A rare event that will not require specific management. Maintain a wildlife registry logbook to record such events.
Theft	Implement and maintain appropriate security and chemical inventory registries. Notify regulatory authorities of any theft.
Dust from transporting materials	Implement and monitor dust from mining and transport activities. Maintain dust control measures and record dust contaminants.

## Conclusions

Implementing the appropriate management strategies can accommodate wildlife risk.

The tailings storage facility, have been determined not to be toxic or acidic and therefore not a risk to wildlife (J. Trewartha pers. com.). The tailings dam will therefore need to be appropriately managed and monitored.

Depending on the tailings storage facility design wildlife is likely to interaction with the tailings storage facility. There will be fauna connectivity between the nearby artificial wetland and any supernatant and wet beach/supernatant interface including species listed as rare or vulnerable under the *National Parks and Wildlife Act 1972*, including but not limited to Blue-billed Duck, Musk Duck, Freckled Duck, Australian Shoveler, Great-crested Grebe, Intermediate Egret, Australian Bittern and Glossy Ibis. Interaction is likely for species listed under the CAMBA and JAMBA treaties in accordance with the *Environment Protection and Biodiversity Conservation Act 1999*. These include but are not limited to Bar-tailed Godwit, Black-tailed Godwit, Common Greenshank, Marsh Sandpiper, Wood Sandpiper, Common Sandpiper, Sharp-tailed Sandpiper, Red-necked Stint, Pacific Golden Plover, Caspian Tern and Fork-tailed Swift.

Provided industry best practise and standards are implemented, monitored and maintained then the impact of fauna can be reduced or eliminated.

The provisions of revegetation and mine closure criteria will accommodate a greater abundance and diversity of biota that currently existed on this site.

## References:

- Armstrong, D. M.; Croft, S. J.; Folkes, J. N. A biological survey of the Southern Mount Lofty Ranges, South Australia, 2001
- Brown, P. The Fish Habitat Handbook - How to Reduce the Impacts of Land-Based Development on South Australia's Fish Habitats, 2001
- Carter, J., and Pierce, B. Freshwater Fishes of the Mount Lofty Ranges, (n.d.)
- Donato, D. Bird Usage Patterns on Northern Territory Mining Water Tailings and their Management to Reduce Mortalities, Public Report. Department of Mines and Energy; Darwin, Northern Territory; 1999.

## Appendix 1:

Table 1. Summary of current resident mammals in the Southern Mount Lofty Ranges region, and those expected to be present on the Angas Zinc Exploration Lease. Status refers to the NPWS Act 1992 and Southern Mount Lofty Ranges region according to (Armstrong, et al., 2001). \* Introduced species.

Species	Common name	Regional Status	NPWS ACT 1972 status	Expected on Angas Zinc EL
<i>Acrobates pygmaeus</i>	Feather Glider	Extinct	Endangered	No
* <i>Capra hircus</i>	Feral Goat			No
<i>Cercartetus concinnus</i>	Western Pygmy Possum			No
<i>Canis lupus dingo</i>	Dingo	Extinct		No
* <i>Vulpes vulpes</i>	Red Fox			Yes
<i>Cervus dama</i>	Fallow Deer			No
<i>Dasyurus viverrinus</i>	Eastern Quoll	Extinct	Endangered	No
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Extinct	Endangered	No
<i>Sminthopsis murina</i>	Common Dunnart			Yes
<i>Sminthopsis crasicaudata</i>	Fat-tailed Dunnart			?
<i>Antechinus flavipes</i>	Yellow-footed Antechinus			Yes
* <i>Felis catus</i>	Cat			Yes
<i>Oryctolagus cuniculus</i>	Rabbit			Yes
<i>Lepus capensis</i>	Brown Hare			Yes
<i>Macropus eugenii</i>	Tammar Wallaby	Extinct	Endangered	No
<i>Macropus robustus</i>	Euro			No
<i>Macropus fuliginosus</i>	Western Grey Kangaroo			Yes
<i>Rattus fuscipes</i>	Bush Rat			Yes
<i>Rattus lutreolus</i>	Swamp Rat			Yes
<i>Hydromys chrysogaster</i>	Water Rat			?
* <i>Mus musculus</i>	House Mouse			Yes
<i>Rattus rattus</i>	Black Rat			Yes
<i>Rattus norvegicus</i>	Brown Rat			Yes
<i>Ornithorhynchus anatinus</i>	Platypus	?	Endangered	No
<i>Isodon obesulus</i>	Southern Brown Bandicoot	Vulnerable	Vulnerable	No
<i>Macrotis lagotis</i>	Greater Bilby	Extinct	Endangered	No
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	Rare		Yes
<i>Phascolarctos cinereus</i>	Koala	Rare	Rare	No
<i>Bettongia lesueur</i>	Burrowing Bettong	Extinct	Endangered	No
<i>Bettongia penicillata</i>	Brush-tail Bettong	Extinct	Rare	No
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum			No
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna			Yes
<i>Chalinolobus gouldii</i>	Gould's Wattle Bat			Yes
<i>Chalinolobus morio</i>	Chocolate Wattled Bat			Yes
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat			Yes
<i>Vespedelus darlingtoni</i>	Large Forest Bat			Yes
<i>Vespedelus regulus</i>	Southern Forest Bat			Yes
<i>Vespedelus vulturinus</i>	Little Forest Bat			Yes
<i>Mormopterus spp.</i>	Southern Freetail Bats			Yes
<i>Tadarida australis</i>	White-striped Freetail Bat			Yes
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail Bat			Yes

Table 2: Bird taxa expected at the Angas Zinc EL, its status and whether they will interact with tailings storage facilities. Where the status is blank the reference is to secure status.

<b>Species</b>	<b>NPWS ACT 1972 Status</b>	<b>Interact with Tailings Dams</b>
Stubble Quail		No
Black Swan		Yes
Blue-billed Duck	Rare	Yes
Musk Duck	Rare	Yes
Australian Wood Duck		Yes
Pink-eared Duck		Yes
Grey Teal		Yes
Chestnut Teal		Yes
Australian Shelduck		Yes
Freckled Duck	Vulnerable	Yes
Hardhead		Yes
Pacific Black Duck		Yes
Australasian Shoveler	Rare	Yes
Australian Grebe		Yes
Hoary-headed Grebe		Yes
Great Crested Grebe	Rare	Yes
Little Black Cormorant		Yes
Pied Cormorant		Yes
Little Pied Cormorant		Yes
Australian Pelican		Yes
Great Egret		Yes
Intermediate Egret	Rare	Yes
Little Egret		Yes
White-faced Heron		Yes
White-necked Heron		Yes
Nankeen Night Heron		Yes
Australasian Bittern	Vulnerable	?
Royal Spoonbill		Yes
Yellow-billed Spoonbill		Yes
Straw-necked Ibis		?
Australian White Ibis		?
Glossy Ibis	Rare	?
Whistling Kite		Yes
Wedge-tailed Eagle		Yes
Swamp Harrier		No
Black Shouldered Kite		No
Collared Sparrowhawk		No
Brown Goshawk		No
Nankeen Kestrel		No
Australian Hobby		No
Brown Falcon		No

Table 2: Continued

<b>Species</b>	<b>Status</b>	<b>Interact with Tailings Dams</b>
Dusky Moorhen		No
Purple Swamphen		No
Black-tailed Native Hen		No
Eurasian Coot		Yes
Australian Spotted Crake		Yes
Latham's Snipe	Vulnerable	No
Painted Snipe	Rare	No
Bar-tailed Godwit	CAMBA and JAMBA listed	Yes
Black-tailed Godwit	CAMBA and JAMBA listed	Yes
Common Greenshank	CAMBA and JAMBA listed	Yes
Marsh Sandpiper	CAMBA and JAMBA listed	Yes
Wood Sandpiper	CAMBA and JAMBA listed	Yes
Common Sandpiper	CAMBA and JAMBA listed	Yes
Sharp-tailed Sandpiper	CAMBA and JAMBA listed	Yes
Red-necked Stint	CAMBA and JAMBA listed	Yes
Black-winged Stilt		Yes
Red-necked Avocet		Yes
Pacific Golden Plover	CAMBA and JAMBA listed	No
Red-capped Plover		Yes
Black-fronted Dotterel		Yes
Red-kneed Dotterel		Yes
Masked Lapwing		Yes
Silver Gull		Yes
Caspian Tern	CAMBA and JAMBA listed	Yes
Whiskered Tern		Yes
Common Bronzewing		Yes
Crested Pigeon		Yes
*Spotted Turtle dove		No
Galah		Yes
Rainbow Lorikeet		No
Purple-crowned Lorikeet		No
Red-rumped Parrot		No
Southern Boobook		No
Tawny Frogmouth		No
Fork-tailed Swift	CAMBA and JAMBA listed	Yes
Sacred Kingfisher		No
Rainbow Bee-eater		No
Striated Pardalote		No
Weebill		No
Yellow-rumped Thornbill		No
Brown Thornbill		No

Table 2: Continued

Species	Status	Interact with Tailings Dams
Red Wattledbird		No
White-plumed Honeyeater		No
New Holland Honeyeater		No
Mistletoebird		No
Rufous Whistler		No
Grey Fantail		No
Willie Wagtail		No
Magpie Lark		No
Black-faced Cuckoo-shrike		No
Australian Magpie		No
Little Raven		Yes
Australian Raven		Yes
Welcome Swallow		yes
Tree Martin		Yes
Fairy Martin		Yes
Clamorous Reed Warbler	CAMBA and JAMBA listed	No
Brown Songlark		No
Silvereye		No
European Starling		No

**Table 3: Reptiles found in the Southern Mount Lofty Ranges (Armstrong, et al., 2001)**

<i>Chelodina longicollis</i> Side-necked Tortoises	<i>Emydura macquarii</i> Common Long-necked Tortoise
<i>Ctenophorus decresii</i> Tawny Dragon	<i>Ctenophorus pictus</i> Painted Dragon
<i>Physignathus lesueurii</i> Water Dragon	<i>Pogona barbata</i> Eastern Bearded Dragon
<i>Tympanocryptis lineata</i> ? Five-lined Earless Dragon	<i>Aprasia pseudopulchella</i> Flinders Worm Lizard
<i>Aprasia striolata</i> Lined Worm Lizard	<i>Christinus marmoratus</i> Marbled Gecko
<i>Delma inornata</i> Olive Snake-lizard	<i>Delma mollerii</i> Adelaide Snake-lizard
<i>Diplodactylus vittatus</i> Eastern Stone Gecko	<i>Lialis burtonis</i> ? Burton's Legless Lizard
<i>Nephrurus millii</i> Barking Gecko	<i>Pygopus lepidopodus</i> Common Scaly-foot
<i>Bassiana duperreyi</i> Eastern Three-lined Skink	<i>Cryptoblepharus plagiocephalus</i> Desert Wall Skink
<i>Ctenotus orientalis</i> Eastern Spotted Ctenotus	<i>Ctenotus robustus</i> Eastern Striped Skink
<i>Egernia cunninghami</i> Cunningham's Skink	<i>Egernia striolata</i> Eastern Tree Skink
<i>Egernia whitii</i> White's Skink	<i>Eulamprus heatwolei</i> Yellow-bellied Water Skink

**Frogs**

Frogs found in the Southern Mount Lofty Ranges (Armstrong, et al., 2001).

Only six are confirmed as currently occurring and resident in the Southern Mount Lofty Ranges:

Painted Frog *Neobatrachus pictus*

Marbled Frog *Limnodynastes tasmaniensis*

Brown Froglet *Crinia signifera*

Bull Frog *Limnodynastes dumerili*

Brown Toadlet *Pseudophryne bibroni*

Brown Tree Frog *Litoria ewingi*.

These species are likely to inhabit the artificial wetland on the Angas Zinc EL.





## **SECTION I-2**

### **FIELD FAUNA SURVEY**



## Opportunistic Fauna Survey: Angus Zinc Project

Report to:  
Terramin Australia Ltd  
September 2006

Donato Environmental Services  
ABN 68083 254 015  
Office +61 8 8842 1915  
Fax +61 8 8842 2157  
[des@rbe.net.au](mailto:des@rbe.net.au)

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## Citation

Cricelli, S.D. and Donato, D.B., 2006. Opportunistic Fauna Survey: Angus Zinc Project, Donato Environmental Services

## Introduction

Terramin Australia Ltd's Angus Zinc Project is located 60 km southeast of Adelaide, South Australia and 1.7 km from the township of Strathalbyn. It is situated on the southern end of Australia's first active mining area. The first mine, the Strathalbyn Lead Mine, began operating in 1846. The closure of Kanmantoo Copper Mine in 1970 marked the end of mining in the area. Copper, lead, zinc, silver and some gold deposits occur throughout the zone.

The mineral zone lies on the western limb of the Monarto Syncline, a large fold structure bisected by the Bremer Fault. The host unit for the ore deposits is characterised by garnet-rich alteration. Recently, Primary Industries and Resources South Australia geologists have identified a possible repetition of the zone on the eastern side of the syncline.

The Angus Zinc Project deposit outcrops under sewerage effluent treatment ponds for the town and plunges south under a limestone quarry. The current drilling program for the feasibility study is expected to achieve a probable reserve of 1.8M tonnes.

Donato Environmental Services was approached by Joe Mifsud, of Natural Resource Services, Pty Ltd. To conduct a one-day opportunistic fauna survey of both the green fields and the sewerage works areas on the Angus Zinc Project Exploration Lease (EL). The objective of the fauna survey is to gain an understanding of the fauna present in the area. No data was collected on the abundance of fauna at these locations.

The Southern Mount Lofty Ranges supports two-thirds of the State's bird taxa including four endemic subspecies. The region is also an important zoogeographic outlier of the Bassian faunal zone that encompasses the subhumid regions of east and southeast Australia. A list of expected vertebrate fauna to be recorded on the Angus Zinc Project EL is provided in Appendix 1. The expected list is derived from an on-site habitat assessment, Birds Australia atlas database and the Southern Mount Lofty Biological Survey report (Armstrong, Croft et al. 2001).

The habitats of the Angus Zinc Project EL have been extensively cleared for some time, except for the sewerage works, and have rendered the site uninhabitable for most native fauna. Only the species that are contiguous with human habitation are likely to be present.

Of the 31 species of native mammals known to reside in the Southern Mount Lofty Ranges at the commencement of European settlement in 1836, only twenty-two can now be confirmed as currently resident.

Avifauna likely to be present are those associated with an agricultural landscape of open fields with introduced grasses. Remnant trees do not provide any measurable habitat resource. Many of the bird populations of Mount Lofty Ranges Bassian forms are geographically isolated from their nearest populations in the southeast of Australia. The Mount Lofty Ranges is one of 18 regions in Australia for which a coordinated conservation plan was recommended under the *Action Plan for Australian Birds* (Armstrong, Croft et al. 2001). There is no habitat present on the Angus Zinc Project EL that would house the endangered Southern Emu-wren Mount Lofty Ranges subspecies.

## Scope of Work

## Existing Literature

The nearby sewerage works houses many species of birds including waterbirds and migratory waders listed under international treaties such as Japan and Australia Migratory Bird Agreement (JAMBA) and the People's Republic of China and Australia Migratory Bird Agreement (CAMBA). These species may interact with the tailings storage facilities and are recognised elsewhere as at-risk species on tailings dams (Donato 1999).

Possibly up to nine bat species may be present in the region and are likely to be confined to the sewerage works. They will at times use the airspace above the active mine site and do access supernatant on tailings dams and associated liquor ponds. No hollows in remnant trees that would house roosting bats were observed at the quarry area although they may be present elsewhere on the lease.

Forty-two native and two introduced reptile species currently reside in the Southern Mount Lofty Ranges (Armstrong, Croft et al. 2001). Reptile habitat can be found at both the green fields and the sewerage works.

Six species of frog are known in the South Mount Lofty Ranges (Armstrong, Croft et al. 2001), although not all are likely to be at the Angus Zinc Project EL. Frog habitat exists at the sewerage works.

## Methodology

A three-hour (1300-1600) site visit was conducted on 19 August 2006, by two people. Both the green fields immediately south of the existing quarry and the sewerage works were surveyed during this time. The two sites were surveyed separately due to their different habitat provisions. The green fields are ungrazed grassland whereas the sewerage works is an artificial wetland. Diurnal fauna were recorded by sight, sound, tracks and scats. At the sewerage works fauna was observed using 8x magnification binoculars.

To document the presence of bats, one Anabat™ echolocation device was located on green fields area south of the existing quarry. A second Anabat™ echolocation device was established at the bird hide at the sewerage ponds. The devices were programmed to operate approximately from 1845 to 2030 hours. The calls were later counted and analysed to identify bat species in the area.

## Results

The two areas on the lease, green fields and sewerage works, produced different results regarding fauna that was present on the day (see Table 1). This table also indicates any species protected under the *National Parks and Wildlife Act 1972* as being endangered (schedule 7), vulnerable (schedule 8), rare (schedule 9) or unprotected (schedule 10). A schedule is a way of grouping species whose numbers are declining, or in the case of schedule 10, out of control. *The National Parks and Wildlife Act 1972* protects species that come under Schedule 7 through to 9. Legislation states no activity that is or is likely to be detrimental to the welfare of a protected species should be undertaken.

Table 1: Fauna recorded and its location – sewerage works (S), green fields (G)

Common Name	Scientific Name	Location	Schedule
Black Kite	<i>Milvus migrans</i>	G and S	
Little Raven	<i>Corvus mellori</i>	G	10
Common Starling	<i>Sturnus Vulgaris</i>	G and S	
House Sparrow	<i>Passer domesticus</i>	G and S	
Welcome Swallow	<i>Hirundo neoxena</i>	G and S	
Galah	<i>Cacatua roseicapilla</i>	G and S	10
Richard's Pipit	<i>Anthus novaeseelandiae</i>	G	
Australian Magpie	<i>Gymnorhina tibicen</i>	G and S	
Skylark	<i>Alauda arvensis</i>	G	
European Goldfinch	<i>Carduelis carduelis</i>	G and S	
Willie Wagtail	<i>Rhipidura leucophrys</i>	G and S	
Black-shouldered Kite	<i>Elanus axillaries</i>	G	
Magpie-lark	<i>Grallina cyanoleuca</i>	G and S	
Adelaide Rosella	<i>Platycercus elegans adelaidae</i>	G and S	
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	G and S	
Fairy Martin	<i>Hirundo nigricans</i>	G and S	
White-plumed Honeyeater	<i>Melithreptus gularis</i>	G and S	
Nankeen Kestrel	<i>Falco cenchroides</i>	G	
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	S	
Hardhead	<i>Aythya australis</i>	S	
Superb Fair-wren	<i>Malurus splendens</i>	S	
Mask Lorikeet	<i>Glossopsitta concinna</i>	S	
Crested Pigeon	<i>Ocyphaps lophotes</i>	S	
Common Blackbird	<i>Turdus philomelos</i>	S	
Eurasian Coot	<i>Fulica atra</i>	S	
Masked Lapwing	<i>Vanellus miles</i>	S	
Black Swan	<i>Cygnus atratus</i>	S	
Pacific Black Duck	<i>Anas superciliosa</i>	S	
Australian Shelduck	<i>Tadorna tadornoides</i>	S	
Australasian Shoveler	<i>Anas rhynchotis</i>	S	9
Grey Teal	<i>Anas gracilis</i>	S	
Blue-billed Duck	<i>Oxyura australis</i>	S	9
Red Wattlebird	<i>Anthochaera carunculata</i>	S	10
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	S	
Little Grassbird	<i>Megalurus timoriensis</i>	S	
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	S	
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	S	
Horsfield's Bronze Cuckoo	<i>Chrysococcyx osculans</i>	S	
Rock Dove	<i>Columba livia</i>	S	
Black-fronted Dotterel	<i>Euseyornis melanops</i>	S	
Dusky Woodswallow	<i>Artamus cyanopterus</i>	S	
Crested Shrike-tit	<i>Falcunculus frontatus</i>	S	8
Spotted Turtle-Dove	<i>Streptopelia chinensis</i>	S	
New Holland Honeyeater	<i>Phylidonyris melanops</i>	S	
White-fronted Chat	<i>Epthianura albifrons</i>	S	
Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>	S	
Brown Toadlet	<i>Pseudophryne bibronii</i>	S	
Marbled Frog	<i>Limnodynastes tasmaniensis</i>	S	
Red Fox	<i>Vulpes vulpes</i>	S and G	
Rabbit	<i>Oryctolagus cuniculus</i>	G	
Sheep		G	



The bats species that were recorded at both sites are described in Table 2.

**Table 2: Bats recorded at each site**

	Calls	Total Number of Calls/Hour
<b>Green Fields</b>		
Inland Broad-nosed Bat	4	0.04
Southern Free-tail Bat	28	0.28
Nyctophilus species	2	0.02
Southern Forest Bat	2	0.02
Little Forest Bat	2	0.02
Inland Broad-nosed Bat/ Southern Freetail Bat	28	0.28
<b>Total</b>	<b>66</b>	<b>97 minutes</b>
<b>Sewerage Works</b>		
Gould's Wattled Bat	16	0.15
Chocolate Wattled Bat	108	1
Southern Free-tail Bat	87	0.8
Little Forest Bat	95	0.87
Southern Forest Bat	66	0.61
Unidentified	15	0.13
<b>Total</b>	<b>301</b>	<b>108 minutes</b>

## Discussion

There are limitations associated with an opportunistic survey, such as seasonality, observation frequency and lack of trapping for terrestrial mammals and reptiles. If trapping was conducted, it would be expected that small mammals and reptiles would be recorded at both sites. However, this method is more effective if conducted during the warmer months. Nevertheless a significant number of species were observed. A total of 51 vertebrate species were recorded during the survey, comprising of 46 birds, two amphibians, three terrestrial mammals and eight bat species. No fish netting was done on the day, fish are not expected at the sewerage works.

The sewerage works provides suitable habitat for wetland species and those that inhabit river red gum, lignum and samphire remnants. The sewerage works provide a substantial feeding resource for insectivorous bats. The number of bats call recorded for unit time was exceptionally high. The roosting location of these bats is currently unknown.

Species that are typical of an agricultural landscape were recorded at the green fields. As grazing has been discontinued, this area is starting to resemble a grassland. Insectivorous bats and birds, such as the Richard's Pipit *Anthus novaeseelandiae*, were notably abundant, indicating sufficient food resources.

No schedule 7 species recorded under the *National Parks and Wildlife Act 1972* were observed at either site. One schedule 8 and two schedule 9 species were recorded at the sewerage works. There were also three schedule 10 (not protected) species recorded during the survey.

## References

- Armstrong, D.M., S. J. Croft, et al. (2001). A biological survey of the Southern Mount Lofty Ranges, South Australia,. Adelaide, Department of Environment and Heritage.
- Donato, D.B.,(2005). Assessment of the Fauna at the Proposed Angus Zinc Project: For inclusion to the Mining and Rehabilitation Program (MARF), Donato Environmental Services, Darwin.
- Donato, D. (1999). Bird Usage Patterns on Northern Territory Mining Water Tailings and their Management to Reduce Mortalities; Public Report,. Darwin, Northern Territory., Department of Mines and Energy.

## Appendix 2:

Summary of current resident mammals in the Southern Mount Lofty Ranges region, and those expected to be present on the Angas Zinc Exploration Lease. Status refers to the NPWS Act 19972 and Southern Mount Lofty Ranges region according to (Armstrong, et al., 2001). \* Introduced species.

Species	Common name	Regional Status	NPWS ACT 1972 status	Expected on Angas Zinc EL
<i>Acrobates pygmaeus</i>	Feather Glider	Extinct	Endangered	No
* <i>Capra hircus</i>	Feral Goat			No
<i>Cercartetus concinnus</i>	Western Pygmy Possum			No
<i>Canis lupus dingo</i>	Dingo	Extinct		No
* <i>Vulpes vulpes</i>	Red Fox			Yes
<i>Cervus dama</i>	Fallow Deer			No
<i>Dasyurus viverrinus</i>	Eastern Quoll	Extinct	Endangered	No
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Extinct	Endangered	No
<i>Sminthopsis murina</i>	Common Dunnart			Yes
<i>Sminthopsis crasicaudata</i>	Fat-tailed Dunnart			?
<i>Antechinus flavipes</i>	Yellow-footed Antechinus			Yes
* <i>Felis catus</i>	Cat			Yes
<i>Oryctolagus cuniculus</i>	Rabbit			Yes
<i>Lepus capensis</i>	Brown Hare			Yes
<i>Macropus eugenii</i>	Tammar Wallaby	Extinct	Endangered	No
<i>Macropus robustus</i>	Euro			No
<i>Macropus fuliginosus</i>	Western Grey Kangaroo			Yes
<i>Rattus fuscipes</i>	Bush Rat			Yes
<i>Rattus lutreolus</i>	Swamp Rat			Yes
<i>Hydromys chrysogaster</i>	Water Rat			?
* <i>Mus musculus</i>	House Mouse			Yes
<i>Rattus rattus</i>	Black Rat			Yes
<i>Rattus norvegicus</i>	Brown Rat			Yes
<i>Ornithorhynchus anatinus</i>	Platypus	?	Endangered	No
<i>Isoodon obesulus</i>	Southern Brown Bandicoot	Vulnerable	Vulnerable	No
<i>Macrotis lagotis</i>	Greater Bilby	Extinct	Endangered	No
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	Rare		Yes
<i>Phascolarctos cinereus</i>	Koala	Rare	Rare	No
<i>Bettongia lesueur</i>	Burrowing Bettong	Extinct	Endangered	No
<i>Bettongia penicillata</i>	Brush-tail Bettong	Extinct	Rare	No
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum			No
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna			Yes
<i>Chalinolobus gouldii</i>	Gould's Wattle Bat			Yes
<i>Chalinolobus morio</i>	Chocolate Wattle Bat			Yes
<i>Nyctophylus geoffroyi</i>	Lesser Long-eared Bat			Yes
<i>Vespedelus darlingtoni</i>	Large Forest Bat			Yes
<i>Vespedelus regulus</i>	Southern Forest Bat			Yes
<i>Vespedelus vulturinus</i>	Little Forest Bat			Yes
<i>Mormopterus spp.</i>	Southern Freetail Bats			Yes
<i>Tadarida australis</i>	White-striped Freetail Bat			Yes
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat			Yes

Table 2: Bird taxa expected at the Angas Zinc EL, its status and whether they will interact with tailings storage facilities. Where the status is blank the reference is to secure status.

<b>Species</b>	<b>NPWS ACT 1972 Status</b>	<b>Interact with Tailings Dams</b>
Stubble Quail		No
Black Swan		Yes
Blue-billed Duck	Rare	Yes
Musk Duck	Rare	Yes
Australian Wood Duck		Yes
Pink-eared Duck		Yes
Grey Teal		Yes
Chestnut Teal		Yes
Australian Shelduck		Yes
Freckled Duck	Vulnerable	Yes
Hardhead		Yes
Pacific Black Duck		Yes
Australasian Shoveler	Rare	Yes
Australian Grebe		Yes
Hoary-headed Grebe		Yes
Great Crested Grebe	Rare	Yes
Little Black Cormorant		Yes
Pied Cormorant		Yes
Little Pied Cormorant		Yes
Australian Pelican		Yes
Great Egret		Yes
Intermediate Egret	Rare	Yes
Little Egret		Yes
White-faced Heron		Yes
White-necked Heron		Yes
Nankeen Night Heron		Yes
Australasian Bittern	Vulnerable	?
Royal Spoonbill		Yes
Yellow-billed Spoonbill		Yes
Straw-necked Ibis		?
Australian White Ibis		?
Glossy Ibis	Rare	?
Whistling Kite		Yes
Wedge-tailed Eagle		Yes
Swamp Harrier		No
Black Shouldered Kite		No
Collared Sparrowhawk		No
Brown Goshawk		No
Nankeen Kestrel		No
Australian Hobby		No
Brown Falcon		No

Table 2: Continued

<b>Species</b>	<b>Status</b>	<b>Interact with Tailings Dams</b>
Dusky Moorhen		No
Purple Swamphen		No
Black-tailed Native Hen		No
Eurasian Coot		Yes
Australian Spotted Crake		Yes
Latham's Snipe	Vulnerable	No
Painted Snipe	Rare	No
Bar-tailed Godwit	CAMBA and JAMBA listed	Yes
Black-tailed Godwit	CAMBA and JAMBA listed	Yes
Common Greenshank	CAMBA and JAMBA listed	Yes
Marsh Sandpiper	CAMBA and JAMBA listed	Yes
Wood Sandpiper	CAMBA and JAMBA listed	Yes
Common Sandpiper	CAMBA and JAMBA listed	Yes
Sharp-tailed Sandpiper	CAMBA and JAMBA listed	Yes
Red-necked Stint	CAMBA and JAMBA listed	Yes
Black-winged Stilt		Yes
Red-necked Avocet		Yes
Pacific Golden Plover	CAMBA and JAMBA listed	No
Red-capped Plover		Yes
Black-fronted Dotterel		Yes
Red-kneed Dotterel		Yes
Masked Lapwing		Yes
Silver Gull		Yes
Caspian Tern	CAMBA and JAMBA listed	Yes
Whiskered Tern		Yes
Common Bronzewing		Yes
Crested Pigeon		Yes
*Spotted Turtledove		No
Galah		Yes
Rainbow Lorikeet		No
Purple-crowned Lorikeet		No
Red-rumped Parrot		No
Southern Boobook		No
Tawny Frogmouth		No
Fork-tailed Swift	CAMBA and JAMBA listed	Yes
Sacred Kingfisher		No
Rainbow Bee-eater		No
Striated Pardalote		No
Weebill		No
Yellow-rumped Thornbill		No
Brown Thornbill		No

Table 2: Continued

<b>Species</b>	<b>Status</b>	<b>Interact with Tailings Dams</b>
Red Wattledbird		No
White-plumed Honeyeater		No
New Holland Honeyeater		No
Mistletoebird		No
Rufous Whistler		No
Grey Fantail		No
Willie Wagtail		No
Magpie Lark		No
Black-faced Cuckoo-shrike		No
Australian Magpie		No
Little Raven		Yes
Australian Raven		Yes
Welcome Swallow		yes
Tree Martin		Yes
Fairy Martin		Yes
Clamorous Reed Warbler	CAMBA and JAMBA listed	No
Brown Songlark		No
Silvereye		No
European Starling		No

**Table 3: Reptiles found in the Southern Mount Lofty Ranges (Armstrong, et al., 2001)**

<i>Chelodina longicollis</i> Side-necked Tortoises	<i>Emydura macquarii</i> Common Long-necked Tortoise
<i>Ctenophorus decresii</i> Tawny Dragon	<i>Ctenophorus pictus</i> Painted Dragon
<i>Physignathus lesueurii</i> Water Dragon	<i>Pogona barbata</i> Eastern Bearded Dragon
<i>Tympanocryptis lineata</i> ? Five-lined Earless Dragon	<i>Aprasia pseudopulchella</i> Flinders Worm Lizard
<i>Aprasia striolata</i> Lined Worm Lizard	<i>Christinus marmoratus</i> Marbled Gecko
<i>Delma inornata</i> Olive Snake-lizard	<i>Delma mollerii</i> Adelaide Snake-lizard
<i>Diplodactylus vittatus</i> Eastern Stone Gecko	<i>Lialis burtonis</i> ? Burtons's Legless Lizard
<i>Nephrurus millii</i> Barking Gecko	<i>Pygopus lepidopodus</i> Common Scaly-foot
<i>Bassiana duperreyi</i> Eastern Three-lined Skink	<i>Cryptoblepharus plagiocephalus</i> Desert Wall Skink
<i>Ctenotus orientalis</i> Eastern Spotted Ctenotus	<i>Ctenotus robustus</i> Eastern Striped Skink
<i>Egernia cunninghami</i> Cunningham's Skink	<i>Egernia striolata</i> Eastern Tree Skink
<i>Egernia whitii</i> White's Skink	<i>Eulamprus heatwolei</i> Yellow-bellied Water Skink

**Frogs**

Frogs found in the Southern Mount Lofty Ranges (Armstrong, et al., 2001).

Only six are confirmed as currently occurring and resident in the Southern Mount Lofty Ranges:

Painted Frog *Neobatrachus pictus*

Marbled Frog *Limnodynastes tasmaniensis*

Brown Froglet *Crinia signifera*

Bull Frog *Limnodynastes dumerili*

Brown Toadlet *Pseudophryne bibroni*

Brown Tree Frog *Litoria ewingi*.

These species are likely to inhabit the artificial wetland on the Angas Zinc EL.



