# STRATFORD MINING COMPLEX
# Squirrel Glider Management Plan

STRATFORD MINING COMPLEX
(STRATFORD EXTENSION PROJECT)

# SQUIRREL GLIDER MANAGEMENT PLAN

## Revision Status Register

| Section/Page/ Annexure | Revision Number | Amendment/Addition | Distribution | DPE Approval Date |
|---|---|---|---|---|
| All | SGMP-R01-A | Original – Draft for Consultation | OEH, DP&E | 19 October 2018 |
| All | SGMP-R02-A | Updated to describe current status of SMC and include relevant contemporary changes | BCS, DPE | 5 July 2023 |

JUNE 2023
Project No. YAN-21-40
Document No. SGMP-R02-A

**TABLE OF CONTENTS**

**TABLE OF CONTENTS (Continued)**



**LIST OF TABLES**



**LIST OF FIGURES**



**LIST OF ATTACHMENTS**



**LIST OF APPENDICES**

# 1 INTRODUCTION

## 1.1 STRATFORD MINING COMPLEX

Stratford Coal Pty Ltd (SCPL), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal), owns and operates the Stratford Coal Mine (SCM) and the Bowens Road North Open Cut (BRNOC), which are located approximately 100 kilometres (km) north of Newcastle, New South Wales (NSW) (Figure 1). The SCM and BRNOC are collectively referred to as the Stratford Mining Complex (SMC).

Yancoal also owns the Duralie Coal Mine (DCM), which is located approximately 20 km south of the SMC (Figure 1). Run-of-mine (ROM) coal from the DCM was previously transported by rail to the SMC for processing and export.

Mining activities approved under the SCM Development Consent and the BRNOC Development Consent were suspended in mid-2014, however, processing of ROM coal from the DCM and the export of product coals continued under the SMC Development Consent.

The Development Consent SSD-4966 for the Stratford Extension Project (SEP) was granted on 29 May 2015 under Part 4 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and involves the extension and continuation of mine operations at the SMC[1], including (among other things):

- mining of up to 2.6 million tonnes of ROM coal per annum;
- continuation of mining in the BRNOC, and the extension of mining into three additional open cut mining areas:
  - Roseville West Pit Extension;
  - Avon North Open Cut; and
  - Stratford East Open Cut;
- progressive backfilling of mine voids with waste rock behind the advancing open cut mining operations;
- continued and expanded placement of waste rock in the Stratford Waste Emplacement and Northern Waste Emplacement;
- coal processing at the existing Coal Handling and Preparation Plant (CHPP);
- stockpiling and loading of product coal to trains for transport on the North Coast Railway to Newcastle;
- disposal of CHPP rejects via pipeline to the existing co-disposal area in the Stratford Main Pit and, later in the Project life, the Avon North Open Cut void;
- continued use of existing contained water storages/dams and progressive development of additional sediment dams, pumps, pipelines, irrigation infrastructure and other water management equipment and structures;
- other associated minor infrastructure, plant, equipment and activities and minor modifications to existing structure, plant and equipment and activities; and
- rehabilitation of the site.

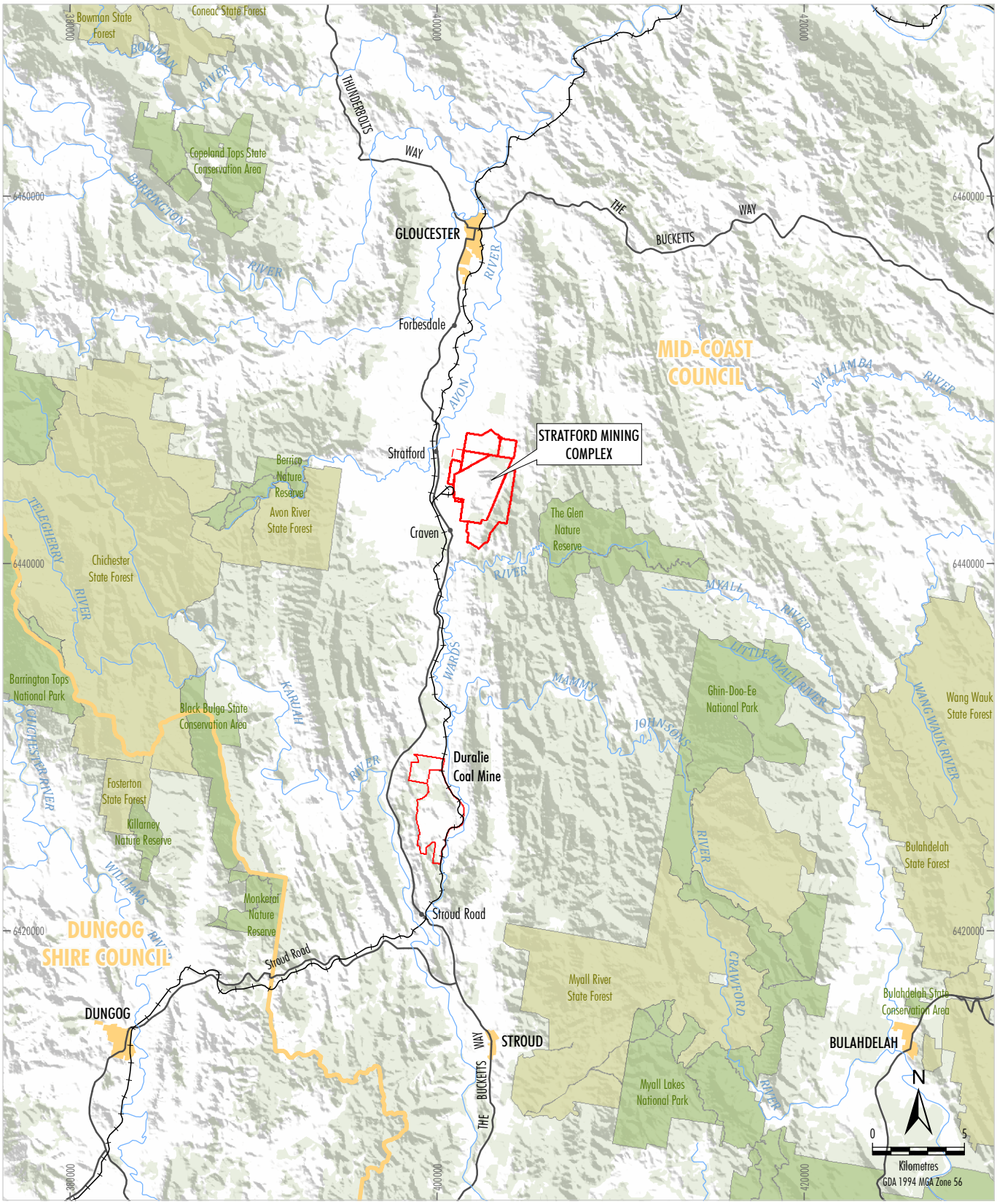
The general arrangement of the approved SMC is provided in Figure 2.

***Current Status of SMC***

Mining activities approved under the SEP Development Consent (SSD-4966) commenced on 4 April 2018. Current mining operations at the SMC are associated with:

- completion of mining in the Roseville West Open Cut Pit followed by progressive backfilling with waste rock material;
- completion of mining in the BRNOC followed by progressive backfilling with waste rock material;
- continued development and mining of the Stratford East Open Cut; and
- continued development and mining of the Avon North Open Cut.

[1] A copy of the Development Consent (and other statutory State and Federal licenses and approvals) is available on the Stratford Coal website (www.stratfordcoal.com.au).




YAN-21-40.MP2021.CF_201A


LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary *
- NSW State Forest
- National Park, Nature Reserve or State Conservation Area
- Local Government Area Boundary

**MLA1 is a proposed future Mining Lease Application (MLA) area and has not yet been lodged.*

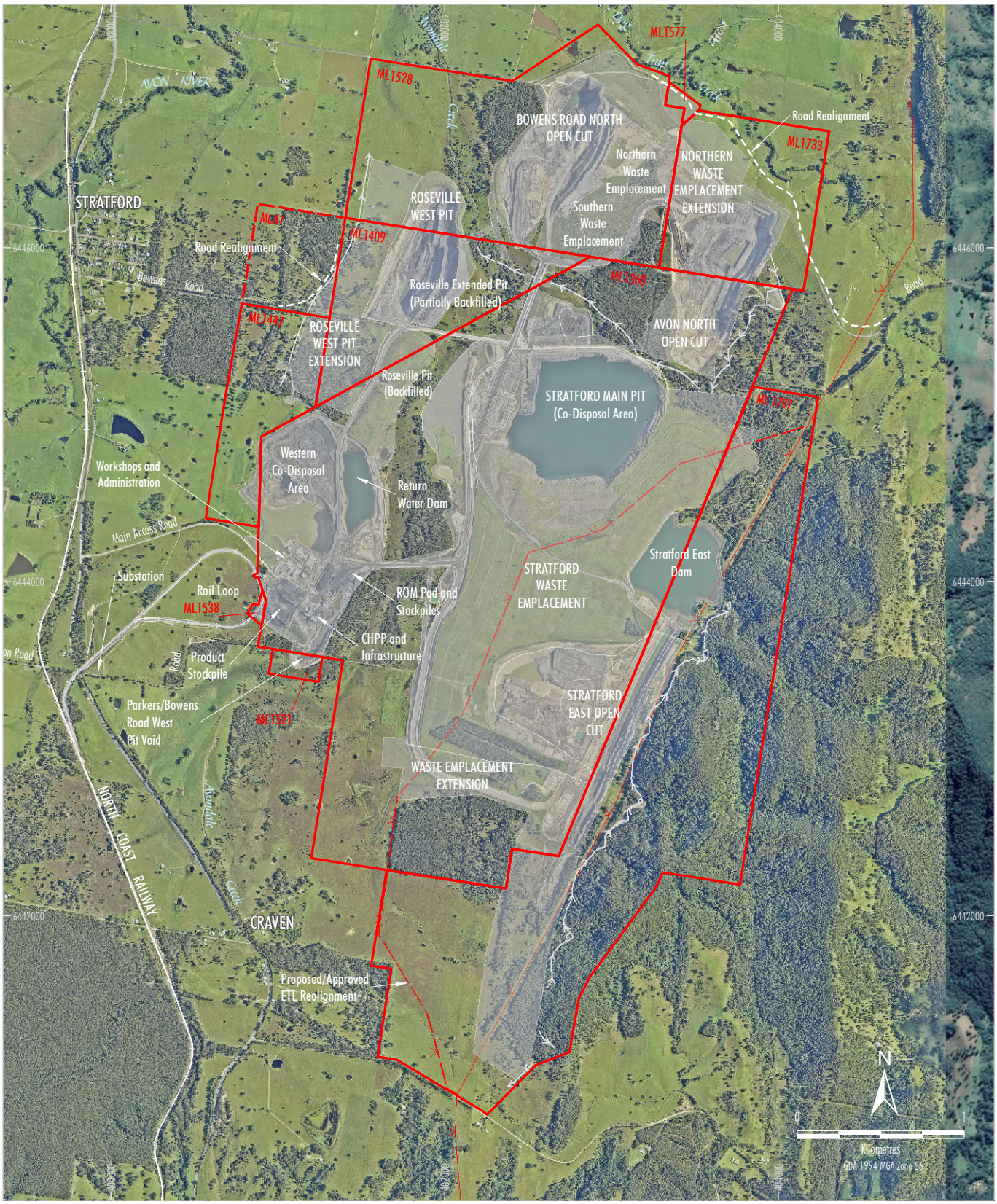
*Source: Geoscience Australia (2006); Yancoal (2019); NSW Department of Planning & Environment (2017)*

STRATFORDCOAL
Part of the Yancoal Australia Group

STRATFORD EXTENSION PROJECT

**Regional Location**

**Figure 1**




YAN-21-40 MP2021 CF_202A

LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary*
- Electricity Transmission Line
- Approximate Extent of Existing/Approved Surface Development
- Conceptual Up-Catchment Diversion

**MLA1 is a proposed future Mining Lease Application (MLA) area and has not yet been lodged.*

*# Not yet constructed*

*Source: Orthophoto - Yancoal (2021); LPI (2016); NSW Department of Planning & Environment (2017)*

STRATFORDCOAL
Part of the Yancoal Australia Group

STRATFORD EXTENSION PROJECT

**Approved General Arrangement**

**Figure 2**

Condition 5, Schedule 2 of the SMC's Development Consent (SSD_4966) authorises mining operations to be carried at the SMC until 31 December 2025. As the SMC progresses towards the end of its approved mine life, operations and activities at the SMC over the next three years will progressively change to reflect this and will generally involve the following:

- **Reduction of open cut pit mining and total mobile plant fleet**: Open cut mining operations will progressively reduce with mining of the SMC's remaining operational pits (Avon North Open Cut and Stratford East Open Cut) to reduce sequentially over the next four years. Consequently, total mobile plant fleet operating at the SMC will also reduce.
- **Progressive open cut pit backfilling activities**: As mining of the open cut pits is progressively completed, backfilling of some of the pits with waste rock material, including Stratford East Open Cut Pit and BRNOC, will also occur either concurrently with mining or after the completion of mining.
- **Progressive rehabilitation of completed areas**: Rehabilitation of backfilled open cut pits, completed areas of the waste emplacements and other disturbed areas will continue to be progressed in accordance with the SMC's Rehabilitation Management Plan.
- **Reduction and then cessation of vegetation clearance activities**: The proposed extent of development of the remaining open cut pits and ancillary mining activities will be reached over the next three years, and subsequently after this time, no new disturbance areas (within the approved surface disturbance areas) are proposed.
- **Closure Planning**: SCPL will continue to implement the SMC's Mine Closure Planning Program (described in the SMC Rehabilitation Management Plan) which includes technical assessments and works that will be undertaken and implemented as the SMC progresses towards the mine closure phase. As these assessments and works are completed, the SMC's environmental management plans will be reviewed and revised as required to reflect the progression of the SMC towards mine closure, in consultation with relevant regulatory agencies.

Following the cessation of mining operations on 31 December 2025, SCPL will undertake bulk rehabilitation earthworks, infrastructure decommissioning, and revegetation of the final landform in accordance with the SMC's Rehabilitation Management Plan. Once bulk rehabilitation earthworks are complete, all major fleet will then be removed from site and the mine's workforce reduced to support post-closure activities.

## 1.2 OBJECTIVE AND STRUCTURE OF THE SQUIRREL GLIDER MANAGEMENT PLAN

This Squirrel Glider Management Plan (SGMP) has been prepared in accordance with the requirements of Condition 38, Schedule 3 of NSW Development Consent SSD-4966 (Section 2.1).

The objective of this SGMP is to address relevant State approval conditions (Section 2.1) and facilitate the management of Squirrel Gliders at the SMC, Biodiversity Enhancement Areas and Biodiversity Offset Areas.

The SGMP was initially prepared for the three-year period between July 2018 and July 2021 and included broader concepts for the longer term (6+ years).

This revision of the SGMP has been prepared to describe the current status of operations at the SMC and anticipated changes as the site progresses towards closure. Updates have also been made to reflect the status and completion of the 2018 to 2020 performance and completion criteria for the offset areas. Further, the long term (6+ years) biodiversity offset strategy components have been updated. Other administrative updates have also been included to contemporise the plan. This document will be reviewed/revised as described in Section 12.3.

In accordance with Condition 38, Schedule 3 of Development Consent SSD-4966, the management actions outlined in this SGMP will only commence once SCPL proposes to commence clearing of potential Squirrel Glider habitat located within 500 m of a Squirrel Glider record as described in Section 4.2. As the SMC progresses towards the end of its approved mine life, no further clearance at the SMC is proposed.

The remainder of the SGMP is structured as follows:

Section 2: Outlines the statutory requirements relevant to the SMC.

Section 3: Provides ecological information relevant to the Squirrel Glider.

Section 4: Defines what constitutes a Squirrel Glider colony.

Section 5: Outlines the vegetation clearance protocol at the SMC.

Section 6: Describes food resources for the Squirrel Glider.

Section 7: Describes nesting habits of the Squirrel Glider.

Section 8: Describes movement patterns of the Squirrel Glider.

Section 9: Outlines the performance and completion criteria of this SGMP.

Section 10 Summarises the results of the Squirrel Glider studies.

Section 11: Describes the monitoring of the Squirrel Glider.

Section 12: Outlines the reporting, auditing and reviewing requirements.

Section 13: Provides a list of references used in this SGMP.

## 1.3 CONSULTATION

In accordance with Condition 38, Schedule 3 of Development Consent SSD-4966, this SGMP is to be prepared in consultation with the NSW Biodiversity Conservation Division (BCD), within the Department of Planning and Environment (DPE) (formerly the Office of Environment and Heritage [OEH]). SCPL notes that BCD is now the Biodiversity Conservation and Science division (BCS) within DPE. This revised SGMP has been provided to the BCS for consultation purposes. On 16 March 2023, the BCS provided comments on the SGMP. SCPL subsequently revised the SGMP to consider the BCS's comments. The BCS's correspondence is included in the Record of Consultation provided in Attachment 1 of this SGMP.

On 5 July 2023, the DPE approved this revised SGMP. The DPE's letter of approval is provided in Attachment 2. The revision status of this SGMP is provided on the title page of this plan.

The revision and approval status of this SGMP is provided on the title page of this plan.

## 1.4 RESPONSIBILITIES

SCPL is responsible for monitoring, reviewing, and implementing the SGMP.

## 1.5 RELATIONSHIP OF THIS PLAN TO OTHER SMC MANAGEMENT PLANS

### 1.5.1 Biodiversity Management Plan

The Biodiversity Management Plan (BMP) provides measures to facilitate the management of biodiversity (including native fauna species such as the Squirrel Glider) at the SMC, Biodiversity Enhancement Areas and Biodiversity Offset Areas in accordance with Condition 39, Schedule 3 of the Development Consent (SSD-4966). The SGMP and BMP are closely integrated.

#### 1.5.2 Rehabilitation Management Plan

A portion of the mine rehabilitation (350 hectares [ha] of native vegetation to be re-established) forms part of the Biodiversity Offset Strategy in Condition 33, Schedule 3 of the Development Consent (SSD-4966). Management of the rehabilitation of areas disturbed for mining at the SMC is described in the Rehabilitation Management Plan (RMP) and includes the development of native woodland which would provide potential habitat for the Squirrel Glider.

# 2 STATUTORY REQUIREMENTS

Statutory obligations relevant to this SGMP are contained in:

- the conditions of NSW Development Consent (SSD-4966);
- the conditions of Commonwealth Approval (EPBC 2011/6176);
- the conditions of EPL 5161;
- relevant licences and permits, including conditions attached to the SMC mining leases (MLs); and
- other relevant legislation.

## 2.1 STRATFORD COAL MINE – RELEVANT NSW APPROVAL CONDITIONS

The conditions of the Development Consent (SSD-4966) relevant to the SGMP, and where they are referenced in this SGMP, are provided in Table 1.

**Table 1**
**Development Consent (SSD-4966) Requirements Relevant to this Squirrel Glider Management Plan**

| Development Consent (SSD-4966) Condition | SGMP Section |
|---|---|
| ***Condition 38, Schedule 3*** | |
| *38. The Applicant shall prepare and implement a Squirrel Glider Management Plan to the satisfaction of the Secretary. This plan must be prepared in consultation with BCD and approved by the Secretary prior to any clearing within 500 metres of a Squirrel Glider colony and shall include:* | |
| *(a) measures to establish the home range of each colony;* | Section 4.2 |
| *(b) a census of suitable tree hollows in home ranges and offset areas suitable for Squirrel Gliders;* | Section 7.1 |
| *(c) establishing the food resources utilised by each colony;* | Section 6.1 |
| *(d) measures to enhance food resources utilised by Squirrel Gliders, particularly for Offset Area 1;* | Section 6.2 |
| *(e) a vegetation clearing protocol to protect individual Squirrel Gliders;* | Section 5 |
| *(f) relocation of trees containing suitable tree hollows;* | Section 5 |
| *(g) installation of suitable nest boxes at a ratio of least 3:1 for each suitable hollow destroyed by the development and their long term management;* | Section 7.2 |
| *(h) measures to assess the rate of tree hollow development within the Offset Areas;* | Section 7.3 |
| *(i) implementation of Yancoal's proposed Glider crossings of haul roads with the establishment of suitable vegetation adjacent to each crossing;* | Section 8.2 |
| *(j) implementation of Yancoal's proposals to enhance vegetation, particularly in Offset Area 3, to create recruitment and dispersal pathways for Squirrel Gliders; and* | Section 8.1 |
| *(k) installation of Gliders crossings of The Bucketts Way and Main Northern Railway, should Yancoal acquire Property 44, unless their installation is prevented by the relevant transport authority.* | Section 8.2 |

In addition, Condition 3, Schedule 5 of Development Consent SSD-4966, provides requirements for management plans (Table 2).

**Table 2**
**Development Consent (SSD-4966) Requirements Relevant to Management Plans**

| Development Consent (SSD-4966) Condition | BMP Section |
|---|---|
| ***Condition 3, Schedule 5*** | |
| *3. The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:* | |
| *(a) detailed baseline data;* | Section 3 |
| *(b) a description of:* | |
| • *the relevant statutory requirements (including any relevant approval, licence or lease conditions);* | Section 2 |
| • *any relevant limits or performance measures/criteria* | |
| • *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures*; | |
| *(c) a description of the measures that will be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;* | Section 4 to 9 |
| *(d) a program to monitor and report on the:* | Sections 11 and 12 |
| • *impacts and environmental performance of the development;* | |
| • *effectiveness of any management measures (see c above);* | |
| *(e) a contingency plan to manage any unpredicted impacts and their consequences;* | Section 11.2 |
| *(f) a program to investigate and implement ways to improve the environmental performance of the development over time;* | Section 12 |
| *(g) a protocol for managing and reporting any:* | Section 12 |
| • *incidents;* | |
| • *complaints;* | |
| • *non-compliances with statutory requirements; and* | |
| • *exceedances of the impact assessment criteria and/or performance criteria; and* | |
| *(h) a protocol for periodic review of the plan.* | Section 12.3 and SMC Environmental Management Strategy and PIRMP |

## 2.2 OTHER COMMITMENTS RELEVANT TO THE SQUIRREL GLIDER MANAGEMENT PLAN

Other relevant commitments (additional to those already captured by the consent conditions) as derived from measures described in the Stratford Extension Project Environmental Impact Statement (EIS) (SCPL, 2012) include:

- establishment of a radio tracking program to assist with the estimation of Squirrel Glider home ranges (Section 4.2); and
- installation of glider poles to assist Squirrel Glider movement throughout the SMC, Biodiversity Offset Areas and Biodiversity Enhancement Areas (Section 8.2).

# 3 SQUIRREL GLIDER – ECOLOGICAL INFORMATION

***Distribution***

The Squirrel Glider is widely, though sparsely, distributed in eastern Australia, from northern Queensland to western Victoria (OEH, 2017). The species is found inland as far as the Grampians in Victoria and the Pilliga and the Coonabarabran areas of NSW (Quin, 1995; OEH, 2017).

***Foraging***

The Squirrel Glider requires abundant hollow-bearing trees and a mix of eucalypts, acacias and banksias. Within a suitable vegetation community, at least one flora species should flower heavily in winter and one or more of the eucalypts should be smooth-barked (Menkhorst *et al*., 1988; Quin, 1995). Vegetation Communities at the SMC are shown on Figure 3.

The Squirrel Glider's diet varies seasonally and consists of nectar, pollen, flowers and acacia gum (OEH, 2017; Menkhorst and Collier, 1987). Xanthorrhoea and sap from the Yellow-bellied Glider's feeding scars may also be eaten. Squirrel Gliders forage in the upper and lower forest canopies and in the shrub understorey (OEH, 2017).

During winter, when other food resources are scarce, the Squirrel Glider may obtain its energy from the winter flowers of the Coastal Banksia, Red Ironbark (*Eucalyptus fibrosa*), River Red Gum (*E. camaldulensis*), Grey Ironbark (*E. paniculata*), Spotted Gum (*Corymbia maculata*), Forest Red Gum (*E. tereticornis*) and, in some areas, Blackbutt (Quin, 1995). Squirrel Gliders appear to be sensitive to loss or failure of winter flowering tree species (van der Ree and Sucking, 2008; Sharpe, 2009). Sharpe (2009) found that an inadequate supply of nectar can cause increased mortality and reduce reproduction. Goldingay *et al.* (2006) detected 50 % fewer Squirrel Gliders during a season when flowering was poor.

***Breeding/Nesting***

The Squirrel Glider is nocturnal and shelters in bowl-shaped, leaf lined nests in tree hollows (Suckling, 1995). Births occur throughout the year and are likely to reflect the availability of food, particularly pollen and nectar (Sharpe and Goldingay, 2010). Millis and Bradley (2001) identified that reproduction showed a seasonal pattern, with peak numbers of pouch young recorded in late autumn and winter.

Within a home range, Squirrel Gliders will use multiple hollow bearing trees as den sites. Crane *et al.* (2010) reported an average of seven hollow bearing trees used by Squirrel Gliders as den sites. Van der Ree and Suckling (2008) describe a group using a combined total of 19 different trees over a 40-day radio tracking period. Squirrel Gliders typically choose tree hollows with tight-fitting entrance holes which prevents access by potential predators (van der Ree and Suckling, 2008). Smooth-barked Eucalypts are preferred as these eucalypts form hollows more readily than rough-barked and support a greater diversity of invertebrates (Quin, 1995).

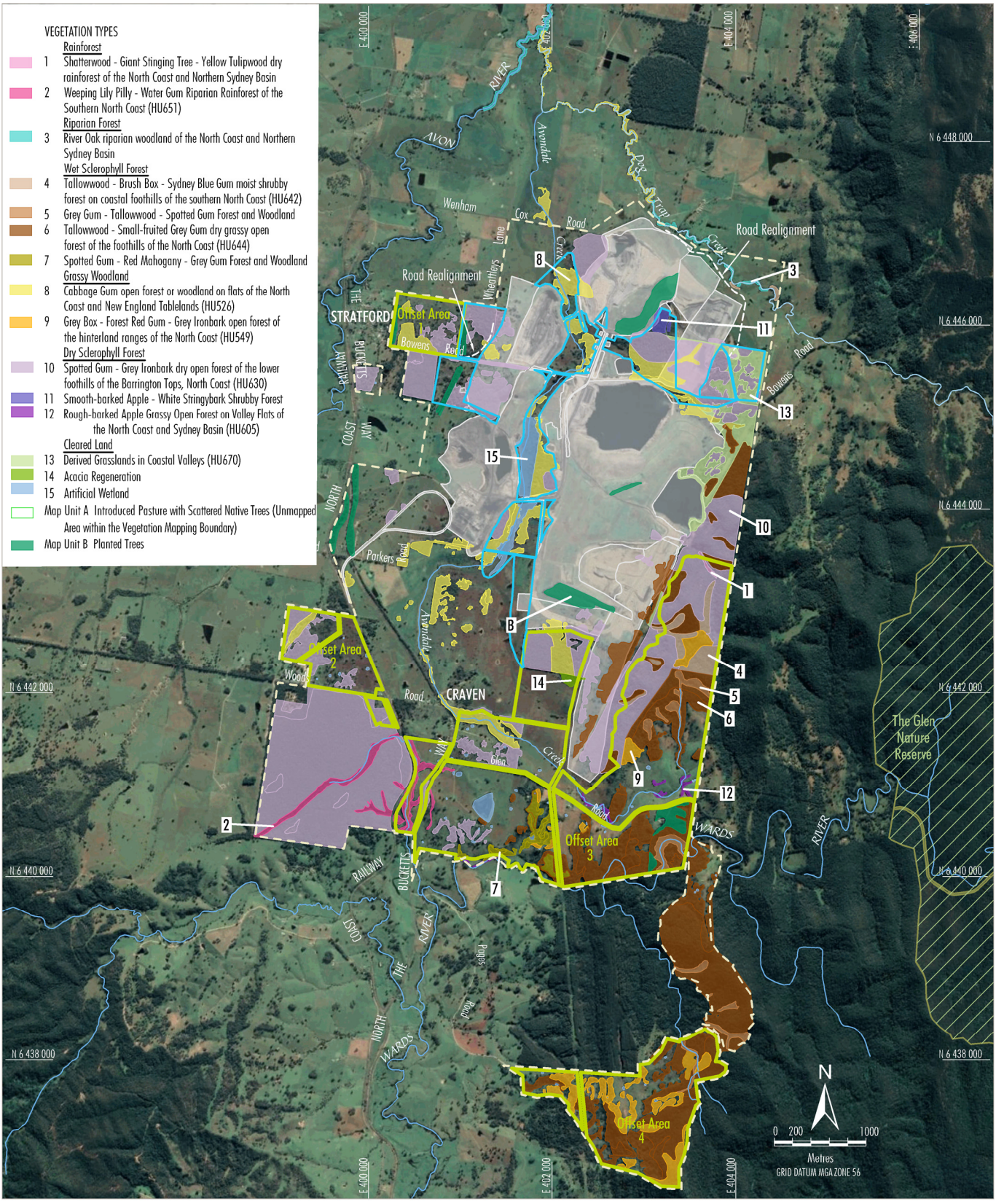
***Nest Boxes***

Squirrel Gliders readily occupy nest boxes when tree hollows are scarce (van der Ree and Suckling, 2008). Ball *et al.* (2011) reported 20 % of 56 nest boxes installed were used after 3 years, while Goldingay *et al.* (2006) detected evidence of use in over 50 % of the 24 nest boxes installed. Ball (2007) found 5.6 % nest boxes installed displayed use by Squirrel Gliders.

The installation of nest boxes at the SMC has occurred over four periods with the most recent installation in February 2021 (SCPL, 2021). Nest boxes are installed in the Biodiversity Areas for additional habitat enhancement.

The current nest box program involves a total of 172 nest boxes targeting a variety of hollow dependent species, including (SCPL, 2021):

- 30 nest boxes targeting the Squirrel Glider (Petaurus norfolcensis) that were installed in 2019 by Kleinfelder Australia Pty Ltd (Kleinfelder);
- 70 nest boxes targeting the Squirrel Glider (54) and a variety of hollow-dependent species (16) that were installed in April 2020 by AMBS; and
- 102 nest boxes targeting the Squirrel Glider (84) and a variety of hollow-dependent species (18) that were installed in February-March 2021 by AMBS.




LEGEND
- Approximate Extent of Existing/Approved Surface Development
- Vegetation Mapping Boundary
- Biodiversity Enhancement Area
- Offset Area

STRATFORDCOAL
Part of the Yancoal Australia Group

STRATFORD EXTENSION PROJECT

Vegetation Types

*Source: Australian Museum Business Services (2011) ; FloraSearch (2011); SCPL (2012); DFS-LPI (2012) ; DPI C&L [CLD] (2012) Orthophoto - GoogleEarth CNES/Airbus (2020)*

**Figure 3**

***Home Range and Movement***

Home ranges have been estimated to be between 0.65 and 8.55 ha and movements tend to be greater for males than females (Quin, 1995; Sharpe and Goldingay, 2007; van der Ree *et al.*, 2003). The home range of a family group is likely to vary according to habitat quality and availability of resources (Quin, 1995; Sharpe and Goldingay, 2007; van der Ree *et al.*, 2003). Brearley at al. (2011) found that Squirrel Gliders living in interior habitats have larger home ranges (approximately 7 ha) than individuals living near roads and residential areas (approximately 3.5 ha).

Squirrel Gliders are agile climbers and can glide for more than 50 m in one movement (van der Ree *et al.*, 2003). Nightly movements are estimated as being between 300 and 500 m (van der Ree *et al.*, 2003) and Holland et al. (2007) describes that Squirrel Gliders can move distances in excess of 300 m in 15 minutes.

***Social Structure***

The Squirrel Glider lives in family groups (i.e. colonies) of between two and ten, generally comprising of one male, at least two females and juveniles (Quin, 1995; Suckling, 1995).

Females are capable of raising two litters in a year, and young are thought to leave the nest at around 6 months (Quin, 1995). Juveniles remain in their natal range for approximately 1 year after emerging from the nest, with juvenile males experiencing aggression from the dominant male. Juvenile mortality following dispersal is high, but established individuals are thought to survive for up to 6 years (Quin, 1995).

***Survey Timing***

Squirrel Gliders can be surveyed at any time of year but sites with bi-pinnate acacia, autumn/winter flowering trees and shrubs such as *Eucalyptus robusta* and *Banksia* sp. Are best surveyed between March and August (OEH, 2017).

***Habitat/Records at the SMC***

Kleinfelder was engaged to undertake an initial targeted Squirrel Glider survey to confirm the location of Squirrel Glider colonies within the potential habitat in the vicinity of the SMC Biodiversity Areas. The initial surveys were undertaken during November 2018 to December 2018 (SCPL, 2020). Squirrel Gliders were identified at five locations out of the 37 locations surveyed in this period. Known Squirrel Glider records in or near the SMC are described in Table 3.

The Squirrel Glider has also been observed in the wider Gloucester Valley as shown on Figure 5. This includes a number of records obtained during the ongoing monitoring of the nest box program implemented by Yancoal at the DCM.

Kleinfelder was engaged to undertake a radio tracking program to determine the Squirrel Glider home ranges (SCPL, 2020). Two radio tracking programs were conducted between January and April 2019 and between July and September 2019. The 2019 tracking programs consisted of trapping of the Squirrel Glider, fitting radio tracking collars and two radio tracking programs conducted over 80 nights total. A total of 36 Squirrel Gliders were captured during the program, 19 Squirrel Gliders were fitted with radio collars and sufficient data points were obtained to allow home range estimates for 13 gliders.

This information has been used to guide the ongoing management of Squirrel Glider populations within the SMC Biodiversity Offset Areas and Biodiversity Enhancement Areas. This information defined the study area for subsequent programs including the census of suitable tree hollows, food resources surveys and habitat enhancement including nest box installations.

Potential habitat mapping produced by AMBS (2011) for the Squirrel Glider within the SMC, Biodiversity Offset Areas and Biodiversity Enhancement Areas is shown on Figure 4.

**Table 3**
**Squirrel Glider Records**

| Record* | Easting | Northing | Location Description | Record Date | Record Source | PAC Naming# |
|---|---|---|---|---|---|---|
| SG1 | 403334 | 6448896 | North of the Stratford Mining Complex | 2011 | AMBS (2011) | Colony 1 |
| SG2 | 403493 | 6448571 | North of the Stratford Mining Complex | 2007 | EcoBiological (2011) | Colony 1 |
| SG3 | 401842 | 6442298 | West of Stratford East Open Cut | 2011 | AMBS (2011) | Colony 2 |
| SG4 | 400600 | 6445540 | Crown Reserve | 2011 | AMBS (2011) | Colony 3 |
| SG5 | 400637 | 6445288 | Crown Reserve | 2011 | AMBS (2011) | Colony 3 |
| SG6 | 400669 | 6445253 | Crown Reserve | 2011 | AMBS (2011) | Colony 3 |
| SG7 | 403178 | 6445469 | Avon North Open Cut area | 2007 | EcoBiological (2011) | Colony 4 |
| SG8 | 401565 | 6443678 | West of Stratford East Open Cut | 1994 | Hoye and Finn (1994) | Not named |
| SG9 | 400605 | 6441689 | South-west of Stratford Mining Complex near the rail reserve. | 1978 | OEH (2017) | Not named |
| SG10 | 401211 | 6446045 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG11 | 401280 | 6446011 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG12 | 400510 | 6445841 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG13 | 400510 | 6445840 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG14 | 400512 | 6445840 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG15 | 400501 | 6445835 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG16 | 400501 | 6445835 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG17 | 400539 | 6445821 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG18 | 400535 | 6445820 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG19 | 400630 | 6445779 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG20 | 400636 | 6445779 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG21 | 400637 | 6445780 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG22 | 400750 | 6445766 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG23 | 400759 | 6445764 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG24 | 400759 | 6445764 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG25 | 400671 | 6445728 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG26 | 400654 | 6445713 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG27 | 400626 | 6445717 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG28 | 400624 | 6445716 | Crown Reserve | 2019 | Kleinfelder (2019) | Not named |
| SG29 | 403388 | 6445696 | Avon North Open Cut area | 2019 | Kleinfelder (2019) | Not named |
| SG30 | 403779 | 6445502 | Avon North Open Cut area | 2019 | Kleinfelder (2019) | Not named |
| SG31 | 403871 | 6445454 | Avon North Open Cut area | 2019 | Kleinfelder (2019) | Not named |
| SG32 | 403571 | 6445413 | Avon North Open Cut area | 2019 | Kleinfelder (2019) | Not named |

**Table 3 (Continued)**
**Squirrel Glider Records**

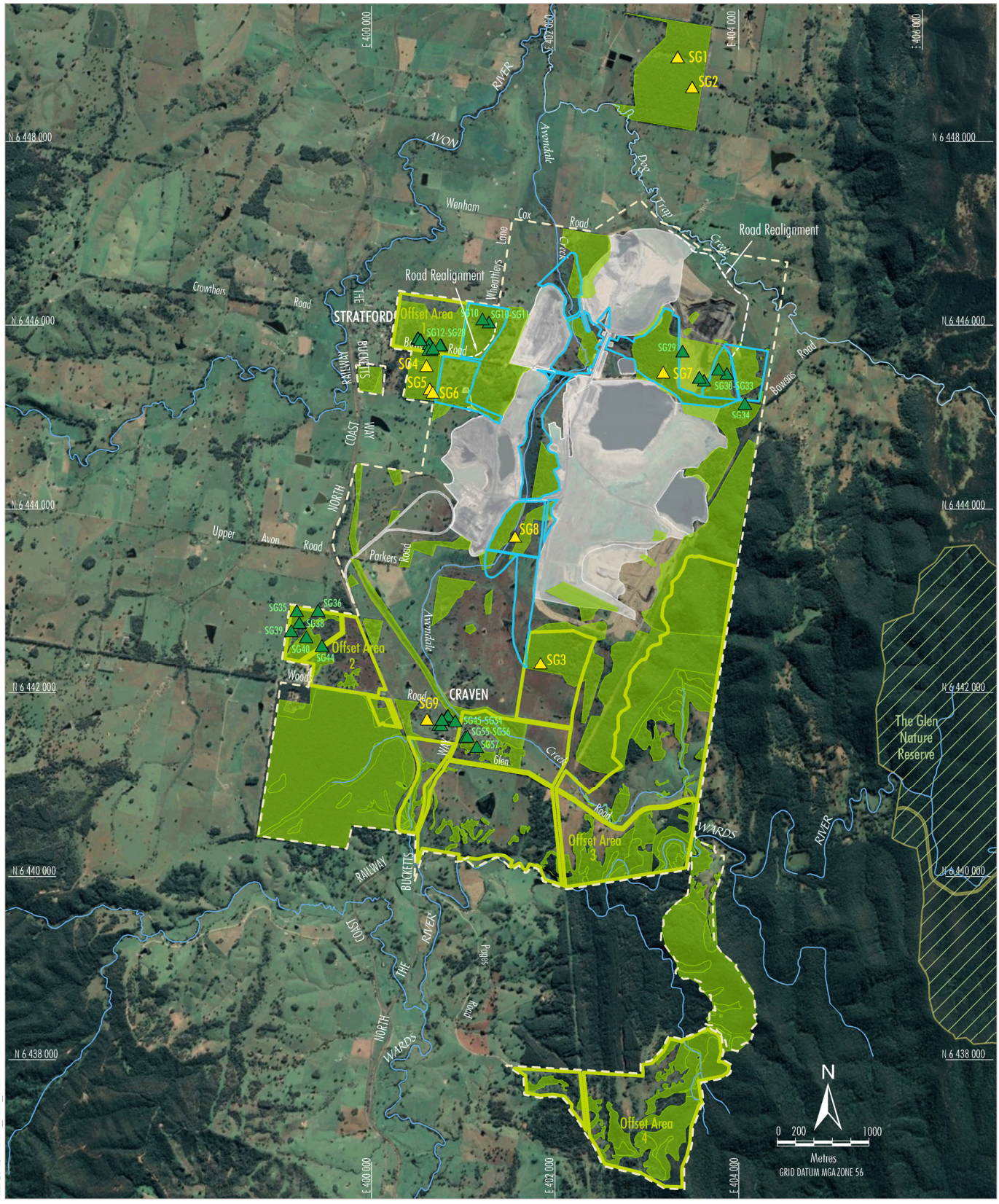
| Record* | Easting | Northing | Location Description | Record Date | Record Source | PAC Naming# |
|---|---|---|---|---|---|---|
| SG33 | 403623 | 6445381 | Avon North Open Cut area | 2019 | Kleinfelder (2019) | Not named |
| SG34 | 404068 | 6445129 | Avon North Open Cut area | 2019 | Kleinfelder (2019) | Not named |
| SG35 | 399188 | 6442871 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG36 | 399421 | 6442874 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG37 | 399216 | 6442740 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG38 | 399216 | 6442742 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG39 | 399128 | 6442654 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG40 | 399292 | 6442588 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG41 | 399464 | 6442493 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG42 | 399464 | 6442493 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG43 | 399464 | 6442493 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG44 | 399464 | 6442492 | South-west of Stratford East Open Cute area near rail reserve | 2019 | Kleinfelder (2019) | Not named |
| SG45 | 400834 | 6441731 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG46 | 400819 | 6441718 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG47 | 400825 | 6441716 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG48 | 400766 | 6441690 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG49 | 400769 | 6441688 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |

**Table 3 (Continued)**
**Squirrel Glider Records**

| Record* | Easting | Northing | Location Description | Record Date | Record Source | PAC Naming# |
|---|---|---|---|---|---|---|
| SG50 | 400767 | 6441686 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG51 | 400914 | 6441670 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG52 | 400733 | 6441631 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG53 | 400734 | 6441630 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG54 | 400761 | 6441627 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG55 | 401046 | 6441504 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG56 | 401023 | 6441497 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |
| SG57 | 401148 | 6441391 | South-west of Stratford Mining Complex near the rail reserve. | 2019 | Kleinfelder (2019) | Not named |

* Refer Figure 4.

# Planning Assessment Commission (2014) *Stratford Extension Project Review Report*.




YAN-21-40 MP2021 SGWP 102A

LEGEND

- Approximate Extent of Existing/Approved Surface Development
- Vegetation Mapping Boundary
- Biodiversity Enhancement Area
- Offset Area

Squirrel Glider

- Recorded Location
- Potential Habitat
- Recorded Location (Kleinfelder, 2019)

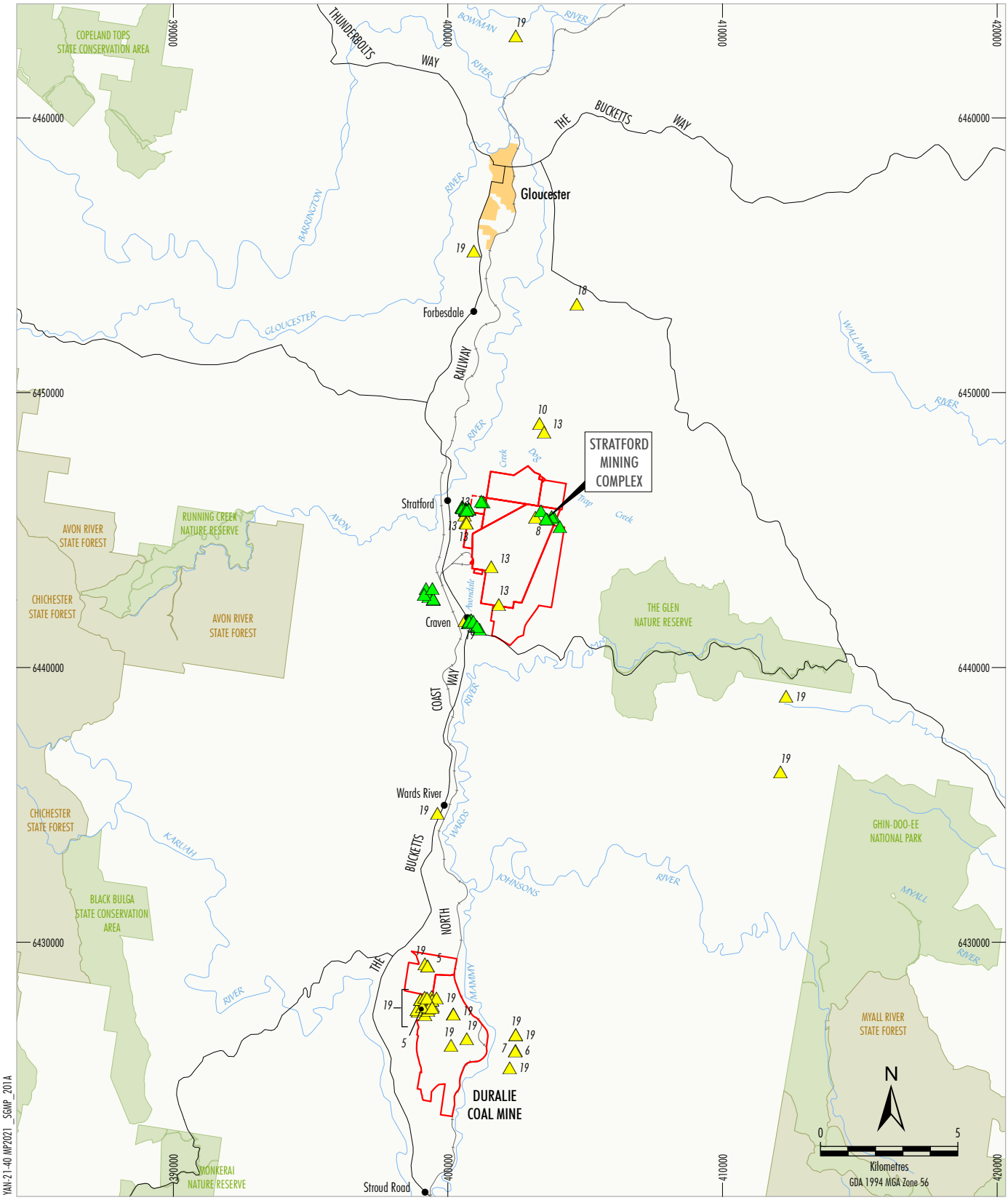
*Source: Australian Museum Business Services (2011) ; FloraSearch (2011); SCPL (2012); DFS-LPI (2012) ; DPI C&L [CLD] (2012) Orthophoto - GoogleEarth CNES/Airbus (2020)*

STRATFORDCOAL
Part of the Yancoal Australia Group

STRATFORD EXTENSION PROJECT

Squirrel Glider
Potential Habitat

**Figure 4**




YAN-21-40 MP2021_SGMP_201A

LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary*
- State Forest
- National Park, Nature Reserve or State Conservation Area
- Squirrel Glider
- Squirrel Glider (Kleinfeider, 2019)

** MLA1 is a proposed future Mining Lease Application (MLA) area and has not yet been lodged*

*Reference:*


5. *EcoBiological (2009a)*
6. *EcoBiological (2009b)*
7. *EcoBiological (2009c)*
8. *EcoBiological (2011a)*
10. *EcoBiological (2011c)*
13. *AMBS (2011b)*
18. *Hoye and Finney (1994)*
19. *OEH (2017)*


*Source: Geoscience Australia (2009); SCPL (2012); DECC (2011); DFS-LPI (2012) and DPI-C&L [CLD] (2012)*

STRATFORDCOAL
Part of the Yancoal Australia Group

STRATFORD EXTENSION PROJECT

**Squirrel Glider - Landscape Distribution**

**Figure 5**

# 4 SQUIRREL GLIDER COLONY AND HOME RANGE

## 4.1 DEFINITION OF A SQUIRREL GLIDER COLONY

The Squirrel Glider lives in family groups (i.e. colonies) of between 2 and 10, generally comprising of one male, at least two females and juveniles (Quin, 1995; Suckling, 1995). Births occur throughout the year and are likely to reflect the availability of food, particularly pollen and nectar (Sharpe and Goldingay, 2010). Millis and Bradley (2001) identified that reproduction showed a seasonal pattern, with peak numbers of pouch young recorded in late autumn and winter.

Females are capable of raising two litters in a year and young are thought to leave the nest at around 6 months (Quin, 1995). Juveniles remain in their natal range for approximately 1 year after emerging from the nest, with juvenile males experiencing aggression from the dominant male. Juvenile mortality following dispersal is high, but established individuals are thought to survive for up to 6 years (Quin, 1995).

Given SG1 and SG2 are not located on SCPL-owned land, and are not considered to be impacted by the Project, this 'colony' is not considered further by this SGMP. In addition, the *Final Assessment Report for the Stratford Extension Project (SSD 4966)* prepared by the DPE (April 2015) did not make mention of SG8 and SG9 due to the age of these records and as such these are not considered further in this SGMP.

For the purposes of this SGMP, and consistent with the *Final Assessment Report for the Stratford Extension Project (SSD 4966)* prepared by DPE (April 2015), the initial locations of the Squirrel Glider colonies relevant to the Project are assumed to be colonies 2 (SG3), 3 (SG 4 to SG 6) and 4 (SG7) on Figure 4.

## 4.2 HOME RANGE OF A COLONY

***Objective***

Condition 38(a), Schedule 3 of Development Consent SSD-4966 requires measures to establish the home range of Squirrel Glider colonies within the SMC. This information has been used to define the study area for the census of suitable tree hollows to be undertaken within the Biodiversity Offset Areas and Biodiversity Enhancement Areas (Figure 6) in accordance with Condition 38(b), Schedule 3 of Development Consent SSD-4966 (Section 7.1).

***Methodology***

As described in Section 3, an initial targeted Squirrel Glider survey was undertaken by Kleinfelder during late spring/early summer 2018 to establish the locations of any existing Squirrel Glider colonies within the potential habitat mapped by AMBS (2011). The initial survey consisted of a total of 692 trap nights over 37 locations using remote camera traps and bait stations. The results of the initial targeted survey were used to update the Squirrel Glider colonies described in Table 3 and shown on Figure 4. Table 4 provides the details of the radio tracking program. Further details on the ensuing home range study, including results and trapping methods are discussed in Section 10.1.

**Table 4**
**Squirrel Glider Survey & Radio Tracking Program Details**

| Aspect | Details |
|---|---|
| **Purpose** | The initial targeted Squirrel Glider survey was used to inform the location of the Squirrel Glider colonies. The radio tracking program was used to establish the home range of each colony of any existing Squirrel Glider colonies at the SMC. The home ranges identified as part of this program became the focus of the works conducted to establish available food resources (Section 6.1) and the tree hollow census (Section 7.1). |
| **Timing and Frequency** | An initial targeted Squirrel Glider survey was conducted by Kleinfelder during late spring/early summer 2018. Trapping and tracking was undertaken twice during the first year (between January and April 2019 and between July and September 2019) to allow the identification of season-specific movements/home ranges. |

**Table 4 (Continued)**
**Squirrel Glider Survey & Radio Tracking Program Details**

| Aspect | Details |
|---|---|
| **Location** | Traps were placed near the locations of colonies 2 to 4 (i.e. SG3 to 7), as shown on Figure 4 and near Squirrel Gliders identified during the initial targeted survey. |
| **Target Individuals** | Sub-adults were targeted prior to dispersal (between 12 and 18 months of age) (van der Ree and Suckling, 2008). |
| **Radio tracking duration** | 40 days per program (i.e. conducted over 80 nights in total) (van der Ree and Bennett, 2003). |
| **Radio tracking device** | A suitable radio tracking device approved under the permit from the NSW Government. |
| **Radio receivers** | Hand-held receiver, or otherwise approved under the permit from the NSW Government. |
| **Methodology** | The radio tracking program was undertaken as follows:<br>• Trapping for Squirrel Gliders undertaken using techniques as per DEC (2004);<br>• The following details recorded for successfully trapped Squirrel Gliders:<br>– date;<br>– sex; and<br>– age of individuals (adults, independent sub-adults or dependent juveniles);<br>• Adult and non-lactating Squirrel Gliders fitted with a radio tracking device* (to minimise the risk to dependant young remaining in a tree hollow) ;<br>• Squirrel Gliders re-captured after the 40 day period and the radio tracking device removed; and<br>• Data analysed to determine movement patterns of the individual Squirrel Gliders. |

* This is consistent with the methodology of van der Ree and Bennett (2003), however all suitable Squirrel Gliders were tracked (not only those determining to be resident by trapping them in two concurrent trapping sessions). The reason for this is the Squirrel Gliders present may have been non-resident and this is useful information.

***Data Analysis/Reporting***

Results were compiled, and will continue to be compiled, after each monitoring event. The data is statistically analysed using the adaptive or fixed kernel method described in Sharpe and Goldingay (2007) (as determined by the suitably qualified expert). The monitoring results are reported in the Annual Review.

***Performance and Completion Criteria***

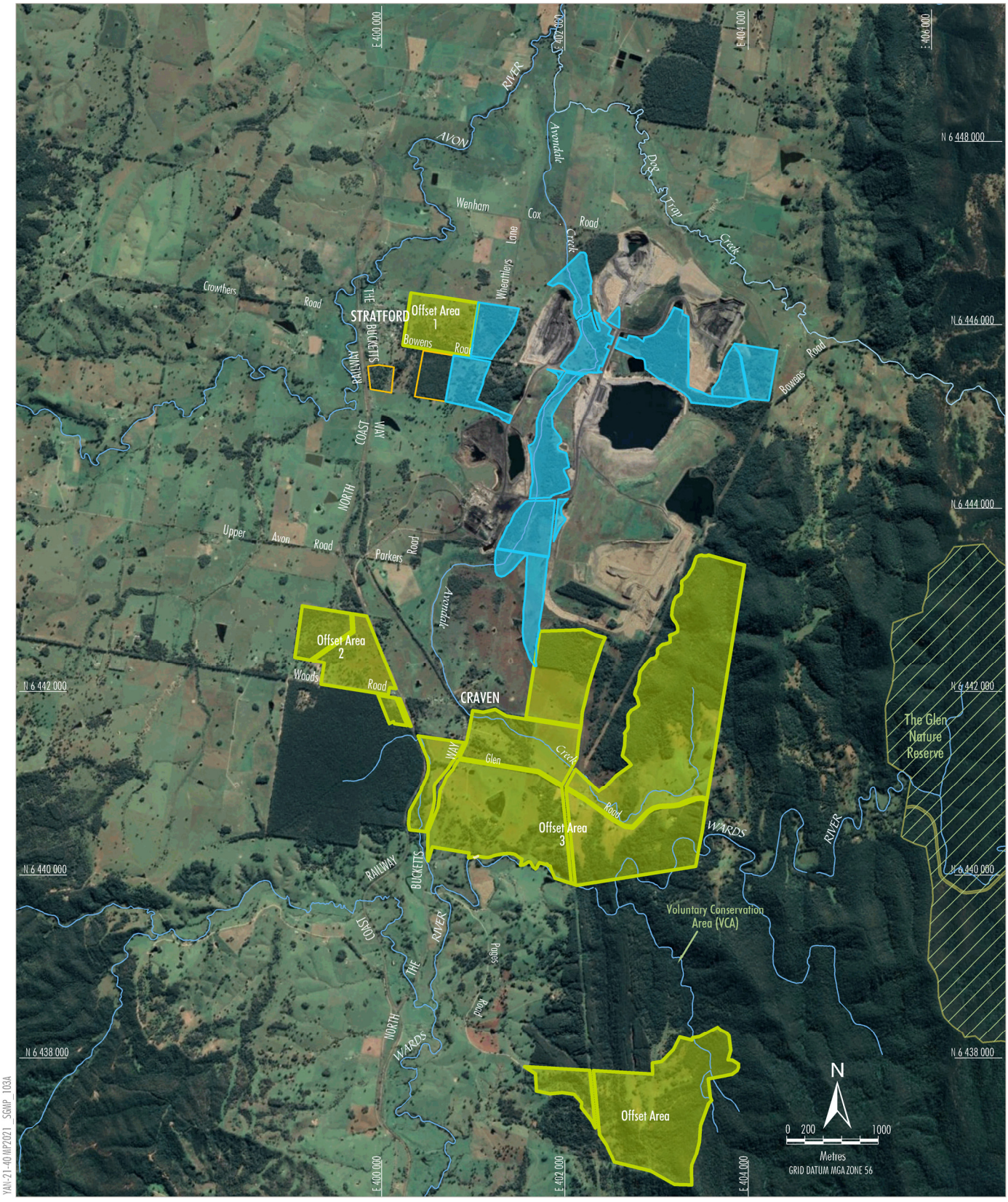
Table 5 outlines the radio tracking program actions implemented across the Biodiversity Offset Areas and Biodiversity Enhancement Areas to December 2020, including performance and completion criteria for each action.

**Table 5**
**Home Range of a Colony Performance and Completion Criteria**

| Management Action | Completed Activities to December 2020 | Annually from December 2020 onwards<br>PC Maintenance Phase | Completion Criteria |
|---|---|---|---|
| Identification of existing Squirrel Glider colonies | Initial targeted survey undertaken. | - | Location of current Squirrel Glider colonies identified*. |
| Mapping of home ranges | Trapping and tracking of individual Squirrel Gliders conducted^. | - | Size of home ranges and for each existing colony has been determined*. |

^ This work will not commence until clearance of potential habitat within 500 m of a Squirrel Glider colony occurs.

* In the event that no Squirrel Gliders are identified, works associated with the mapping of home ranges will focus on the Squirrel Glider colonies identified in Table 3.




LEGEND
Crown Land
Biodiversity Enhancement Area
Offset Area

STRATFORDCOAL
Part of the Yancoal Australia Group

STRATFORD EXTENSION PROJECT

**Biodiversity Offset Areas, Biodiversity Enhancement Area**

*Source: Australian Museum Business Services (2011) ; FloraSearch (2011); SCPL (2012); DFS-LPI (2012) ; DPI C&L [CLD] (2012) Orthophoto - GoogleEarth CNES/Airbus (2020)*

**Figure 6**

# 5 VEGETATION CLEARANCE PROTOCOL

***Objective***

Condition 38(e and f), Schedule 3 of Development Consent SSD-4966 require a vegetation clearing protocol with the aim of protecting individual Squirrel Gliders and relocation of trees containing suitable tree hollows. A vegetation clearance protocol is detailed in the SMC BMP which has been developed to minimise the impact from vegetation clearance activities on native flora and fauna, including threatened species.

The sections below only detail the aspects of the vegetation clearance protocol which are relevant to the Squirrel Glider.

## 5.1 CLEARING RESTRICTIONS

As mentioned in Section 1.2, the measures outlined in this SGMP will only commence once SCPL proposes to commence clearing of potential Squirrel Glider habitat located within 500 m of a Squirrel Glider colony. As described in Section 1.2, no further clearance at the SMC is proposed.

If land clearance were to occur, it would be undertaken progressively, with restriction of clearing to the minimum area necessary to allow mining operations to continue for the ongoing year. Clearance of habitat trees would occur outside of the Squirrel Glider breeding season.

## 5.2 PRE-CLEARANCE FAUNA SURVEYS

Targeted pre-clearance surveys for vertebrate fauna will be undertaken by a suitably qualified person(s). The pre-clearance surveys will be undertaken in two stages. The objective of the pre-clearance vertebrate fauna surveys is to identify:

1. habitat features in trees that could harbour Squirrel Gliders and place them at risk during vegetation clearance activities (e.g. tree hollows), or features that could be salvaged and reused such as mature trees with hollows; and
2. vertebrate fauna most likely to be at risk during vegetation clearance activities and those that will be managed during clearing activities.

## 5.3 CLEARING PROCEDURES TO MINIMISE HARM TO SQUIRREL GLIDERS

Vegetation clearance in a particular area will be conducted within two weeks following the pre-clearance vertebrate animal surveys in that area.

A suitably qualified person(s) will be present during clearing of habitat trees to manage vertebrate animals in accordance with appropriate licenses (AMBS, 2011). Habitat trees will be inspected for Squirrel Gliders by a suitably qualified person(s) immediately prior to and after felling.

The following clearing methods will be employed when clearing habitat trees containing a feature (e.g. hollows, openings, cracks) suspected to be used by Squirrel Gliders:

- immediately prior to clearance, the tree will be knocked with machinery to encourage animals to move to an alternative tree;
- the tree will be lowered slowly using an excavator (or similar), with the tree hollow facing upwards (to enable animals to exit);
- alternatively, the individual habitat features (hollow branch) could be individually removed and placed gently on the ground;
- the felled tree will be visually inspected for animals; and
- the felled tree will be left *in situ* overnight to enable remaining animals to exit at night.

Material for habitat enhancement will be salvaged prior to or following felling of vegetation (whichever is more appropriate).

## 5.4 SALVAGE OF MATERIAL FOR HABITAT ENHANCEMENT IN THE BIODIVERSITY OFFSET AREAS

Some tree hollows salvaged during vegetation clearance activities will be selectively chosen for placement in areas where habitat enhancement is required. These features may be securely attached to suitable trees or placed on the ground. Tree hollows placed in trees will be monitored according to the nest box program (Section 7.2).

SCPL will salvage hollow-bearing and stag trees from cleared vegetation and 'erect' these dead trees into areas of habitat enhancement (SCPL, 2012).

## 5.5 REPORTING

A Vegetation Clearance Protocol report is prepared annually and reported in the Annual Review (Section 12.2).

# 6 SQUIRREL GLIDER FOOD RESOURCES

## 6.1 ESTABLISHING AVAILABLE FOOD RESOURCES

***Objective***

Condition 38I, Schedule 3 of Development Consent SSD-4966 requires measures to establish the food resources utilised by each Squirrel Glider colony (Section 4.1). As described in Section 3, the Squirrel Glider's diet varies seasonally and consists of nectar, pollen, flowers and acacia gum (OEH, 2017; Menkhorst and Collier, 1987). DPE (2015) clarifies that the identification of food resources is to include the identification of season-specific resources such as key winter-flowering nectar resource species. The identification of food resources within the home ranges identified by the radio tracking program (Section 4.2) will focus on key tree species utilised by the Squirrel Glider.

***Methodology***

Floristic surveys will be undertaken in the colony home ranges identified in Section 4.2, to identify the key food resources likely being utilised by the Squirrel Glider within the Biodiversity Offset Areas and Biodiversity Enhancement Areas. Table 6 provides the details of the Squirrel Glider surveys.

**Table 6**
**Squirrel Glider Food Resource Survey Details**

| Aspect | Details |
|---|---|
| **Purpose** | The floristic surveys will allow SCPL to generate a list of key flora species likely being used as a foraging resource by the Squirrel Glider within the home ranges. |
| **Timing and Frequency** | To be undertaken after the first year of the radio tracking program has been undertaken and home ranges for each of the Squirrel Glider colonies have been established. The surveys will be undertaken on a one-off basis. |
| **Location** | Surveys will focus on Squirrel Glider home ranges within the Biodiversity Offset Areas and Biodiversity Enhancement Areas identified during the radio tracking surveys (Section 4.2). |
| **Methodology** | The floristic surveys will consist of identifying tree species within the home range of each colony that are likely being utilised as a foraging resource. Where possible feed trees are identified, the following information will be collected for the tree the individual was recorded in:<br>• Species of tree.<br>• Number of hollows present (if any).<br>• Whether the tree is in flower. |

***Performance and Completion Criteria***

Table 7 outlines the performance and completion criteria to establish food resources across Squirrel Glider home ranges located within the Biodiversity Offset Areas and Biodiversity Enhancement Areas to December 2020.

**Table 7**
**Squirrel Glider Food Resources Performance and Completion Criteria**

| Management Action | Completed Activities to December 2020 | Annually from December 2020 onwards<br>PC Maintenance Phase | Completion Criteria |
|---|---|---|---|
| Identification of Available Food Resources | - | Vegetation surveys undertaken in Squirrel Glider home ranges within the Biodiversity Offset Areas and Biodiversity Enhancement Areas. | Key food resources within each of the Squirrel Glider home range identified. |

***Reporting***

The survey results will be reported in the Annual Review.

## 6.2 MEASURES TO ENHANCE FOOD RESOURCES

Condition 38(d), Schedule 3 of Development Consent SSD-4966 requires measures to enhance food resources utilised by Squirrel Gliders, particularly for Offset Area 1.

Section 8.1 provides a description of the revegetation program which will be implemented by SCPL within the Biodiversity Offset Areas and Biodiversity Enhancement Areas as detailed within Section 5.3 the SMC BMP (Section 1.5.1). A sub-component of this work will involve the planting of flora species which enhance the food resources and dispersal pathways for Squirrel Gliders in accordance with Condition 38, Schedule 3 of Development Consent SSD-4966 (Squirrel Glider Revegetation Pathways [Management Zone A1]).

Further detail is provided in Section 8.1.

# 7 SQUIRREL GLIDER NESTING

## 7.1 TREE HOLLOW CENSUS WITHIN HOME RANGE

***Objective***

Condition 38(b), Schedule 3 of Development Consent SSD-4966 requires a census of suitable tree hollows in home ranges and offset areas suitable for Squirrel Gliders. A tree hollow census was undertaken within the home ranges identified by the radio tracking program (Section 4.2) to identify hollow bearing trees suitable for use as den sites by the Squirrel Glider.

***Methodology***

As outlined in Section 4.2, a radio tracking program has allowed SCPL to identify the home ranges of the Squirrel Gliders within the Biodiversity Offset Areas and Biodiversity Enhancement Areas.

Following identification of Squirrel Glider home ranges in the radio tracking surveys, a tree hollow census was undertaken to identify the tree hollow density and key denning resources for the Squirrel Glider within the Biodiversity Offset Areas and Biodiversity Enhancement Areas. Table 8 provides the details of the tree hollow census. More detailed results of the study can be found in Section 10.1.

**Table 8**
**Tree Hollow Census Details**

| Aspect | Details |
|---|---|
| **Purpose** | The tree hollow census has allowed SCPL to determine the extent of suitable denning resources for the Squirrel Glider within the home ranges in the Biodiversity Offset Areas and Biodiversity Enhancement Areas. The extent of suitable denning resources was used to inform the implementation of the proposed nest box program (Section 7.2). |
| **Timing and Frequency** | The tree hollow census was undertaken in 2019 following establishment of the home ranges of each colony (Section 4.2). |
| **Location** | Surveys focused on the Squirrel Glider home ranges identified during the radio tracking surveys (Section 4.2). |
| **Methodology** | A census of tree hollows was undertaken within the Squirrel Glider home ranges (Section 4.2) with the following minimum information recorded for each hollow identified (where possible):<br>• location of tree hollow;<br>• size of tree hollow; and<br>• signs of animal presence (e.g. scats, fur, nesting material, etc.). |

***Performance and Completion Criteria***

Table 9 outlines the performance and completion criteria for tree hollow census actions implemented across the Biodiversity Offset Areas and Biodiversity Enhancement Areas to December 2020.

**Table 9**
**Tree Hollow Census Performance and Completion Criteria**

| Management Action | Completed Activities to December 2020 | Annually from December 2020 onwards<br>PC Maintenance Phase | Completion Criteria |
|---|---|---|---|
| Tree Hollow Census | Tree hollow census undertaken within Squirrel Glider home ranges. | - | Tree hollow census completed and denning resources within the Squirrel Glider home ranges identified. |

***Reporting***

The tree hollow census results are reported in the Annual Review.

## 7.2 NEST BOX PROGRAM

***Objective***

Nest boxes have been installed to provide habitat opportunities for the Squirrel Glider in accordance with Condition 38(g), Schedule 3 of Development Consent SSD-4966.

The SMC BMP provides a detailed description of the nest box program implemented by SCPL. The following section provides a brief description of the aspects of the nest box program which are relevant to the Squirrel Glider.

In accordance with Schedule 3, Condition 38 (g) of the Development Consent, suitable nest boxes for the Squirrel Glider have been installed at a ratio of at least 3:1 for each tree hollow suitable for the Squirrel Glider cleared for the mine. Section 5 describes how tree hollows are documented as part of the Vegetation Clearance Protocol. Squirrel Glider nest boxes are designed with a small entrance hole (45-50 millimetres diameter) to exclude larger possums and birds (AMBS, 2011).

DPE requires that nest boxes are to be managed for a period of between 20 and 50 years, depending on the census of existing hollow-bearing trees (Section 7.1) and assessment of tree hollow development (Section 7.3).

***Monitoring & Maintenance***

The monitoring and maintenance of nest boxes is described in Section 5.10 of the SMC BMP.

The nest boxes are monitored to provide information on usage and potentially the presence of the population. If individuals utilise the nest boxes regularly for den sites, data on reproductive success may also be obtained. If nest boxes are not being used, consideration would need to be given to relocating boxes or installing additional boxes, to increase availability and choice for family groups.

The nest boxes are monitored by suitably qualified personnel with quarterly inspections undertaken during the first year and subsequent annual inspections in spring.

***Performance and Completion Criteria***

The performance and completion criteria for the nest boxes is described in Section 5.10 of the SMC BMP.

## 7.3 RATE OF TREE HOLLOW DEVELOPMENT

***Objective***

Condition 38(h), Schedule 3 of Development Consent SSD-4966 requires measures to assess the rate of tree hollow development within the Biodiversity Offset Areas. This information would be used to inform the duration of the nest box program (Section 7.2) along with the census of existing hollow-bearing trees (Section 7.1).

***Methodology***

The PAC (2014) states:

> *A recent study by Parnaby et al 2011 put the age of mature north-western NSW ironbarks in the 500-1000 year range (with some likely to approach 2000 years) and suggested that development of hollows suitable for arboreal fauna takes hundreds, not tens, of years. The study drew on a wide range of data from other parts of Australia as well as from the study area in the Pilliga. In relation to the hardwoods in the Pilliga (mainly ironbarks) the first hollow formation takes around 200 years, with some species taking over 300 years. For the faster-growing Blackbutt (eastern coastal range) hollows suitable for arboreal fauna take 140-190 years to develop and large hollows 200-240 years. The conclusion concerning hollow formation in the Project Area must be that, even if a most optimistic view of tree maturity and hollow formation is adopted, there will be many decades before the re-vegetated areas develop hollows suitable for arboreal fauna (including Squirrel Gliders). The more tenable position is that at least 100-150 years will be required.*

Given the length of time it takes for tree hollows to develop (as recognised by the PAC in the above statement), it is not feasible to monitor the development of tree hollows within the Biodiversity Offset Areas via annual monitor events. SCPL proposes to implement a methodology similar to that described in Wormington and Lamb (1999) to establish the rate of hollow development in a single species of tree which is known to be utilised by the Squirrel Glider for denning purposes.

Wormington and Lamb (1999) describe that the rate of hollow formation within a number of Eucalypt species is dependent on the growth rate of the species. This suggests that hollows begin to develop after comparable times in the different species although the time taken for large hollow development differs between the species (Wormington and Lamb, 1999).

Given smooth-barked Eucalypts are preferred by the Squirrel Glider as these eucalypts form hollows more readily than rough-barked and support a greater diversity of invertebrates (Quin, 1995), SCPL will assess the rate of hollow development in the Spotted Gum (*Corymbia maculata*). This species is known to occur widely within the Project Area, Biodiversity Offset Areas and Biodiversity Enhancement Areas as it is the dominant canopy species within the *Spotted Gum – Grey Ironbark dry open forest of the lower foothills of the Barrington Tops, North Coast* vegetation community mapped by FloraSearch (2012) (Figure 3).

*Rate of Hollow Development in Spotted Gums*

The rate of hollow development of Spotted Gum within the Biodiversity Offset Areas and Biodiversity Enhancement Areas will be assessed to determine the age that this species typically develops hollows suitable for use as a den site by the Squirrel Glider.

SCPL will conduct a literature review of the information available in scientific literature to determine the rate of hollow development within the Spotted Gum.

*Age of the Spotted Gums in the Biodiversity Offset Areas and Biodiversity Enhancement Areas*

Floristic surveys will be undertaken within the Biodiversity Offset Areas and Biodiversity Enhancement Areas to record the diameter at breast height of Spotted Gums which do not yet possess hollows and an estimate of the age of these trees will be developed. From this information, the suitably qualified expert(s) will determine the estimated period of time when these trees will be likely to develop hollows which could provide suitable denning resources for the Squirrel Glider.

The results of this work will be used to inform the duration of the nest box program (Section 7.2). That is, should the work indicate that the trees within the Biodiversity Offset Areas and Biodiversity Enhancement Areas would develop sufficient hollows in under 50 years to compensate for the loss of hollows within the Project area, SCPL will cease the nest box program at that time. FloraSearch (2012) shows that a large portion of the trees within the Biodiversity Offset Areas and Biodiversity Enhancement Areas were present within the 1964 aerial photography. This indicates that these trees would likely be developing tree hollows in the short to medium term, allowing SCPL to limit/cease the nest box program before the 50 year period outlined in DPE (2015).

***Data Analysis***

The data will be statistically analysed as determined by the suitably qualified expert(s).

***Performance and Completion Criteria***

Table 10 outlines the performance and completion criteria to assess the rate of tree hollow development actions implemented across the Biodiversity Offset Areas and Biodiversity Enhancement Areas to December 2020.

**Table 10**
**Assessing Tree Hollow Development Performance and Completion Criteria**

| Management Action | Completed Activities to December 2020 | Annually from December 2020 onwards<br>PC Maintenance Phase | Completion Criteria |
|---|---|---|---|
| Determining rate of tree hollow development in Spotted Gum (*Corymb26aculateata*)* | Literature review undertaken. | - | The age at which Spotted Gum trees develop hollows has been determined. |
| Assessing age of Spotted Gum Trees within the Biodiversity Offset Areas and Biodiversity Enhancement Areas* | Spotted Gum trees without hollows in the Biodiversity Offset Areas and Biodiversity Enhancement Areas assessed to determine anticipated time period until hollow development. | - | Time period until development of hollows in Spotted Gum trees within the Biodiversity Offset Areas and Biodiversity Enhancement Areas has been established. |

* This work will only commence once clearance of hollow bearing trees occurs.

***Reporting***

Results will be compiled and a report will be prepared documenting the findings of the assessment. The results will be reported in the Annual Review.

# 8 SQUIRREL GLIDER MOVEMENT

## 8.1 VEGETATION PATHWAYS

SCPL implements a revegetation program within the Biodiversity Offset Areas and Biodiversity Enhancement Areas as detailed in the SMC BMP. The aim of revegetation is to establish a range of habitat niches through revegetation (including canopy, understorey and ground cover) (SCPL, 2012). The Revegetation Area (Management Zone A) (Figure 7) (dominated by non-native vegetation) in the Biodiversity Offset Areas and Biodiversity Enhancement Areas is revegetated to substantially increase the area of native vegetation in the area and maximise habitat diversity and a range of successional stages (SCPL, 2012).

The Revegetation Area (Management Zone A) (Figure 7) covers introduced pasture and is actively managed to promote revegetation of native woodland/forest species. This includes, but is not necessarily limited to, removal of weeds, creating disturbance to the introduced grassland (via slashing or low-intensity controlled burning), and planting and of flora species represented in the surrounding native vegetation communities.

Condition 38, Schedule 3 of Development Consent SSD-4966 requires enhancement of vegetation, particularly in Offset Area 3, to create recruitment and dispersal pathways for Squirrel Gliders. As such, a sub-component of the Revegetation Areas (Management Zone A) is planted with flora species that enhance the food resources and dispersal pathways for Squirrel Gliders (Squirrel Glider Vegetation Pathways [Management Zone A1]). Squirrel Glider Vegetation Pathways (Management Zone A1) occur in the Biodiversity Offset Areas (particularly in Offset Area 3) and Biodiversity Enhancement Areas (Figure 7).

The Squirrel Glider Vegetation Pathways (Management Zone A1) are located in three locations within the Biodiversity Offset Areas and Biodiversity Enhancement Areas to increase the ability of the Squirrel Gliders to disperse between these areas (Figure 7). The provisional revegetation species list for Squirrel Glider Vegetation Pathways (Management Zone A1) is provided in Appendix A. The flora species included in the list have been recorded in the locality by FloraSearch (2012) and/or AMBS (2011).

***Monitoring***

Monitoring of the Squirrel Glider Vegetation Pathways (Management Zone A1) is undertaken to quantitatively measure the change in habitat and vegetation condition over time. Vegetation condition monitoring commenced in spring 2018 and is undertaken annually as detailed in the SMC BMP.

***Performance and Completion Criteria***

Table 11 outlines the performance and completion criteria for the vegetation pathways actions implemented across the Squirrel Glider Vegetation Pathways (Management Zone A1) to December 2020. Table 11 also outlines activities relevant to vegetation pathways to be undertaken from December 2020 onwards.

**Table 11**
**Squirrel Glider Vegetation Pathways Performance and Completion Criteria**

| Management Action | Completed Activities to December 2020 | Annually from December 2020 onwards<br>PC Maintenance Phase | Completion Criteria |
|---|---|---|---|
| Squirrel Glider Vegetation Pathways (Management Zone A1) | Commence planting of flora species which provide habitat for the Squirrel Glider within designated revegetation zones (Figure 7). | Continue plantings of flora species which provide habitat for the Squirrel Glider. | Squirrel Glider vegetation pathways planted within the indicative area shown on Figure 7, and have reached a size suitable to provide connective habitat for the Squirrel Glider. |


YAN-21-40 MP2021 SGWP 104A

LEGEND

- Electricity Transmission Line
- Crown Land
- Approximate Extent of Existing/Approved Surface Development
- Biodiversity Enhancement Area
- Offset Area
- Resource Company Owned Dwelling
- Privately Owned Dwelling
- Tracks
- Management Zone A - Revegetation Area (Indicative Location)
- A1 Squirrel Glider Vegetation Pathways (Indicative Location)
- Glider Pole (Indicative Location)

*Source: Australian Museum Business Services (2011) ; FloraSearch (2011); SCPL (2012); DFS-LPI (2012) ; DPI C&L [CLD] (2012) Orthophoto - GoogleEarth CNES/Airbus (2020)*

STRATFORDCOAL
Part of the Yancoal Australia Group

STRATFORD EXTENSION PROJECT

**Squirrel Glider Vegetation Pathways for the Biodiversity Offset Areas and Biodiversity Enhancement Areas - North**

**Figure 7**

***Record Keeping and Reporting***

Record keeping for the Squirrel Glider Vegetation Pathways (Management Zone A1) is discussed in Section 12.1, and reporting requirements are discussed in Section 12.2.

## 8.2 GLIDER POLES

***Objective***

Installation of glider poles in the Biodiversity Offset Areas and Biodiversity Enhancement Areas (i.e. wooden poles erected over haul roads and between habitats and potentially used by Squirrel Gliders for movement until natural habitat is established).

***Methodology***

To provide for the continued movement of the individuals or family groups within and around the SMC, the proposed locations shown on Figure 7 will be targeted for installation of glider poles. These include:

1. either side of the haul road from the Bowens Road north pit towards the Stratford East Open Cut;
2. either side of the haul road crossing Avondale Creek; and
3. within Offset Area 3, to the west of the Stratford East Open Cut.

In addition to these locations, should SCPL acquire Property 44, additional glider poles will be installed at the crossings of The Bucketts Way and Main Northern Railway (unless ruled impractical by the relevant transport authority) (SCPL, 2012).

*Installation*

The glider poles will be placed at approximately 25 m intervals (where possible) (AMBS, 2011). Glider poles will be installed in combination with nest boxes specifically designed for the Squirrel Glider (Section 7.2), to provide appropriate shelter and protection in areas where there is little canopy protection.

The glider poles will consist of a vertical beam (similar to a telephone pole) with a cross bar (or launch beam) at the top. The launch beam is constructed perpendicular to the vertical pole, allowing the Squirrel Glider a platform to launch from (Gleeson and Gleeson, 2012).

For the glider poles proposed to be installed either side of haul roads, aerial fauna crossings (such as fauna bridges) may be installed in their place should the span between poles be more than 40 m. This will facilitate the road crossing and minimise the chance of fauna mortality potentially associated with Squirrel Gliders falling short of the landing pole. Table 12 gives an example of possible heights and distances for placing gliding poles, considering landing height (van der Ree et al., 2003). The glider poles to be installed will be at least 15 to 20 m high, depending on the height of the surrounding vegetation, to allow Squirrel Gliders to glide the 25 m between the poles. Should the surrounding vegetation be less than 15 m high, the glider poles may need to be brought closer than 25 m apart to allow shorter poles to be installed.

**Table 12**
**Pole Height and Average Gliding Distance**

| Pole Height (m) | Average Glide Distance (m) |
|---|---|
| 25 | 40 |
| 20 | 32 |
| 15 | 22 |
| 10 | 12 |

Source: AMBS (2011).

The following minimum data will be recorded upon installing the glider poles:

- date;
- GPS location of each glider pole;
- height of the glider pole;
- surrounding vegetation maturity/type; and
- photographs of each installed pole.

***Monitoring***

Once installed, the glider poles will be monitored by suitably qualified personnel to determine fauna usage (AMBS, 2011). The monitoring of the glider poles is discussed in Section 8.3.

***Performance and Completion Criteria***

Table 13 outlines the performance and completion criteria for the glider pole program actions to be implemented across the Biodiversity Offset Areas and Biodiversity Enhancement Areas to December 2020. Table 13 also outlines activities relevant to the glider pole program to be undertaken from December 2020 onwards.

**Table 13**
**Glider Pole Program Performance and Completion Criteria**

| Management Action | Completed Activities to December 2020 | Annually from December 2020 onwards<br>PC Maintenance Phase | Completion Criteria |
|---|---|---|---|
| Installation of Glider Poles | - | Completion of glider pole installations. | Glider poles have been installed. |
| Maintenance of Glider Poles | Annual inspection complete. | Annual inspections of glider poles to determine if maintenance is required. | - |

***Reporting***

The monitoring results will be reported in the Annual Review.

## 8.3 GLIDER POLE MONITORING

***Objective***

Once installed, the glider poles will be monitored by suitably qualified personnel to determine fauna usage (AMBS, 2012).

***Timing***

Monitoring will occur quarterly in the first year and then be reduced to annually (in spring) following a review of the monitoring reports.

***Methodology***

Camera-traps will be installed at each of the two proposed installation locations. One camera will be directed at each of the poles, to monitor usage of each pole (Goldingay *et al.,* 2011). The camera traps would also remain in place for 20 nights during each monitoring round (Goldingay *et al.,* 2011).

***Data Analysis***

The video footage would be analysed to identify any fauna species recorded.

# 9 PERFORMANCE AND COMPLETION CRITERIA

***Performance Criteria***

As described in Section 1.2, the original SGMP was prepared for the three-year period between July 2018 and July 2021 and included broader concepts for the medium term (three to six years) and the longer term (6+ years). In this revision of the SGMP, updates have been made to reflect the status and completion of the 2018 to 2020 performance and completion criteria for the offset areas. This document will be reviewed/revised as described in Section 11.3.

Performance criteria are interim targets for the management activities. The performance of Squirrel Glider Management is monitored against the performance criteria provided in the relevant tables throughout the SGMP. If performance criteria are not being met, the reason for not meeting the performance criteria will be investigated by SCPL and contingency measures will be considered (where appropriate). The performance criteria will be refined during the life of the mine.

***Completion Criteria***

Completion criteria are provided throughout the relevant sections of the SGMP and provided in Tables 5, 7, 9, 10 and 12. The completion criteria will be revised and refined as appropriate during the life of the mine.

# 10 RESULTS OF SQUIRREL GLIDER STUDIES

## 10.1 HOME-RANGE STUDY

To determine the home-ranges of Squirrel Glider colonies at the SMC, an initial remote camera survey was conducted by Kleinfelder to determine the location of Elliot B traps. Arboreal trapping was conducted by Kleinfelder over two periods in 2019 in accordance with appropriate licenses/permits (Kleinfelder, 2020). Squirrel Gliders were captured for radio-tracking and recaptured for collar removal. Elliot B traps were installed at five trapping transects consisting of 10 sheet metal box traps spaced at approximately 100 metre intervals. The traps were installed on trees within suitable habitat identified by the initial remote camera survey and previous records (Kleinfelder, 2019a) (Figure 8).

Each Squirrel Glider that was captured during the arboreal trapping phase was weighed, measured, sexed, aged, named, and fitted with a uniquely numbered ear tag. Squirrel Gliders were selected for tracking if they were adult and without young. One male and one female Squirrel Glider from each study site were preferred (Kleinfelder, 2020). Squirrel Gliders were then released at the trap site which they were caught.

The home-ranges of each SMC Squirrel Glider colony are displayed on Figure 8.

***Radio Tracking***

Radio-tracking was conducted over two periods to detect any variability in range size and use over different seasons. The first round was conducted in summer/autumn between 30 January 2019 and 3 April 2019. The second round was conducted in winter/spring between 7 July and 1 September 2019.

Released Squirrel Gliders fitted with radio-transmitters were tracked to dens to obtain data. A total of 36 Squirrel Gliders were captured during the arboreal trapping phase of the home range study (19 females and 17 males). Nineteen individuals were fitted with tracking collars; fourteen of which retrieved viable data due to transmitter failures and predation (Kleinfelder, 2020).

ZoaTrack was used to spatially analyse Squirrel Glider locations obtained from trap captures and radio-tracking locations (Dwyer et al., 2015). Squirrel Glider seasonal home ranges were estimated through the Minimum Convex Polygon (MCP) and Fixed Kernal (FK) methods. The MCP estimate considers all locations recorded for an individual Squirrel Glider and creates the smallest possible polygon that incorporates the location records. The FK percentage refers to the boundary of the area containing that volume of utilised distribution.

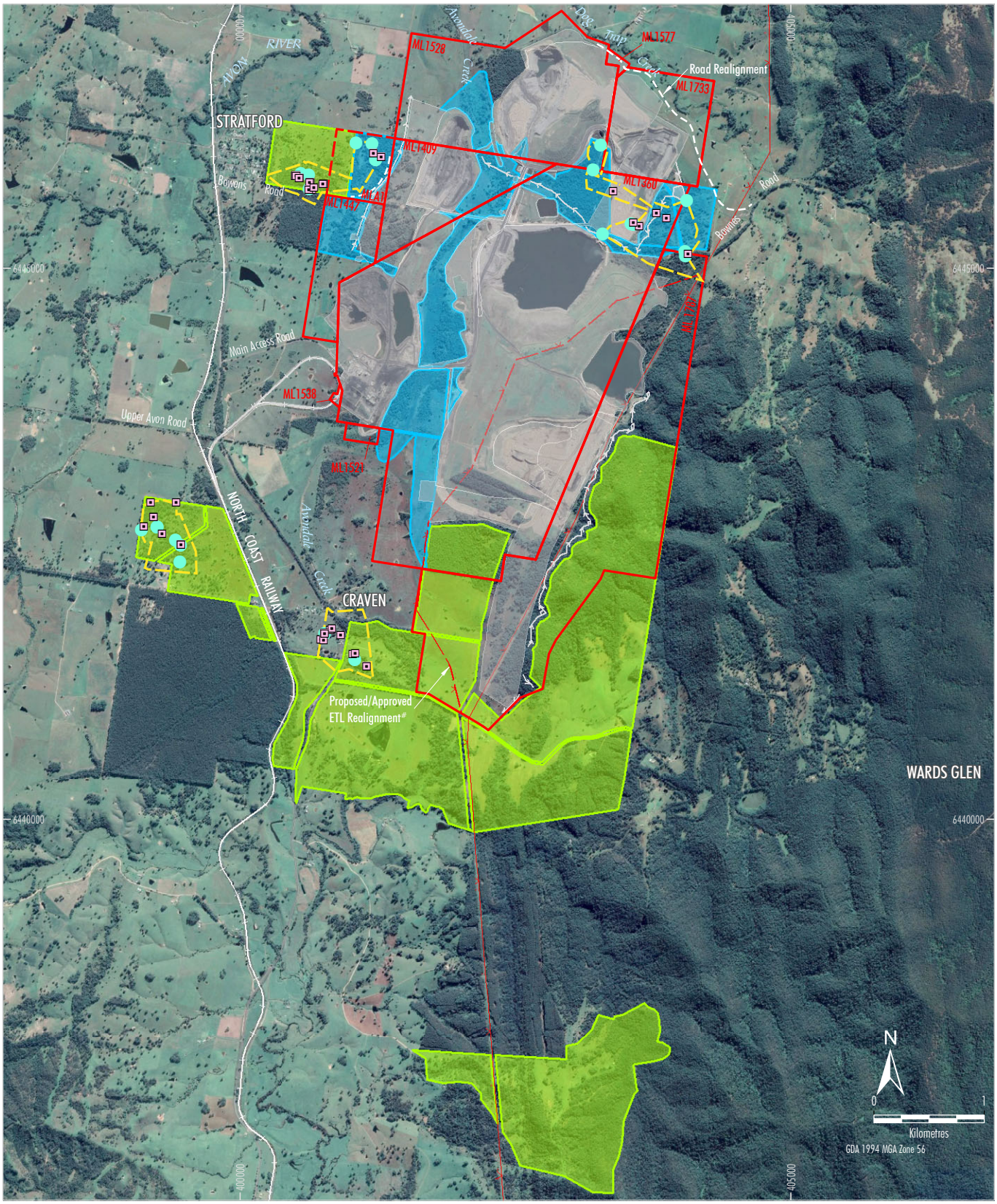
***Remote Camera Survey***

Squirrel Gliders were detected at 13.5% of locations surveyed during the remote camera survey. This was found to be an appropriate method to determine utilised areas, however, Squirrel Gliders were later confirmed present at some locations not detected by cameras but identified during trapping.

***Home Range Estimation***

Seasonal home range estimates calculated during the home range study (MCP100% 11.3 ha ± 2.1 ha, FK95% 3.8 ha ± 0.3 ha) are similar to results reported in Goldingay et al. (2010) (Kleinfelder, 2020). Goldingay et al. (2010) investigated the home range of Squirrel Gliders at Tea Gardens, NSW and Minnippi Parklands (Brisbane). The MCP100% estimated was 13.3 ha ± 3.1 ha and FK95% 4.6 ha ± 0.7 ha (Kleinfelder, 2020). This suggested the habitat quality may be lower in this part of the Squirrel Gliders' geographic range (Kleinfelder, 2020). MCP100% estimations from the Brisbane area (MCP100% 6.7 ha ± 1.5 ha) are almost half the size of estimations calculated for Tea Gardens (MCP100% 13.3 ha ± 3.1 ha) and the current study (Kleinfelder, 2020).

Estimating the size of the home range of a species poses various challenges as individuals should ideally be tracked for a large part of the year to accurately characterise home range areas (Goldingay, 2015). This is difficult for Squirrel Gliders, as the battery life of Squirrel Glider radio-collars is approximately 6 months, and collars can start to abrade their necks prior to that (Kleinfelder, 2020). Capturing Squirrel Gliders multiple times to remove and later reattach collars cannot be done with any reliability (Ree and Bennett 2003).




YAN-21-40 MP2021_SGMP_202A

LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary*
- Electricity Transmission Line
- Approximate Extent of Existing/Approved Surface Development
- Conceptual Up-Catchment Diversion
- Offset Area
- Biodiversity Enhancement Area
- Trapping Location
- Den Trees
- Squirrel Glider Home Range

*MLA1 is a proposed future Mining Lease Application (MLA) area and has not yet been lodged.*

*# Not yet Constructed*

*Source: Orthophoto - GoogleEarth CNES/Airbus (2020); LPI (2016); NSW Department of Planning & Environment (2017)*

STRATFORDCOAL
Part of the Yancoal Australia Group

STRATFORD EXTENSION PROJECT

Outcomes of Squirrel Glider Studies

**Figure 8**

The seasonal home range calculated during the home range study suggests that Squirrel Gliders within the SMC utilise at least 11.3 ha ± 2.1 ha, and mainly den and forage within an area of 3.8 ha ± 0.3 ha.

Important findings from the home range study indicate that the home range of Squirrel Gliders does not vary due to survey rounds/seasons, sites or sexes (Kleinfelder, 2020). This suggests that a variety of foraging habitat exists temporally in areas where Squirrel Gliders were radio-tracked (Kleinfelder, 2020).

## 10.2 HOLLOW-BEARING TREE CENSUS

Following an initial Squirrel Glider survey in 2018 (Kleinfelder, 2019a), Kleinfelder Australia was commissioned by SCPL to conduct a hollow-bearing tree census within the SMC Biodiversity Enhancement Area and Biodiversity Offset Areas (in accordance with Section 7.1 of this SGMP) (Kleinfelder, 2019b). The ground-based hollow-bearing tree census was conducted in areas known to form part of the home ranges occupied by the local Squirrel Glider populations, as determined in the initial Kleinfelder Squirrel Glider survey (2019a).

Several attributes that may influence Squirrel Glider den selection were recorded to allow comparisons to other published studies (Kleinfelder, 2019b). Recorded den attributes were similar to that of Crane et al. (2008), and included location, tree species and DBH, tree and den height, den opening length, width, aspect, and hollow category. Hollow category was separated into three types according to the location or structure of the hollow within the tree, including branch hollow, trunk hollow and fissure/crack.

During the hollow bearing tree census, a total of 480 hollow bearing trees were identified and mapped. These trees contained a total of 648 hollows. Hollows were found in 13 tree species including stags (dead standing trees) which were the most common tree species to contain hollows (37%) followed by *Eucalyptus umbra* (Broad-leaved white mahogany) (25%).

Attributes of available hollows and known den hollows (Table 16) were compared by Kleinfelder (2019b) to investigate the hollow preferences of Squirrel Gliders. A total of 543 hollows within the SMC Biodiversity Enhancement Area and Biodiversity Offset Areas were found to be suitable for the species. Twenty-nine den trees consisting of seven species were recorded during the study (Figure 8) with up to three gliders occasionally sharing one tree.

**Table 16**
**Summary of Known Den Attributes and Attributes of Hollow Bearing Trees**

| Attribute | Mean ± Standard Error | Range |
|---|---|---|
| Known Den Tree Attributes | | |
| Tree Height (m) | 18.8 ± 1.4 | 3 - 34 |
| Den Height (m) | 7.7 ± 1.1 | 1.2 - 28 |
| Den opening width (cm) | 6.2 ± 0.6 | 3 - 17 |
| Den opening length (cm) | 12.7 ± 3.4 | 4 - 100 |
| Den opening area (cm²) | 71.8 ± 17.3 | 18 - 500 |
| Diameter at Breast Height (DBH) (cm) | 63.6 ± 3.8 | 24 - 102 |
| Dieback % | 42.6 ± 7.9 | 0 - 100 |
| Total no. of visible hollows | 1.6 ± 0.2 | 1 - 3 |
| Hollow Attributes Gathered During Hollow Bearing Tree Census | | |
| Hollow Height (m) | 8.2 ± 0.2 | 1 - 25 |
| Hollow opening width (cm) | 13.7 ± 0.56 | 3 - 100 |
| Hollow opening length (cm) | 25.6 ± 2.0 | 3 - 400 |
| Hollow opening area (cm²) | 548.6 ± 56.6 | 12–7 - 3910 |
| DBH (cm) | 73.82 ± 1.4 | 10 - 200 |
| Total no. of visible hollows | 1.4 ± 0.9 | 1 - 8 |

Dens in *Eucalyptus siderophloia* (Grey Ironbark) and stags were equally the most common tree species used by Squirrel Gliders for denning (*E. siderophloia* = 11, 33% and stags = 11, 33%). Other den trees included *Eucalyptus umbra* (Broad-leaved white mahogany), *Angophora floribunda* (Rough-barked Apple), *Eucalyptus moluccana* (Grey Box), *Eucalyptus amplifolia* (Cabbage Gum) and *Eucalyptus tereticornis* (Forest Red Gum). The most common aspect of known Squirrel Glider dens was upright (26%) followed by north-east (16%). Preferred den selection among the Squirrel Gliders was found to be significantly influenced by the width of the hollow opening and the hollows category (branch, trunk or fissure/crack).

The hollow-bearing tree census results established a baseline for the number and distribution of hollows throughout the SMC Biodiversity Enhancement Area and Biodiversity Offset Areas, and provides an estimated density of hollows for each vegetation community (Kleinfelder, 2019b). It was not determined from the hollow-bearing tree census whether the calculated hollow density is dependent on age and/or species type.

# 11 MONITORING

There are various monitoring programs to monitor and report on the effectiveness of Squirrel Glider management measures that will be implemented at the SMC (Table 14).

**Table 14**
**SMC Monitoring Program**

| Monitoring Program | Relevant SGMP Section | Frequency | Documentation |
|---|---|---|---|
| Vegetation Clearance Protocol | Section 5 | As required | Following vegetation clearing |
| Nest Box Monitoring | Section 7.2 | Quarterly for 12 months and then annually | Annual report |
| Revegetation Monitoring | Section 8.1 | Annually, spring | Annual report |
| Squirrel Glider Population Monitoring | Section 11.1 | Every three years in conjunction with the fauna monitoring program | Annual report |

## 11.1 SQUIRREL GLIDER POPULATION MONITORING

***Objective***

As outlined in Section 7.1.4 of the SMC BMP, fauna monitoring is undertaken to document the fauna species response to improvement in vegetation and habitat in the Biodiversity Offset Area.

***Timing***

Terrestrial fauna surveys commenced in spring 2019 and will be undertaken every three years to monitor the use of the Biodiversity Offset Area by vertebrate fauna (SCPL, 2012).

***Methodology***

Should the monitoring data indicate that important den sites are due to be cleared, additional nest boxes may be installed and/or the important hollows relocated (SCPL, 2012). In addition, if family groups are known to regularly utilise certain areas for foraging, additional plantings may be necessary to reduce the impact of the vegetation clearing (SCPL, 2012).

The success of young individuals dispersing, and their survival, is likely to provide an indication of the health of the population as the Project disturbance continues (AMBS, 2011). If offspring are failing to survive and successfully reproduce, management interventions may be applied, for example installing additional nest boxes or glider poles, and/or increasing planting of feed trees (AMBS, 2011).

## 11.2 RISKS AND CONTINGENCY MEASURES/REMEDIAL ACTIONS

In accordance with Condition 3(e), Schedule 5 of Development Consent SSD-4966, the potential risks to the successful implementation of the management strategies described in this SGMP are identified in Table 15 along with a description of the contingency measures that will be implemented to mitigate against these risks. Contingency measures (remedial actions) are to be implemented if the monitoring program identifies that the performance criteria are not being met. Contingency measures may not be limited to those listed in Table 15.

**Table 15**
**Risks to Squirrel Glider Management and Contingency Measures/Remedial Actions**

| Aspect | Section | Potential Risk | Possible Contingency Measures/Remedial Actions |
|---|---|---|---|
| Defining the Home Range of a Colony | Section 4 | No Squirrel Gliders are identified during the initial surveys. | • SCPL will rely on the work undertaken for the EIS and focus on the Squirrel Glider colonies in Table 3 (excluding SG1 and SG2). |
| | | Squirrel Gliders are not trapped to allow radio tracking. | • Existing literature is used to determine likely home range of each colony. |
| | | Individuals that are trapped and tracked show signs of dispersal rather than remaining within a home range. | • Radio tracking of adults and sub-adults which are known to remain within home ranges is relied on and outliers in the data will be removed (Sharpe and Goldingay, 2007). |
| Establishing Available Squirrel Glider Food Resources | Section 6.1 | Squirrel Gliders are not identified during the spotlighting work. | • Existing literature is used to determine likely food resources being used by the Squirrel Gliders within the identified home ranges. |
| Nest Box Program | Section 7.2 | Native fauna not inhabiting the nest boxes. | • Consideration of relocating the nest box to an alternative location. |
| | | Infestation of nest boxes by pests. | • Replacement of the nest boxes. |
| Determining the Rate of Hollow Development | Section 7.3 | Limited number of Spotted Gum identified prior to clearing to allow age to be determined. | • Existing literature is used to determine likely age of Spotted Gum trees when they develop tree hollows. |
| Establishing Vegetation Pathways | Section 8.1 | Poor native plant growth/germination. | • Additional planting or sowing to replace lost recruits or seedlings if the rate of loss is higher than the rate of establishment.<br>• Consider the benefits and practicality of applying soil ameliorants. |
| | | Grazing herbivores are significantly damaging young seedlings. | • If grazing kangaroos are significantly damaging young seedlings, the need for kangaroo control measures will be reviewed. Options for managing the issue include use of tree guards to protect young seedlings. |
| | | Insect pests significantly damaging young seedlings. | • Pesticide will be used safely according to the safety data sheets. |
| Glider Pole Program | Section 8.2 | No evidence of the glider poles being used by Squirrel Gliders. | • Allowing the surrounding vegetation to mature, increasing the likelihood of Squirrel Gliders using the glider poles. |
| | | | • Consideration will be given to implementing additional plantings in the vicinity of the glider poles to encourage their use. |

# 12 REPORTING, AUDIT AND REVIEWING

In accordance with Condition 3, Schedule 5 of Development Consent (SSD-4966), SCPL has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

The management of incidents is described in the SMC Pollution Incident Response Management Plan. The management of complaints and non-compliances is described in detail in the Environmental Management Strategy. The management of exceedances of performance criteria is detailed in this SGMP. In accordance with Condition 8, Schedule 5 of NSW Development Consent SSD-4966, SCPL will provide regular reporting on the environment performance of the SMC on the SMC's website.

## 12.1 DOCUMENTATION

SCPL will maintain accurate records substantiating all activities, including measures taken to implement any management documents, and make them available upon request to DPE. The results of the following works will be reported once, upon completion of the activities detailed in the relevant sections of this SGMP, and will be combined into a single report on the Squirrel Glider population at the SMC:

- defining the home range of a colony (Section 4.2);
- establishing available Squirrel Glider food resources (Section 6.1);
- tree hollow census (Section 7.1); and
- determining the rate of hollow development (Section 7.3).

## 12.2 REPORTING

### 12.2.1 Annual Review

In accordance with Condition 4, Schedule 5 of Development Consent (SSD-4966), SCPL will conduct an Annual Review of the environmental performance of the SMC by the end of March each year, or other timing as may be agreed by the Secretary of the DPE.

In accordance with Condition 4, Schedule 5 of Development Consent (SSD-4966), the Annual Review will:

*a) describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;*

*b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against the:*

- *the relevant statutory requirements, limits or performance measures/criteria;*
- *the monitoring results of previous years; and*
- *the relevant predictions in the EIS;*

*c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;*

*d) identify any trends in the monitoring data over the life of the development;*

*e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and*

*f) describe what measures will be implemented over the next year to improve the environmental performance of the development.*

The Annual Review will include:

- a summary of the home range of Squirrel Glider Colonies outcomes (Section 4.2);
- a summary of the Vegetation Clearance Protocol outcomes (Section 5);
- a summary of the results of the Squirrel Glider surveys and likely food resources (Section 6.1);
- results of the tree hollow census (Section 7.1);
- nest box monitoring results (Section 7.2);
- results of the assessment to determine rate of hollow development (Section 7.3); and
- glider pole monitoring results (Section 8.2).

The Annual Review will be made publicly available on the Stratford Coal website, in accordance with Condition 11, Schedule 5 of Development Consent (SSD-4966).

#### 12.2.2 Publishing of this SGMP

This SGMP will be made publicly available on the Stratford Coal website in accordance with Condition 11, Schedule 5 of Development Consent (SSD-4966). A hard copy of the SGMP will also be kept at the SMC.

### 12.3 REVIEW AND REVISION OF THIS PLAN

In accordance with Condition 5, Schedule 3 of Development Consent (SSD-4966), this SGMP will be reviewed to the satisfaction of the Secretary of the DPE within three months of the submission of:

(a) an Annual Review under Condition 4, Schedule 5 of Development Consent (SSD-4966);

(b) an incident report under Condition 7, Schedule 5 of Development Consent (SSD-4966);

(c) an audit report under Condition 9, Schedule 5 of Development Consent (SSD-4966); or

(d) any modification to the conditions of Development Consent (SSD-4966).

Where this review leads to revisions of the SGMP, then within 4 weeks of the review, the revised SGMP will be submitted for the approval of the Secretary of the DPE. The revision status of the SGMP is indicated on the title page of each copy.

# 13 REFERENCES


Australian Museum Business Services (2011) *Terrestrial Fauna Assessment for the Stratford Extension Project.* Report prepared for Stratford Coal Pty Ltd.

Ball, T. (2007) *The ecology and management of the Squirrel Glider (Petaurus norfolkensis) in a fragmented landscape, central Queensland*. Thesis.

Ball, T., Goldingay, R.L., and Wake, J. (2011) *Den trees, hollow-bearing trees and nest boxes: management of squirrel glider (Petaurus norfolcensis) nest sites in tropical Australian woodland*. Australian Mammalogy, 33, 106-116.

Beyer, G. L., Goldingay, R. L., and Sharpe, D. J. (2008) *The characteristics of squirrel glider (Petaurus norfolcensis) den trees in subtropical Australia*. Australian Journal of Zoology, 56, 13-21.

Brearley, G., Bradley, A., Bell, S., and McAlpine, C. (2010). *Influence of contrasting urban edges on the abundance of arboreal mammals: A study of squirrel gliders (Petaurus norfolcensis) in southeast Queensland, Australia*. Biological Conservation, 143, 60-71.

Brearley, G., McAlpine, C., Bell, S., and Bradley, A. (2011) *Squirrel glider home ranges near urban edges in eastern Australia.* Australian Journal or Zoology, 285, 256–265.

Crane, M. J., Montague-Drake, R. M., Cunningham, R.B. and Lindenmayer, D.B. (2008). *The characteristics of den trees used by the squirrel glider (Petasurus norfolcensis) in temperate Australian woodlands*. Wildlife Research, 35, 663-675.

Crane, M. J., Lindenmayer, D. B. and Banks, S. C. (2017). *Conserving and restoring endangered southern populations of the Squirrel Glider (Petasurus norfolcensis) in agricultural landscapes.* Ecological Management & Restoration, 18, 15-25.

Crane, M., Lindenmayer, D., and Cunningham, R. (2010) *The use of den trees by the squirrel glider (Petaurus norfolcensis) in temperate Australian woodlands.* Australian Journal or Zoology, 58, 39–49.

Department of Environment and Conservation (2004). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. Working Draft. Department of Environment and Conservation, NSW. Hurstville.

Dwyer, R. G., Brooking, C., Brimblecombe, W., Campbell, H. A., Hunter, J., Watts, M.and. Franklin, C. E. (2015*). An open Web-based system for the analysis and sharing of animal tracking data*. Animal Biotelemetry, 3(1).

Ecobiological (2011) *Fauna Survey Report Stratford Coal Mine, Gloucester, New South Wales.*

FloraSearch (2012) *Stratford Extension Project – Flora Assessment.* Report prepared for Stratford Coal Pty Ltd.

Francis, M. J., Spooner, P. G. and Matthews, A. (2015). *The influence of urban encroachment on squirrel gliders (Petaurus norfolcensis): effects of road density, light and noise pollution*. Wildlife Research, 42, 324-333.

Gleeson, J., and Gleeson, D. (2012) Reducing the Impacts of Development on Wildlife. CSIRO Publishing.

Goldingay, R.L., Sharpe, D.J., Beyer, G.I. and Dobson, M. (2006). *Using ecological studies to understand the conservation needs of the Squirrel Glider in Brisbane's urban forest remnants*. Australian Mammalogy, 28, 173-186.

Goldingay, R., Sharpe, D. and Dobson, M. (2010). *Variation in the home-range size of the squirrel glider* (*Petasurus norfolcensis*). Australian Mammalogy, 32,183-188.

Goldingay R.L., Taylor, B.D. and Ball, T. (2011). *Wooden poles can provide habitat connectivity for a gliding mammal*. Australian Mammalogy, 33, 36-43.

Holland G., Bennet, A.F. and Van Der Ree, R. (2007). *Time budget and related aspects of the foraging behaviour and habitat use of the squirrel glider*. Wildlife Research, 34(4), 288-295.

Hoye, G.A. and Finney, D. (1994). *Report on a Survey of the Bat Fauna of an Area Proposed for Open Cut Coal Mining Near Stratford, New South Wales.* Attachment 8.2-B Bat Survey (1994) of Appendix 8.2.

Kleinfelder Australia Pty Ltd. (2019a). *Initial Squirrel Glider survey as part of Stratford Coal's Squirrel Glider Management Plan at Stratford Mining* Complex. Report prepared for Stratford Coal Pty Ltd.

Kleinfelder Australia Pty Ltd. (2019b). *2019 Stratford Mining Complex Hollow-bearing Tree Census Report*. Report prepared for Stratford Coal Pty Ltd.

Kleinfelder Australia Pty Ltd. (2020). *2019 Stratford Mining Complex Squirrel Glider Colony & Home Range Report* Report prepared for Stratford Coal Pty Ltd.

Menkhorst P.W., Weavers B.W. and Alexander J.S.A. (1988). *Distribution, Habitat and Conservation Status of the Squirrel Glider Petaurus australis (Petauridae: Marsupialia) in Victoria*. Australian Wildlife Research 15, 59-71.

Menkhorst, P.W. and Collier, M. (1987). *Diet of the Squirrel Glider, Petaurus norfolcensis (Marsupialia: Petauridae), in Victoria*. Australian Mammalogy, 11**,** 110-115.

Millis, A., and Bradley, A. (2001) *Reproduction in the squirrel glider, Petaurus norfolcensis (Petauridae) in south-east Queensland*. Australian Journal of Zoology, 49, 139–154.

NSW Department of Planning, Industry and Environment (2017) *Vegetation Condition Benchmarks* https://www.environment.nsw.gov.au/projects/biometric-dataset.htm

Office of Environment and Heritage (2017) *BioNet Threatened Species Profile Database*.
Website:
Accessed: November 2017.

Planning Assessment Commission (2014) *Stratford Extension Project Review Report*

Quin, D.G. (1995). *Population Ecology of the Squirrel Glider (Petaurus norfolcensis) and the Sugar Glider (P. breviceps) (Marsupialia:Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales*. Wildlife Research, 22**,** 471-505.

Sharpe, D. (2009). *Ecology of the Squirrel Glider in subtropical Australia*. PhD thesis, Southern Cross University, Lismore, NSW.

Sharpe, D.J. and Goldingay, R.L. (2007) *Home range of the Australian Squirrel Glider, Petaurus norfolcensis (Diprotodontia)* Journal of Mammalogy, 88(6), 1515-1522.

Sharpe, D., and Goldingay, R. (2010) *Population ecology of the nectar-feeding squirrel glider (Petaurus norfolcensis) in remnant forest in subtropical Australia*. Wildlife Research, 2010, 37, 77–88.

Stratford Coal Pty Ltd (2012) *Stratford Extension Project Environmental Impact Statement.*

Stratford Coal Pty Ltd (2020) *Stratford Mining Complex Annual Review 2020*.

Traill, B. 1993. *The diet and movements of a pair of Powerful Owls Ninox strenua in dry eucalypt forest*. Australian Raptor Studies (Ed. P. Olsen.), 155-159.

Suckling, G.C. (1995). *Squirrel Glider*. In R. Strahan (Ed.) The Mammals of Australia, 234-235. Reed Books, Chatswood.

Van der Ree, R, Bennet, A and Gilmore, D. (2003). *Gap-crossing by gliding marsupials: thresholds for use of isolated woodland patches in an agricultural landscape*. Biological Conservation, 115, 241- 249.

Van der Ree R. and Suckling, G.C. (2008). *Squirrel Glider Petaurus norfolkensis. In: 'The Mammals of Australia'*. Eds S. Van Dyck and R. Strahan.

Wormington, K. and Lamb, D. (1999). *Tree hollow development in wet and dry sclerophyll eucalypt forest in south-east Queensland, Australia*. Australian Forestry, 62, 336-345.

**ATTACHMENT 1**

**RECORD OF CONSULTATION WITH BCS**

Department of Planning and Environment

Your ref: SSD-4966-PA-24
Our ref: DOC23/117090-3

Thomas Kirkwood
Yancoal

By email: Thomas.kirkwood@yancoal.com.au

Dear Mr Kirkwood

**Stratford Mine Extension - SMC Squirrel Glider Management Plan (SSD-4966-PA-24) (MidCoast)**

I refer to your Major Projects Portal request on 15 February 2023 seeking advice in relation to the Squirrel Glider Management Plan (SGMP) post approval requirement of Condition 38, Schedule 3 of NSW Development Consent SSD-4966 Stratford Mine Extension.

Biodiversity Conservation Division (BCD) of the Department of Planning and Environment (DPE) has reviewed *Stratford Mining Complex – Squirrel Glider Management Plan* (Squirrel Glider Management Plan) prepared by Stratford Coal dated February 2023. BCD recommendations are provided in **Attachment A**. If you have any further questions about this issue, please contact Giorginna Xu, Senior Conservation Planning Officer, on 4927 3185 or at huntercentralcoast@environment.nsw.gov.au

Yours sincerely

Joe Thompson
**Director Hunter Central Coast Branch**
**Biodiversity and Conservation Division**
16 March 2023

Enclosure: Attachments A and B

**ATTACHMENT 2**

**DPE LETTER OF APPROVAL OF SGMP**

Department of Planning and Environment

Our ref: SSD-4966-PA-24

John Cullen
Operations Manager
Stratford Coal Pty Ltd
3364 Bucketts Way South
Stratford, NSW, 2422

05/07/2023

Subject: **Stratford Extension Project (SSD-4966) - Squirrel Glider Management Plan**

Dear Mr. Cullen,

I refer to the Squirrel Glider Management Plan submitted in accordance with Schedule 3, Condition 38 of the Development Consent for the Stratford Extension Project (SSD-4966).

I note the revision of the Squirrel Glider Management Plan has been prepared in consultation with Biodiversity and Conservation Science division.

The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the relevant conditions in consent (SSD-4966).

Accordingly, as nominee of the Planning Secretary, I approve the Squirrel Glider Management Plan (Revision 2, June 2023).

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Scotney Moore, on 02 9274 6342.

Yours sincerely

Stephen O'Donoghue
Director
Resource Assessments
As nominee of the Planning Secretary

**APPENDIX A**

**REVEGETATION SPECIES LIST - SQUIRREL GLIDER FEED TREES/SHRUBS**

**Table A1**
**Revegetation Species List - Squirrel Glider Feed Trees/Shrubs**

| Scientific Name | Common Name | Known Habitat | Flowering Times* |
|---|---|---|---|
| ***Fast Growing Mid-storey Plant Species*** | | | |
| *Acacia irrorata* Sieber ex Spreng. subsp. *irrorata* | Blueskin | A, C | November-January |
| *Acacia leiocalyx* (Domin) Pedley subsp. *leiocalyx* | Curracabah | B | June–October |
| ***Canopy Tree Species*** | | | |
| *Corymbia maculata* (Hook.) K.D.Hill & L.A.S.Johnson | Spotted Gum | C, D | Winter |
| *Eucalyptus amplifolia* Naudin subsp. *amplifolia* | Cabbage Gum | A | August-September |
| *Eucalyptus crebra* F.Muell. | Narrow-leaved Ironbark | B | Late autumn to spring |
| *Eucalyptus fibrosa* F.Muell. | Red Ironbark | D | Winter |
| *Eucalyptus microcorys* F.Muell. | Tallowwood | B | July-November |
| *Eucalyptus moluccana* Roxb. | Grey Box | A | March - May |
| *Eucalyptus resinifera* Smith subsp. *resinifera* | Red Mahogany | A, B | October-February |
| *Eucalyptus siderophloia* Benth. | Grey Ironbark | A, B, C | Winter-Early Summer |
| *Eucalyptus tereticornis* Sm. | Forest Red Gum | B, C, D | Winter |
| *Lophostemon confertus* (R.Br.) Peter G.Wilson & J.T.Waterh. | Brush Box | B | October–December |

* PlantNet

A CSIRO (1998) *Feeding behaviour of the Squirrel Glider at Nungawalbin Nature Reserve, north-eastern New South Wales*, Wildlife Research, 25, 243 – 254.

B Rowston et. Al. (2001) Habitat preferences of squirrel gliders, *Petaurus norfolcensis*, in the fragmented landscape of southeast Queensland, Forest Ecology and management, 164, 197-209

C Smith, A and Murray, M (2003) Habitat requirements of the Squirriel Glider (*Petaurus norfolcensis*) and associated posums and gliders on the New South Wales central coast, CSIRO Publishing, 30, 291 – 301.

D Quinn, DG (1995) Population ecology of the Squirrel Glider (*Petaurus norfolcensis*) and the sugar glider (P.breviceps) at Limebeurners Creek, on the central north coast of New South Wales. Widl. Res. 22, 471 -505.