



# APPIN MINE ADAPTIVE MANAGEMENT PLAN - WATER SENSITIVE EPBC ACT LISTED SPECIES

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## DOCUMENT REVISION LOG

### Persons authorising this Plan

NAME	TITLE	DATE
Chris Schultz	Superintendent Environment	January 2021

### Document Revisions

REVISION	DESCRIPTION OF CHANGES	DATE
1.0	Original document Prepared by Niche Environment & Heritage for Illawarra Coal	September 2012
2.0	Revised pursuant to Commonwealth Dept. of Environment comments	February 2014
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4.0	Change to South32 and review of monitoring programs and update mining status	June 2017
5.0	Resubmit to DoEE for approval	Aug 2018
6.0	Revise format for consistency. Removal of reference to EIP and update aquatic health monitoring program details. Incorporation of comments from DAWE.	January 2021

### Persons involved in the review of this Plan

NAME	TITLE	COMPANY	EXP (YRS)	DATE
David Gregory	Specialist Environment	IMC	10	November 2020
Chris Schultz	Superintendent Environment	IMC	25	January 2021
Nicola Curtis	Principal Approvals	IMC	7	November 2020

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## 1. INTRODUCTION

Appin Mine incorporates the underground mining operations, which extract coal from the Bulli Seam, and associated surface activities, including the West Cliff Coal Preparation Plant (WCCPP) and Coal Wash Emplacement Area (CWEA). Appin Mine is located approximately 25 kilometres (km) north-west of Wollongong in New South Wales (See Figure 1). Appin Mine is owned and operated by Endeavour Coal Pty Ltd, a subsidiary of Illawarra Coal Holdings Pty Ltd (ICHPL), which is a wholly owned subsidiary of South32 Limited. Appin Mine, Cordeaux Colliery and Dendrobium Mine (and associated facilities) collectively operate as South32 Illawarra Metallurgical Coal (IMC).

Run-of-Mine (ROM) coal is extracted from the Appin underground mining operations and delivered directly to the WCCPP by winder and conveyor or is transported from the Appin East Pit Top via truck along Appin and Wedderburn Roads to the WCCPP. Processed coal (clean coal product) from the WCCPP is transported by road to the Port Kembla Coal Terminal (PKCT) for shipping to domestic and international customers, or to BlueScope Steel or other local customers.

The coal wash generated as part of the washing process is emplaced at the purpose-built emplacement area located at Appin North.

Activities associated with Appin Mine are undertaken within the existing mining tenements Consolidated Coal Lease (CCL) 724 and CCL 767, Coal Lease (CL) 381 and CL 388, Mining Leases (ML) 1382, 1433, 1574, 1678, 1698 and 1473 and Mining Purposes Lease (MPL) 200 and MPL 201.

In September 2009, ICHPL submitted an Environmental Assessment (EA) for its Bulli Seam Operations (BSO) Project to the then NSW Department of Planning and Infrastructure (DoPI)<sup>1</sup> for the continuation of existing underground coal mining operations for Appin Mine and West Cliff Mine. In October 2010, ICHPL submitted a Preferred Project Report (PPR) to the Secretary of the DoP requesting that the North Cliff, Area 2 and the majority of the Area 3 mining domains be removed from the BSO Project Application. This resulted in removal of most of the proposed mining beneath the Dharawal State Conservation Area and all 226 upland swamps previously identified within the Application Area. The Company submitted a PPR Amendment in October 2011 which addressed changes to the Application Area which substantially relate to the proposed declaration of the Dharawal National Park.

ICHPL received Project Approval MP08\_0150 (the Project Approval)<sup>2</sup> from the Planning Assessment Commission of NSW under delegation of the Minister for Planning and Infrastructure on 22 December 2011 for current and proposed mining at Appin Mine for the next 30 years, and production of up to 10.5 million tonnes per annum of ROM coal.

EPBC Approval 2010/5350 (the EPBC Approval) was issued by the Australian Government on 15 May 2012 under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. This Adaptive Management Plan for Water Sensitive EPBC Act Listed Species (AMP) has been prepared to meet the requirements of Condition 8 of the EPBC Approval.

<sup>1</sup> Now Department of Planning, Industry and Environment (DPIE)

<sup>2</sup> As modified by MOD 1 (April 2015) and MOD 2 (October 2016)

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## 1.1 Plan Objectives

The key objective of the AMP is to satisfy Condition 8 of the EPBC Approval.

outlines the EPBC Approval conditions in relation to the AMP and the sections in the AMP where relevant conditions are addressed.

## 1.2 Scope

The scope of the AMP applies to potential surface and ground water impacts of the BSO Project on species listed under the EPBC Act within the study area.

To determine which EPBC Act listed species are susceptible to surface and ground water impacts, a review of the detailed assessments conducted as part of the BSO Project EA and Environmental Impact Statement (EIS) was undertaken, including:

- BioAnalysis Pty Ltd (2010) Illawarra Coal Bulli Seam Operations Project Aquatic Ecology Assessment, Appendix D of the EIS;
- FloraSearch (2010) Illawarra Coal Bulli Seam Operations Project Terrestrial Flora Assessment, Appendix E of the EIS; and
- Biosphere Environmental Consultants (2010) Illawarra Coal Bulli Seam Operations Project Terrestrial Fauna Assessment, Appendix F of the EIS.

Figure 1 and Figure 2 illustrates the Project Area, the current study area to which the AMP applies and the location of target species, which is described in more detail in Section 4.

Appendix 2 provides details of all EPBC Act listed species that have previously been recorded within (or near to) the BSO Project Area, and justification for their inclusion or exclusion from the AMP. EPBC Act listed species records are shown on Figure 7.

The key activities addressed in the AMP include the clearing of native vegetation for the Stage 4 CWEA and mining activities beneath watercourses. The Stage 4 CWEA is scheduled to commence in approximately 10 years. To reduce the impacts of the Project, longwall mining has been excluded from under rivers. Mining will however occur under smaller tributaries of these rivers. Longwall mining is currently occurring in Appin Area 7 and Area 9. Underground mining activities in Area 5 (previously West Cliff Area 5) were completed in 2016; however, environmental monitoring and subsidence remediation in this area is ongoing.

Of the species described in Appendix 2, the following species are considered further in this document:

### Fauna

- Macquarie Perch (*Macquaria australasica*)
- Giant Borrowing Frog (*Heleioporus australiacus*)
- Littlejohn's Tree Frog Green (*Litoria littlejohni*)

### Flora

- Woronora Beard-heath (*Leucopogon exolasius*)

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These species were selected as they have potential habitat in the Project Area, and their habitat and/or lifecycle are closely related to surface and groundwater environments. The BSO Project EIS ecological assessments (Biosphere, 2010; BioAnalysis, 2010; Flora Search, 2010), have discussed the potential effect of subsidence on surface and groundwater related habitats on these species, however these assessments conclude that substantial changes that endanger selected threatened species, their habitats or viability of their populations are unlikely.

## 2. LEGISLATION AND PLANNING

### 2.1 Project Approval and Statement of Commitments

Potential surface and groundwater impacts from the Project are assessed in the BSO Project EA 2009 and BSO Project EIS 2011. The results were assessed under the *Environmental Planning and Assessment Act 1979 (EP&A Act)* and *EPBC Act* respectively. All activities carried out as part of the BSO Project will be generally in accordance with the Project Approval, the EPBC Approval and with the EA and EIS.

### 2.2 Environment Protection Licence Requirements

Environment Protection Licence No. 2504 (EPL 2504) applies to Appin Mine and associated activities. A copy of the licence can be accessed at the Environment Protection Authority (EPA) website:

<http://www.epa.nsw.gov.au/prpoeoapp/>.

### 2.3 Relevant Legislation

Key regulatory and AMP obligations applicable to Appin Mine are managed via an obligations management database. The obligations are allocated to responsible personnel. This process is detailed in the Environmental Compliance/Conformance Assessment and Reporting Procedure.

Legislation applicable to the AMP includes but is not limited to:

- *Biodiversity Conservation Act 2016*;
- *Contaminated Land Management Act, 1997*;
- *Mining Act, 1992*;
- *National Parks and Wildlife Act, 1974*;
- *Local Land Services Act, 2013*;
- *Water Management Act, 2000*.
- *Protection of the Environment Operations Act, 1997*;
- *Water NSW Act, 2014*;
- *Fisheries Management Act, 1994*; and
- *Water Act, 1912*.

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Land management and biodiversity conservation reforms commenced on 25 August 2017. The reforms repealed the *Threatened Species Conservation Act 1995* and several parts and provisions of the *National Parks and Wildlife Act* that dealt with threatened species and communities, and protected wildlife. Provisions under the *EP&A Act* that dealt with threatened species impact assessments were also repealed.

The repealed provisions have been replaced with the *Biodiversity Conservation Act 2016* (BC Act) and supporting regulations, which are administered by the Biodiversity and Conservation Division of the Department of Planning, Industry and Environment (DPIE).

## 2.4 Guidelines

This AMP has been developed to be consistent with the principles of the following guidelines that are relevant to water management and monitoring:

- National Water Quality Management Strategy, Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000);
- National Water Quality Management Strategy, Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (ANZECC & ARMCANZ, 2000).
- Contamination sites: Draft Guidelines for the Assessment and Management of Groundwater Contamination (DEC, 2004);
- The NSW State Groundwater Policy Framework document (DLWC, 1997);
- The NSW State Groundwater Quality Protection Policy (DEC, 1998);
- The NSW State Groundwater Dependent Ecosystems Policy (DLWC, 2002); and
- Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impact on water resources (Department of Environment, 2013).

## 2.5 Relevant Leases

The Mining Leases in Table 1 are applicable to operations in the Project Area.

**Table 1: Mining Leases**

Mining Lease	Number	Issue Date	Expiry /Anniversary Date
Consolidated Coal Lease	767	29/10/1991	08/07/2029
Coal Lease	388	22/01/1992	22/01/2034
Mining Lease	1382	20/12/1995	20/12/2037
Mining Lease	1433	24/07/1998	Renewal pending
Mining Lease	1574	09/07/2008	30/12/2023
Mining Lease	1678	27/09/2012	26/09/2033
Mining Lease	1698	26/06/2014	26/06/2035
Consolidated Coal Lease	724	04/07/1991	18/12/2031
Coal Lease	381	24/10/1991	24/10/2033

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Mining Lease	Number	Issue Date	Expiry /Anniversary Date
Mining Purposes Lease	200	13/01/1982	13/01/2024
Mining Purposes Lease	201	13/01/1982	13/01/2024
Mining Lease	1473	20/11/2000	29/11/2021

### 3. MONITORING AND ADAPTIVE MANAGEMENT FRAMEWORK

Condition 8a of the EPBC Approval requires provision of “a monitoring and adaptive management framework that will identify potential water related impacts of the action on EPBC Act Listed species and their habitat”.

The Environmental Management Strategy provides the framework for environmental management across Appin Mine. An overview of the Environmental Management Framework for Appin Mine is shown in Diagram 1. The Appin Mine Environmental Management Strategy can be accessed via the South32 regulatory website:

<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>.

The monitoring and adaptive management framework that will identify potential water related impacts of the action on EPBC Act Listed Species and their habitat operates as follows.

Potential impacts from mining induced subsidence is monitored and managed via an Extraction Plan which is to be approved by the Secretary of DPIE prior to longwall mining commencing in any area. The monitoring and management methods, mechanisms and performance indicators implemented under the Extraction Plan process are detailed in Section 8. Extraction Plans are submitted on a progressive basis as mining commences in each mining domain. Approved Extraction Plans are in place for Appin Area 7 Longwalls 701 – 710, Appin Area 9 Longwalls 901 – 904, West Cliff Area 5 Longwall 34 – 36 and Area 5 Longwalls 37 – 38<sup>3</sup>. Potential impacts from the Project are monitored and managed via the Management Plans shown in Diagram 1.

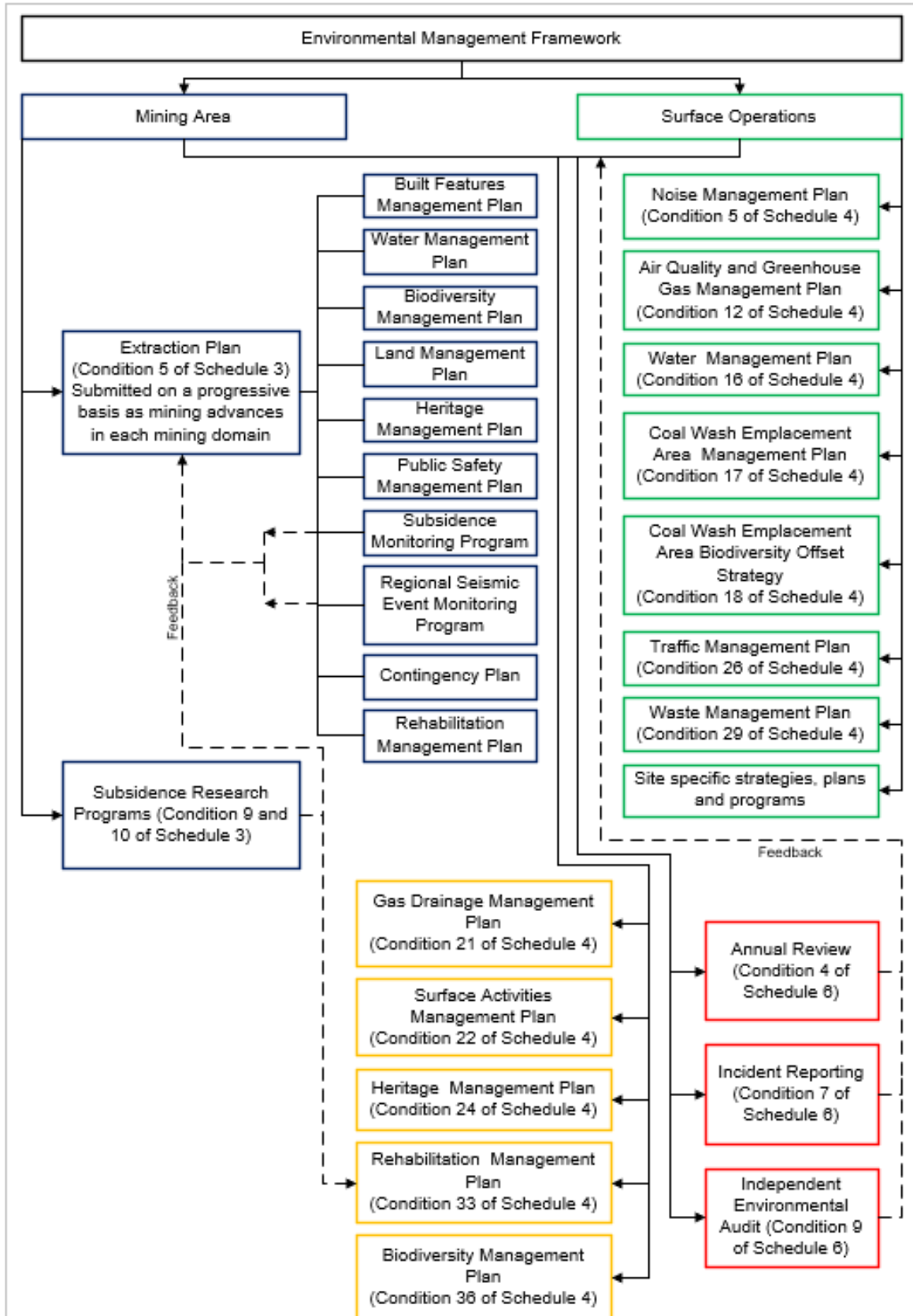
Established monitoring sites required by the Management Plans identified in Diagram 1 are provided in those specific documents and where relevant to the AMP are referred to in Section 8 and provided as appendices in this document.

Reporting and review protocols are addressed in Section 12.

IMC environmental management strategies, plans and programs are developed to comply with legislative, corporate and ISO 14001 certification standards. These strategies, plans and programs are subject to regular auditing and review and are used to provide site personnel with specific environmental management guidelines relevant to the operations they are involved with.

<sup>3</sup> Mining was completed in Area 5 in 2016

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**Diagram 1: Appin Mine Environmental Management Framework**

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## 4. EPBC ACT LISTED SPECIES AND THEIR HABITATS

This section of the AMP addresses Condition 8b of the EPBC Approval which requires provision of “a review of the ecological system that defines the ecological assets, functions and habitats to be protected and establish pre-mining baseline conditions”.

### 4.1 Relevant EPBC Listed Species

Of the species described in Appendix 2, the following species are considered further in this document:

#### Fauna

- Macquarie Perch (*Macquaria australasica*);
- Giant Burrowing Frog (*Heleioporus australiacus*);
- Littlejohn’s Tree Frog (*Litoria littlejohni*).

#### Flora

- Woronora Beard-heath (*Leucopogon exolasius*).

These species were selected as their habitat and or lifecycle are closely related to surface and groundwater environments. Refer to Appendix 2 for further detail on justification for the inclusion of these species.

### 4.2 Habitat Requirements, Lifecycles and Distributions of Threatened Species

#### 4.2.1 Giant Burrowing Frog (*Heleioporus australiacus*)

##### 4.2.1.1 Distribution

The Giant Burrowing Frog occurs in south-eastern Australia, inhabiting the coast and adjacent ranges from the Sydney Basin in NSW down to the Gippsland region of Victoria (NPWS, 2001c). In the north of its distribution, this species is largely confined to the sandstone geology of the Sydney Basin and extends as far south as Jervis Bay (Daly, 1996; Penman at al., 2004). South of Jervis Bay, this species is known from disjunct ‘pockets’ from Narooma in NSW, south into eastern Victoria, although it is likely that its range does or once covered the areas in between.

Three tadpoles were identified in O’Hare’s Creek catchment by (Biosphere, 2009), however there are no historical records of the Giant Burrowing Frog occurring in the current study area.

##### 4.2.1.2 Habitat

The northern populations of the Giant Burrowing Frog are largely confined to sandstone ridge top habitat and broader upland valleys and are often associated with small headwater streams (DSEWPC, 2012b). It also utilises slow flowing to intermittent streams in undisturbed areas (NPWS, 2001c), it has been recorded calling around artificial ponds in semi-rural landscapes (Lemckert 2008) and may utilise upland swamps (DSEWPC, 2012b). There is some indication that the tadpoles of this species are specialised to survive in low pH water and cannot tolerate more neutral aquatic environments (Green et al., 2004).

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#### 4.2.1.3 Lifecycle

Much of the Giant Burrowing Frog’s existence is spent burrowed underground sometimes beneath deep leaf-litter or in earth-filled rock crevices interspersed with brief periods of activity throughout the year during rainy weather (NPWS, 2001c; Lemckert and Brassil, 2003; Penman et al., 2006). Burrows are excavated into the earth around, or associated with rocks fissures or boulders (DSEWPC, 2012b).

The Giant Burrowing Frog mainly breeds between August to late March (Cronin, 2001; Anstis 2002). Females lay up 1200 large eggs in a foamy mass in their chamber or concealed among vegetation. Tadpoles develop in three to six months (NPWS, 2001c). The diet of the Giant Burrowing Frog mainly consists of invertebrates including ants, beetles, cockroaches, spiders, centipedes and scorpions (NPWS, 2001c). Tadpoles graze on algae at the bottom of deep clear pools (Anstis, 2002).

#### 4.2.2 Littlejohn's Tree Frog (*Litoria littlejohni*)

##### 4.2.2.1 Distribution

Littlejohn's Tree Frog is distributed along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in north-eastern Victoria (NSW Scientific Committee, 2000c). Within the Greater Southern Sydney Bioregion, the Woronora Plateau and the higher rainfall areas of the Blue Mountains are considered two key areas that are important to this species (DECC, 2007). Littlejohn’s Tree Frog has been found to be common at Darkes Forest.

Three individual tree frogs were observed opportunistically by Biosphere’s aquatic ecology survey (2009) within the Dharawal National Park which is no longer within the Project Area. There are no historical records of the tree frog occurring in the current study area (Figure 2) however, marginal potential habitat for this species occurs within the West Cliff Area 5 domain. Sightings in the wider area, including National Parks Estate, are shown in Figure 3.

##### 4.2.2.2 Habitat

Littlejohn's Tree Frog occurs in water bodies associated with eucalypt woodlands and heaths among sandstone outcrops (DSEWPC, 2012). Recent studies indicate a preference for areas that are warm but also moist and are relatively flat (Lemckert, 2010). In the most northerly part of its range this species is associated more with permanent ponds. This also appears to be the case in Victoria, but the populations south of Sydney on the Woronora Plateau and in the Nowra area is almost entirely related to stream sites. This raises the potential for more than one species to be present within the currently recognized taxa.

##### 4.2.2.3 Lifecycle

Littlejohn's Tree Frog can be heard calling and appears to breed in any month of the year, although there appears to be preferences for autumn and later winter (Lemckert, 2004). Breeding is relatively predictable after heavier rains but calling on stream sites south of Sydney appears to be moderately regular throughout the colder months at least. Breeding habitat appears not to be restricted to any particular type of water body having been found in streams, temporary pools and dams (Anstis, 2002; Lemckert, 2004). Littlejohn's Tree

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Frog hunts either in shrubs or on the ground (DSEWPC, 2012c) although it has obvious suckers and is likely to climb trees at some point in the year. Tadpoles have been observed feeding on vegetation, sediment and surface matter (Anstis 2002), however the diet of adult frogs is unknown although is presumed to consist of invertebrates (DSEWPC, 2012c).

### 4.2.3 **Macquarie Perch (*Macquaria australasica*)**

#### 4.2.3.1 *Distribution*

Macquarie Perch are generally found in the Murray-Darling Basin and parts of south-eastern NSW, including the Hawkesbury and Shoalhaven catchments (DPI, 2005). Macquarie Perch occurs in the middle to upper reaches of the Murray River and its tributaries in NSW and Victoria as well as the Yarra system in Victoria (Allen et al., 2002).

Macquarie Perch was recorded in the Georges River catchment in 1984 (DPI, 2008). Macquarie Perch has been recently recorded in the Georges River, near its confluence with Punchbowl Creek (S. Carter pers. Com in BioAnalysis Part 3A Assessment) approximately 15 km downstream of the Project extent of longwall mining area. Sightings of Macquarie Perch are shown in Figure 9.

Some reaches of O’Hare’s and Stokes Creek (tributaries of the Georges River) provide the rocky pool habitat typically used by Macquarie Perch however, recent intensive sampling in these streams did not detect any individuals (Knight and Bruce, 2008). However, these streams are not located within the Project Area.

Three individuals were collected from Cataract River and are part of the population that occurs throughout the reach of the Cataract River between the Cataract Dam and Broughtons Pass Weir. Individuals of this species have also been found in the Nepean River, downstream of Pheasants Nest Weir (Gerhke and Harris, 1996).

#### 4.2.3.2 *Habitat*

The Macquarie Perch inhabits the cool, clear water of rivers, lakes and reservoirs and prefers deep rocky pools with lots of cover (Allen et al., 2002).

#### 4.2.3.3 *Lifecycle*

Macquarie Perch generally occur as solitary fish, swimming near the bottom or in mid-water, however individuals form small shoals during the spawning season which occurs between October and December (Allen et al., 2002). Macquarie Perch in reservoirs move into flowing feeder streams to spawn (ibid.). Migration associated with spawning is known to occur in lake dwelling Macquarie Perch however, migration may not be necessary in stream dwelling fish (DSEWPC, 2012d).

Macquarie Perch shed their eggs in fast-flowing riffles above pools and require clean, well oxygenated gravel for the successful development of their young (Bevitt et al., 1998). Sexual maturity occurs after two years for males and three years for females (Allen et al., 2002). This species mainly forages on the bottom with the bulk of their diet consisting of aquatic invertebrates (DSEWPC, 2012d).

The aquatic ecology Environmental Assessment (BioAnalysis, 2009) stated that mine water discharges are unlikely to affect the current populations of Macquarie Perch. Monitoring is

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required to determine whether the species or its habitat may be impacted. The monitoring program(s) are discussed further in Section 8 of this document.

#### 4.2.4 **Woronora Beard-heath (*Leucopogon exolasius*)**

##### 4.2.4.1 *Distribution*

The Woronora Beard-heath is found along the upper Georges River, O’Hares Creek, Stokes Creek and in the Avon, Cataract and Woronora catchments (Flora Search 2010; DSEWPC, 2012f). It also occurs in Heathcote National Park (ibid.). The Flora Search assessment (2010) identified Woronora Beard-heath in sandstone riparian scrub in the O’Hare’s Creek and Cataract River catchments.

##### 4.2.4.2 *Habitat*

The Woronora Beard-heath is also found on the lower slopes of valleys in sandstone gully forest. The habitat for this species is reported to be steep rocky lower slopes and sandy alluvium along rivers and creeks (DSEWPC, 2012f).

##### 4.2.4.3 *Lifecycle*

Flowering occurs in August and September (DSEWPC, 2012f). Germination of dormant seeds occurs via seasonal changes rather than fire, but fire may enhance the process once begun (Powell, 2010).

#### 4.2.5 **Conclusions**

Of the amphibians listed in the AMP, no species have historical records (Threatened Species Data Base, 2017) within the current Project Area (Figure 2). There have been observations of Macquarie Perch within the Georges River at the confluence of Punchbowl Creek (refer to Figure 3). This site is approximately 17 km downstream of the West Cliff Area 5 Project Area and approximately 20 km from the mine discharges at Brennans Creek. There is evidence of populations within the Nepean River (although unlikely to occur near current mining areas) and Cataract River. No Macquarie Perch have been identified in any these river’s tributaries, although they may contain suitable habitat (Stokes Creek and O’ Hare’s Creek).

Of the listed flora species under consideration above, only *Pultenaea aristata* is known to occur in the study area. There were no records of this species within the existing study area noted during the BSO Project EIS, however this species has since been recorded within the rehabilitated area of the Stage 3 CWEA (Figure 2 and Figure 8). This species is not subject to surface water flows or groundwater availability within the emplacement area and therefore is not considered further in this management plan. Further, the species is subject to monitoring and management actions outlined in the Appin Mine CWEA Management Plan (required under EPBC Approval Condition 6 and Condition 17 of Schedule 4 of the Project Approval).

### 4.3 **Pre-mining baseline conditions**

Pre-mining baseline conditions in terms of distribution and habitat of the selected species are summarised in Section 4.2. A baseline Aquatic Biodiversity Assessment (Bioanalysis,

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2009) and Terrestrial Flora and Fauna Assessment (Flora Search, 2009; Biosphere 2009) were undertaken in support of the BSO Project EA. Baseline groundwater (Heritage Computing, 2010) and surface water assessments (Gilbert and Associates, 2009) were undertaken in support of the BSO Project EA. The study area for these assessments included the Appin and former West Cliff (now Appin North) Project Areas.

#### 4.3.1 West Cliff Area 5 Longwalls 34 to 36 Baseline Conditions

Baseline studies on the aquatic ecology of the upper Georges River were undertaken prior to the commencement of longwall mining by Campbelltown City Council, Jarvis (1997) and MPR (1999). These studies were intended to provide a baseline against which the impacts of longwall mining could be assessed. For details, refer to Appendix C of the West Cliff Area 5 Subsidence Management Plan (SMP) - West Cliff Area 5 Longwalls 34 to 36 Assessment of Mine Subsidence Impacts on Aquatic Habitat and Biota:

[https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/west-cliff/west-cliff-area-5-longwall-34---36-smp/appendix-c-aquatic-ecology.pdf?sfvrsn=709076f0\\_4](https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/west-cliff/west-cliff-area-5-longwall-34---36-smp/appendix-c-aquatic-ecology.pdf?sfvrsn=709076f0_4)

Biosis Research Pty Ltd was commissioned to undertake a terrestrial flora and fauna assessment of the potential subsidence impacts of longwall mining in Area 5. The report assessed the ecological values of the study area and potential impacts associated with longwall mining. For detail, refer to Appendix D of the West Cliff Area 5 SMP – Terrestrial Flora and Fauna Assessment, West Cliff Area 5 Longwalls 34-36:

[https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/west-cliff/west-cliff-area-5-longwall-34---36-smp/appendix-d-flora-fauna.pdf?sfvrsn=314157b3\\_4](https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/west-cliff/west-cliff-area-5-longwall-34---36-smp/appendix-d-flora-fauna.pdf?sfvrsn=314157b3_4)

#### 4.3.2 West Cliff Area 5 Longwalls 37 to 38 Baseline Conditions

Baseline water quality monitoring has been undertaken in the Georges River, upriver, adjacent to and down river of the proposed longwalls from 2004, with baseline water quality monitoring undertaken in Mallaty Creek (MC) and Nepean Creek (NC) from 2008. Ecoengineers have undertaken an Assessment of Water Quality Effects and Water Quality Monitoring Plan – West Cliff Colliery Longwalls 37 and 38 Extraction Plan, (Ecoengineers, 2013). Monitoring has continued, and further sites have been installed since this assessment to provide a comprehensive dataset prior to mining. A groundwater assessment has been undertaken by Geoterra, West Cliff Ground Water Assessment Longwalls 37 and 38, to further study groundwater impacts as a result of the proposed extraction (Geoterra, 2013). Baseline aquatic ecology investigations of waterways within the area have been undertaken since 2003. Specific investigations in the Georges River have been undertaken by The Ecology Lab (Cardno Ecology Lab) annually since 2005. Further detailed Aquatic Ecology information is contained within the Biodiversity Management Plan, attached as Annex D to the Extraction Plan and in West Cliff Longwalls 33-38 Aquatic Ecology Monitoring 2003-2016 (Cardno Ecology Lab, 2016).

Annex C – Water Management Plan, West Cliff Area 5 Longwalls 37 and 38 Extraction Plan:

[https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/west-cliff/west-cliff-longwall-37-38-subsidence-management/annex-c--water-management-plan.pdf?sfvrsn=5f22cdd3\\_4](https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/west-cliff/west-cliff-longwall-37-38-subsidence-management/annex-c--water-management-plan.pdf?sfvrsn=5f22cdd3_4)

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Annex D – Biodiversity Management Plan, West Cliff Area 5 Longwalls 37 and 38 Extraction Plan:

[https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/west-cliff/west-cliff-longwall-37-38-subsidence-management/annex-d--biodiversity-management-plan.pdf?sfvrsn=a992e6a5\\_4](https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/west-cliff/west-cliff-longwall-37-38-subsidence-management/annex-d--biodiversity-management-plan.pdf?sfvrsn=a992e6a5_4)

#### **4.3.3 Appin Area 7 Longwalls 705-710 Baseline Conditions**

Volume 2, Appendix C of the Appin 705-710 SMP contains baseline information in regards to water quality, fish, aquatic invertebrates and aquatic macrophytes. The document also summarises the previous investigations of aquatic ecology in the area.

[https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/appin/smp-application/appendix-c-longwalls-705-710-effects-of-mine-subsidence-on-aquatic-habitat-and-biota.pdf?sfvrsn=e4abf7b6\\_6](https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/appin/smp-application/appendix-c-longwalls-705-710-effects-of-mine-subsidence-on-aquatic-habitat-and-biota.pdf?sfvrsn=e4abf7b6_6)

Biosis Research Pty Ltd was commissioned to undertake a terrestrial flora and fauna assessment of the potential subsidence impacts of Longwall mining in Appin Area 7, Longwalls 705-710. The report assessed the ecological values of the study area and potential impacts associated with Longwall mining. For detail, refer to Appendix D – Appin Colliery Area 7 Longwalls 705-710 Impacts of Subsidence on Terrestrial Flora and Fauna:

[https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/appin/smp-application/appendix-d-longwalls-705-710-impacts-of-subsidence-on-terrestrial-flora-and-fauna.pdf?sfvrsn=9cfe0e73\\_6](https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/appin/smp-application/appendix-d-longwalls-705-710-impacts-of-subsidence-on-terrestrial-flora-and-fauna.pdf?sfvrsn=9cfe0e73_6)

#### **4.3.4 Appin Area 9 Baseline Conditions**

Supplementary field surveys for Aquatic Biodiversity (Cardno Ecology Lab, 2012) and Terrestrial Biodiversity (Biosis, 2012) were undertaken to support the Extraction Plan for Appin Area 9, Longwalls 901-904. Supplementary assessments for groundwater (GeoTerra, 2011) and surface water (Ecoengineers, 2012) were undertaken for the purposes of this Extraction Plan.

Annex C - Water Management Plan, Appin Area 9 Longwall 901-904 Extraction Plan:

[https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/appin/appin-area-9-longwall-901-904-subsidence-management/annex-c-water-management-plan.pdf?sfvrsn=49824c39\\_4](https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/appin/appin-area-9-longwall-901-904-subsidence-management/annex-c-water-management-plan.pdf?sfvrsn=49824c39_4)

Annex D - Biodiversity Management Plan - Appin Area 9 Longwall 901-904 Extraction Plan:

[https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/appin/appin-area-9-longwall-901-904-subsidence-management/annex-d-biodiversity-management-plan.pdf?sfvrsn=cb328d77\\_4](https://www.south32.net/docs/default-source/illawarra-coal/bulli-seam-operations/appin/appin-area-9-longwall-901-904-subsidence-management/annex-d-biodiversity-management-plan.pdf?sfvrsn=cb328d77_4)

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## 5. ECOLOGICAL OUTCOMES AND PERFORMANCE OBJECTIVES

This section of the AMP addresses Condition 8d of the EPBC Approval which requires the proponent to “*define ecological outcomes and performance objectives.*”

It is noted that performance objectives for other EPBC listed species or communities potentially impacted by the project are addressed in the following plans as required by the EPBC Act Approval:

- *Persoonia hirsuta* Offset Management Plan (approved);
- Shale Sandstone Transition Forest Offset Management Plan (approved);
- Broad Headed Snake Management Plan (approved);
- Southern Brown Bandicoot Management Plan (approved); and
- Appin Mine CWEA Management Plan (approved).

The Project Approval provides Subsidence Impact Performance Measures (Schedule 3). The condition relevant to biodiversity is provided in Table 2.

**Table 2: Subsidence Impact Performance Measures (Biodiversity)**

<b>Biodiversity (Condition 1 Schedule 3)</b>	
Threatened species, threatened populations, or endangered ecological communities.	Negligible environmental consequences.

In relation to the subsidence impact performance measure for biodiversity the term “negligible” is defined within the Project Approval as “small and unimportant, such as not to be worth considering”.

Other Performance Measures from Condition 1 of Schedule 3 of the Project Approval relevant to the AMP are outlined in Table 3.

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**Table 3: Subsidence Impact Performance Measures (Other)**

<b>Watercourses (Condition 1 Schedule 3)</b>	
Nepean River	Negligible environmental consequences including: <ul style="list-style-type: none"> <li>• <i>negligible</i> diversion of flows or changes in the natural drainage behavior of pools;</li> <li>• <i>negligible</i> gas releases and iron staining; and</li> <li>• <i>negligible</i> increase in water cloudiness.</li> </ul>
Georges River	Negligible environmental consequences including: <ul style="list-style-type: none"> <li>• <i>negligible</i> diversion of flows or changes in the natural drainage behavior of pools;</li> <li>• <i>negligible</i> gas releases and iron staining; and</li> <li>• <i>negligible</i> increase in water cloudiness.</li> </ul> <p>over at least 80% of the stream length subject to vertical subsidence &gt;20 mm.</p> <p>No subsidence impact or environmental consequence greater than minor.</p>
Other watercourses	No greater subsidence impact or environmental consequences than predicted in the EA and PPR.
<b>Land (Condition 1 Schedule 3)</b>	
Dharawal State Conservation Area	Negligible environmental consequences.
Cliffs of “special significance” (i.e. cliffs longer than 200 m and/or higher than 40 m; and cliff-like rock faces higher than 5 m that constitute waterfalls)	Negligible impact (that is occasional rock falls displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs) within any longwall mining domain.
Other cliffs flanking the Nepean River	Negligible environmental consequences (that is occasional rock falls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs) within any longwall mining domain.
Other cliffs	Minor impacts (that is occasional rock falls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 3% of the total face area of such cliffs within any longwall mining domain).



To mitigate the potential impacts and environmental consequences of the BSO Project on EPBC Act listed species, monitoring and recording will be undertaken (refer Section 8).

The Trigger-Action-Response Plans (TARPs) relate to identifying, assessing and responding to the range of conditions related to potential subsidence impacts on the rivers which form the potential habitat for Macquarie Perch which is the primary species of management concern in the AMP. Detailed performance indicators are outlined in the Extraction Plan TARPs for each mining area. Refer Appendix 3, Appendix 4, Appendix 5 and Appendix 6 for specific surface water quality, flow and aquatic ecology TARPs from each Extraction Plan.

If any impact is recorded, consideration would be given to implementing appropriate management, remediation and/or mitigation measures in consultation with the Biodiversity and Conservation Division, Department of Agriculture, Water and Environment (DAWE) and other relevant stakeholders (refer Section 9). If the performance measures are exceeded, IMC will notify relevant stakeholders and implement the Contingency Plan (Section 10).

## 6. WATER REQUIREMENTS FOR TARGET SPECIES

This section addresses Condition 8e of the EPBC Approval which is *“to identify water requirements (volume, timing, duration, frequency, and quality) for meeting ecological outcomes and performance objectives”*.

Species water requirements, impacts from the BSO Project and the management actions to achieve ecological outcomes and performance objectives are listed in Table 4.

### 6.1 Fish

Macquarie Perch could be impacted by subsidence through reduced habitat availability through pool diminution and possible discontinuity in smaller tributaries. These impacts are largely mitigated through the Mine Plan or longwall layout that does not include longwall mining below rivers and aims to avoid impacts to critical ecological assets such as the Macquarie Perch.

The BioAnalysis aquatic ecology assessment concluded that it is unlikely that the BSO Project would have a significant adverse effect on lifecycles, habitat connectivity, and quality or availability of habitat for the Macquarie Perch as subsidence is not predicted to lead to loss of riffle habitat or large permanent pools within watercourses that provide suitable habitat for this species within the Project Area. Changes in water quality are expected to be localised, transient and unlikely to cause adverse effects. Any impacts to potential habitat for Macquarie Perch would be rehabilitated as part of the BSO Project.

Mine water discharge from Brennans Creek Dam (BCD) can also impact water quality and river flow objectives and Macquarie Perch water requirements. Mine water operations can influence the provision of pool refugia, nutrient levels and temperature, and ecotoxicity. Through the implementation of programs to reduce pollutants and compliance with licence requirements, impacts from mine water discharges such as the BCD discharge are mitigated. There have been no records of the species and the habitat is considered marginal within the streams near the mine water releases e.g. Brennans Creek.

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Monitoring of mine water discharge and upstream and downstream water quality is an EPL requirement and is part of the ongoing management of mine water releases.

A water treatment plant (WTP) is planned for Appin North to provide an improvement in water quality released from site. It is planned for the WTP to release 1.5 ML/day averaged over the month.

Hydrological and water quality monitoring of streams within the Project mining areas is conducted to determine any surface water and surface/ground water impacts. This monitoring will fall under the Extraction Plan process. Monitoring of Macquarie Perch will be conducted under the Extraction Plans for any mining which could impact Macquarie Perch habitat (refer details in Section 8).

## 6.2 Amphibians

The amphibians listed within this plan are facultative stream breeders, meaning they can use a range of water bodies to complete their life cycles. However, the Giant Burrowing Frog is much more commonly recorded breeding within streams and populations of the frog in the region directly around the Project Area have almost exclusively been recorded on streams. No EPBC Act listed threatened amphibian species have been recorded in the Project Area, therefore it is highly unlikely that discharges will affect any populations.

Subsidence related impacts may affect small permanent or semi-permanent pools which they require to complete their life cycle. These impacts are largely mitigated through mine planning that aims to avoid critical ecological areas.

The BSO Project EIS Terrestrial Fauna Ecology Assessment (Biosphere, 2010) concluded that it is unlikely that the BSO Project would have a significant adverse effect on lifecycles, habitat connectivity, and quality or availability of habitat for the Giant Burrowing Frog or Littlejohns Tree Frog.

The reasons for this conclusion are:

- the effects of subsidence on water quality are predicted to be localised and transient;
- increases in electrical conductivity are minor;
- potential impacts on riparian vegetation would be localised and limited in extent; and
- there would be limited impact on their habitat with respect to the nature of hydrologic changes.

## 6.3 Flora

Habitat for the Woronora Beard-heath includes sandstone riparian environments. These habitats can be subject to impacts such as pool or groundwater reductions resulting from subsidence, changed channel alignment, and in rare circumstance strata gas emissions.

The EIS Flora Assessment (Flora Search, 2010) stated that it is unlikely that the BSO Project would significantly affect the lifecycles of threatened sandstone riparian species because of the small area affected, the resilience of the plants, and the proximity to populations that will not be affected by subsidence.

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## 7. MANAGEMENT STRATEGIES

Condition 8c of the EPBC Approval requires the proponent to:

*c. detail strategies and actions for maintaining, enhancing, and if required, restoring ecological assets, functions and habitats, for dependent EPBC Act listed species and their habitat including but not limited to the Macquarie Perch in Brennans Creek and the Georges and Nepean Rivers.*

The strategies for maintaining, enhancing and restoring ecological assets, functions and habitats for the Macquarie Perch and other EPBC Act listed species primarily aim to address:

- a) water quality; and
- b) stream function.

In considering these management strategies, the context for each species considered in the AMP is outlined below:

- There are no records for Macquarie Perch within the Project Area. Potential habitat occurs in the Project Area but the species is highly unlikely to be present due to numerous fish barriers in the subject watercourses.
- There are no records for either the Giant Burrowing Frog or Littlejohns Tree Frog within the Project Area despite targeted surveys for these species. Marginal potential habitat exists within the Project Area, but the species are unlikely to be present due to lack of preferred habitat.
- Potential habitat for the Woronora Beard-heath (*Leucopogon exolasius*) occurs within the Georges River but there are no records for this species within the Project Area despite surveys completed for this species.

### 7.1 Water Quality

#### 7.1.1 Brennans Creek and Georges River

A water treatment plant (WTP) is planned to be constructed at Appin North to provide an improvement in water quality released from site. It is planned for the WTP to release 1.5 ML/day averaged over the month.

The WTP will process water from the Appin Mine underground workings and the underdrainage from the CWEA. The discharge of water from the underground workings to BCD ceased in February 2019. A noticeable improvement in water quality in BCD has been observed.

EPL 2504 was varied in March 2020 to include more stringent water quality concentration limits for discharge into Brennans Creek (which flows to the Georges River).

The installation of the WTP will enhance the water quality from the baseline flows associated with discharge from BCD.

#### 7.1.2 Nepean River

EPL 2504 was varied in March 2020 to include more stringent water quality concentration limits for discharge into the Nepean River catchment. Modifications to the WTP at Appin

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West are required to achieve these limits. Implementing these modifications will enhance the water quality from the baseline flows associated with discharge from Appin West.

Mine design for Areas 7 and 9 offsets longwall extraction from the Nepean River to limit subsidence impacts. Limiting subsidence impacts maintains the existing water quality in the Nepean River.

## 7.2 Stream Function

Inspections have identified gas releases, iron staining and rock fracturing to pools and rockbars along the Georges River, adjacent to Area 5, as a result of mine subsidence. A decline in water level below baseline in some pools has also been recorded.

The Georges River Remediation Plan has been developed and will be implemented to remediate subsidence impacts. The rehabilitation work is proposed to be carried out in a number of stages, as grouting works will need to be conducted iteratively. Pools with more significant impacts will generally be targeted as a priority, as this may then indirectly improve the condition of pools with lesser impacts. The staged nature of the rehabilitation project has been designed to enable improvements and efficiencies to be incorporated in later activities.

This project will restore potential habitat for EPBC listed species.

In addition, a requirement has been included in EPL 2504 for maintaining a 1.5 ML per day flow in Brennans Creek /Georges River. This flow will be provided by the output from the Appin North WTP. The provision of this flow of high quality water will enhance the ecological habitat above baseline conditions. While some species, such as freshwater eels, may be able to relocate to nearby pools during periods of low flow and low pool water levels, most species would be likely to perish as a result of desiccation and/or predation.

Mine design for Areas 7 and 9 offsets longwall extraction from the Nepean River to limit subsidence impacts. Limiting subsidence impacts maintains the existing ecological assets, functions and habitats. Mine subsidence induced impacts resulting from the project are not predicted to lead to loss of riffle habitat or large permanent pools within watercourses that provide suitable habitat for this species within the Project area.

## 8. MONITORING PROGRAM

Condition 8f of the EPBC Approval requires the proponent to:

- f. identify monitoring, evaluating and reporting mechanisms including comprehensive water quality monitoring, incorporating the emplacement area, that includes:*
  - i. detailed baseline data;*
  - ii. monitoring methods, location and effort;*
  - iii. specific performance indicators that will be used to judge performance, or guide the implementation of any required management measures; and*
  - iv. a program to monitor and report on the impacts and environmental performance of the action and effectiveness of management measures;*

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## 8.1 Monitoring Overview

The Appin Mine Environmental Management Framework (Diagram 1) details a comprehensive monitoring program for the project. In summary:

- Potential impacts from mining induced subsidence are monitored and managed via an Extraction Plan for each mining area.
- Potential impacts from surface operations are monitored and managed via the surface operations management plans and site specific plans as shown in Diagram 1.

This section of the AMP discusses monitoring and management measures specifically in relation to the target EPBC listed species, including the context of species records, habitat occurrence, likelihood of occurrence in the BSO Project Area and the predicted impacts on these species. These considerations underpin the level of monitoring proposed in the AMP.

Specifically, the context for each species considered in the AMP is outlined below:

- There are no records for Macquarie Perch within the Project Area. Potential habitat occurs in the Project Area but the species is highly unlikely to be present due to numerous fish barriers in the subject watercourses. A precautionary approach has been taken and routine aquatic monitoring (including fish sampling) is being undertaken in the relevant watercourses.
- There are no records for either the Giant Burrowing Frog or Littlejohns Tree Frog within the Project Area despite targeted surveys for these species. Marginal potential habitat exists within the Project Area, but the species are unlikely to be present due to lack of preferred habitat. Accordingly, no targeted monitoring is proposed for these species unless unpredicted impacts occur, or these species are detected.
- Potential habitat for the Woronora Beard-heath (*Leucopogon exolasius*) occurs within the Georges River but there are no records for this species within the Project Area despite surveys completed for this species. Accordingly, no targeted monitoring is proposed unless this species is detected in the Project Area.

Table 4 provides a Monitoring and Management Summary for the abovementioned target species. Further species-specific monitoring details are provided in Sections 8.2 to 8.4.

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**Table 4: Monitoring and Management Summary for Target Species**

Relevant Threatened Species listed under EPBC Act								
Common Name	Scientific Name	Water Requirements for Target Species	Potential Water Related Impacts	BSO Project EIS Impact Assessment	Occurrence in the Project Area	Habitat in the Project Area	Monitoring Summary	Management Actions to Achieve Ecological Outcomes and Performance Objectives
<b>Fish</b>								
Macquarie Perch	<i>Macquaria australasica</i>	Prefers cool, clear water of rivers, lakes and reservoirs and prefers slow flowing, deep rocky pools.  Connectivity to flowing feeder streams for spawning.  Flow and water quality that provides clean riffle substrate for laying of eggs.	Habitat can be affected by subsidence and potentially discharges from BCD. The lifecycle of the Macquarie Perch has the potential to be adversely affected if activities associated with the Project cause loss of habitat (associated with rock bar fracturing and subsequent draining of pools), physical barriers (drainage of sections of stream resulting in extensive barriers to fish movement), chemical barriers, reduction in water quality (e.g. increased acidity or sediments loads, low dissolved oxygen levels and increased concentrations of metals such as iron, zinc, manganese and nickel) and smothering of eggs in breeding areas (e.g. iron precipitates forming over eggs and rock surfaces).	<ul style="list-style-type: none"> <li>Unlikely to be significantly impacted</li> </ul>	<ul style="list-style-type: none"> <li>No records near the current Appin Area 7 and West Cliff Area 5 mining areas.</li> <li>Macquarie Perch has been recently recorded in the Georges River, near its confluence with Punchbowl Creek (S. Carter pers. Com in BioAnalysis 2010) approximately 15 km downstream of the Project extent of longwall mining area.</li> <li>A population occurs throughout the reach of the Cataract River between the Cataract Dam and Broughtons Pass Weir.</li> <li>Individuals of this species have also been found in the Nepean River, downstream of Pheasants Nest Weir (Gerhke and Harris, 1996) but it is thought to be unlikely to inhabit the section of River adjacent to Appin Area 7 (Ecology Lab 2008).</li> </ul>	<ul style="list-style-type: none"> <li>Potential habitat in the Project Area but highly unlikely to be present due to numerous fish barriers in the subject watercourses.</li> </ul>	<ul style="list-style-type: none"> <li>Aquatic monitoring (including fish sampling) via the Appin Area 7 Longwalls 701 – 710 Extraction Plans (Biodiversity Management Plan). Refer Section 8.2, Figure 10 and Appendix 3.</li> <li>Aquatic monitoring (including fish sampling) via the West Cliff Area 5 Longwall 34 - 36 Extraction Plans (Biodiversity Management Plan). Refer Section 8.2, Figure 11, Appendix 4 and Appendix 5.</li> <li>Aquatic monitoring (including fish sampling) via the Appin Area 9 Longwall 901-904 Extraction Plans (Biodiversity Management Plan). Refer Section 8.2, Figure 10 and Appendix 6.</li> <li>EPL 2504 Water quality monitoring (EPA Licence) for West Cliff, Appin East and Appin West Pit Top sites. Refer Section 8.2, Section 8.5 and Appendix 7.</li> <li>General water quality monitoring of subsidence impacts under the Extraction Plans referred to above.</li> <li>EPL Georges River Aquatic Health Monitoring Program (including program to improve water quality and minimum flow requirements) - Appendix 8.</li> <li>Surface water (hydrological) monitoring via Extraction Plans referred to above. Refer Section 8.</li> <li>Monitoring of subsidence impacts via Extraction Plans referred to above.</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring (EPA Licence) for discharges (including Brennans Creek), and general water quality monitoring of subsidence impacts under the Extraction Plans.</li> <li>Aquatic monitoring impacts under the Extraction Plans.</li> <li>Implementation of Georges River Aquatic Health Monitoring Program</li> <li>Surface water (hydrological) monitoring via Extraction Plans.</li> <li>Mine Plan reduces impacts to most known habitat areas (major waterways).</li> <li>Monitoring of subsidence impacts via Extraction Plans.</li> <li>Contingency plans and adaptive management options. Refer Sections 9 and 10.</li> </ul>
<b>Amphibians</b>								
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	Facultative stream breeder. The species may	Loss of habitat associated with rock bar fracturing and subsequent draining of	<ul style="list-style-type: none"> <li>Unlikely to be significantly impacted</li> </ul>	<ul style="list-style-type: none"> <li>No records in the Project Area.</li> <li>Refer Figure 2.</li> </ul>	<ul style="list-style-type: none"> <li>Potential habitat but unlikely to be present due to lack of preferred habitat</li> </ul>	<ul style="list-style-type: none"> <li>No routine targeted monitoring as no records in the project area.</li> <li>Targeted monitoring may be initiated if relevant subsidence management TARPs reach level 3,</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring via Extraction Plans.</li> <li>Monitoring of subsidence impacts to habitat and water quality (Extraction Plan)</li> <li>Contingency plans and adaptive management options if species detected and impacts identified. Refer Sections 9 and 0.</li> </ul>



Relevant Threatened Species listed under EPBC Act								
Common Name	Scientific Name	Water Requirements for Target Species	Potential Water Related Impacts	BSO Project EIS Impact Assessment	Occurrence in the Project Area	Habitat in the Project Area	Monitoring Summary	Management Actions to Achieve Ecological Outcomes and Performance Objectives
		also utilise upland swamps as a component of the range of habitats it is able to exploit, although streams are the main breeding environment.	pools and swamplands. Effect on water quality, with potentially pH being critical.			over much of the Project Area.	triggering corrective management actions for terrestrial biodiversity. Refer to the relevant Extraction Plan. <ul style="list-style-type: none"> <li>Any individuals of this species discovered in the Project Area will be addressed by targeted monitoring that will be included in subsequent revisions of this Plan.</li> <li>Refer Section 8.3.</li> <li>Refer Figure 2 for species record locations.</li> <li>Refer Appendix 3 for Appin Area 7 and Appendix 6 for Appin Area 9 Extraction Plans (Biodiversity Management Plans).</li> </ul>	
Littlejohns Tree Frog	<i>Litoria littlejohni</i>	Facultative stream breeder. Breeding habitat not restricted to any particular type of water body having been found in streams, temporary pools and dams. However, populations in this part of its range are almost all associated with streams.	Loss of habitat associated with rock bar fracturing and subsequent draining of pools and swamp lands. Effect on water quality.	<ul style="list-style-type: none"> <li>Unlikely to be significantly impacted</li> </ul>	<ul style="list-style-type: none"> <li>No records in the Project Area.</li> <li>Refer Figure 2.</li> </ul>	<ul style="list-style-type: none"> <li>Potential habitat but unlikely to be present due to lack of preferred habitat over much of the Project Area.</li> </ul>	<ul style="list-style-type: none"> <li>No routine targeted monitoring as no records in the Project Area.</li> <li>Targeted monitoring may be initiated if relevant subsidence management TARP reach level 3, triggering corrective management actions for terrestrial biodiversity. Refer to the relevant Extraction Plan.</li> <li>Any individuals of this species discovered in the Project Area will be addressed by targeted monitoring that will be included in subsequent revisions of this Plan.</li> <li>Refer Section 8.3.</li> <li>Refer Figure 2 for species record locations.</li> <li>Refer Appendix 3 for Appin Area 7 and Appendix 6 for Appin Area 9 Extraction Plans (Biodiversity Management Plans).</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring via Extraction Plans.</li> <li>Monitoring of subsidence impacts to habitat and water quality (Extraction Plan).</li> <li>Contingency plans and adaptive management options if species detected and impacts identified. Refer Sections 9 and 10.</li> </ul>
<b>Terrestrial Flora*</b>								
<i>Leucopogon exolasius</i>	Woronora Beard-heath	Sandstone riparian habitat.	The water related impacts of the project have the potential to impact through the dewatering of their habitat through cracking and subsidence. Strata gas emissions.	<ul style="list-style-type: none"> <li>Will not be significantly impacted</li> </ul>	<ul style="list-style-type: none"> <li>No records in the Project Area.</li> <li>Refer Figure 2.</li> </ul>	<ul style="list-style-type: none"> <li>Yes.</li> </ul>	<ul style="list-style-type: none"> <li>No specific monitoring as there are no records in the Project Area.</li> <li>Any individuals of this species discovered in the Project Area will be addressed in subsequent revisions of this Plan.</li> <li>Refer Figure 2 for species record locations.</li> </ul>	<ul style="list-style-type: none"> <li>No management required as this time</li> </ul>



## 8.2 Macquarie Perch (*Macquaria australasica*)

### 8.2.1 Monitoring Site Locations

Figure 10 and Figure 11 provide a summary of aquatic monitoring locations. Monitoring locations will be updated as the mining areas relocate during the 30 year project.

### 8.2.2 Aquatic Monitoring Programs

Currently aquatic monitoring is conducted across four programs relating to the current longwall mining areas (Appin Area 7, Area 9 and West Cliff Area 5) and monitoring under the Georges River Aquatic Health Monitoring Program<sup>4</sup> required by EPL 2504. These programs are itemized below with references to further specific information attached to this document.

- Aquatic monitoring (including fish sampling) via the Appin Area 7 Longwalls 701 – 710 Extraction Plans (Biodiversity Management Plan). Refer Appendix 3.
- Aquatic monitoring (including fish sampling) via the West Cliff Area 5 Longwall 37 - 38 Extraction Plan (Biodiversity Management Plan). Refer Appendix 5.
- Aquatic monitoring (including fish sampling) via the Appin Area 9 Longwall 901 - 904 Extraction Plans (Biodiversity Management Plan). Refer Appendix 6.
- Georges River Aquatic Health Monitoring Program<sup>5</sup>. The Aquatic Health Monitoring Program incorporates (refer to Appendix 8):
  - quantitative sampling of macroinvertebrates;
  - ecological assessment processes using DNA extracted from sediment;
  - in-stream water quality; and
  - laboratory water testing.

Future Extraction Plans, Site Specific Management Plans or EPL conditions may require amendments to monitoring site locations due to changes in the impact area or surface water discharge location or nature of discharge.

Table 5 provides a monitoring summary for Macquarie Perch.

<sup>4</sup> Formerly the Environment Improvement Program (EIP)

<sup>5</sup> The Aquatic Health Monitoring Program was approved by the EPA in 2020. The EIP was revoked in March 2020 through a variation to EPL 2504.

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**Table 5: Monitoring Summary for Macquarie Perch**

Mining Area	River	Sites	Methods	Effort
Appin Area 7	Nepean River	Eight impact and six control sites.  Refer Figure 10	Baited traps and seine nets.  Refer details in Appendix 3	Minimum two times in the two years prior to the commencement of mining.  Spring monitoring during mining and for two years after mining.
West Cliff Area 5	Georges River	Five sites for LW 34-36. Six Sites for LW 37 and 38  Refer Figure 11	Combination of backpack electrofishing and bait trapping.  Refer details in Appendix 5	Minimum two times in the two years prior to the commencement of mining.  Spring monitoring during mining and for two years after mining.
Appin Area 9	Nepean River	Six sites  Refer Figure 10	Baited traps and seine nets.  Refer details in Appendix 6	Minimum two times in the two years prior to the commencement of mining and once every two years during and after mining.
Appin North Site	Georges River	Six impact sites and three control sites.  Refer Figure 11	Refer Appendix 8 for methodology details.	Refer Appendix 8 for details.

### 8.2.3 Aquatic Monitoring Methods

The typical methods for aquatic monitoring are described below. Refer to Appendix 3, Appendix 4, Appendix 5 and Appendix 6 for further detail on methods in each mining area as noted in Table 5. Refer to Appendix 8 for specific methodology on the Georges River Aquatic Health Monitoring Program.

The following habitat features are recorded:

- in-stream features such as sequence of pools, runs and riffles;
- stream substratum;
- presence, type and extent of aquatic vegetation;
- presence of barriers to fish passage into and beyond the study area; and
- a photographic record of the habitat.

Water quality will be measured at each site using a water quality probe. Variables to be measured include; pH, dissolved oxygen, oxidation-reduction potential, temperature, turbidity and conductivity. Where applicable, the results will be compared to ANZECC (2000) water quality guidelines for the protection of aquatic ecosystems.

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Fish will be sampled using a back-pack electrofisher and baited traps. At each site, six baited traps are to be deployed in a variety of habitats such as amongst aquatic plants and snags, in deep holes and over bare substratum. The back-pack electrofisher is to be operated around the edge of pools and in riffles. At each site, four, two minute shots are to be performed. Fish are to be collected in a scoop net, identified and measured. Native species are to be released unharmed whilst exotics are not to be returned to the water.

At each site macroinvertebrates will be sampled using the AusRivAS protocol developed under the National River Health Program. Where available, riffle and edge habitats will be sampled using a dip net along a 10 m stretch of habitat. Samples will be sorted in the field, preserved in alcohol and transported to a laboratory for identification. Taxa will be identified to levels required for calculating SIGNAL2 values according to the AusRivAS protocol.

Reports will be produced at the conclusion of each aquatic monitoring survey that provide sufficient information to describe the habitats and biota that may be affected by subsidence or Appin Mine water releases.

#### 8.2.4 **Management Responses Monitoring Methods**

The principal TARPs relate to identifying, assessing and responding to abnormal conditions related to subsidence impacts. In relation to Macquarie Perch, the relevant TARP categories include:

- surface water quality; and
- aquatic ecology.

If level 3 TARPs are triggered within potential Macquarie Perch habitat, Corrective Management Actions (CMAs) such as additional monitoring, habitat rehabilitation or other adaptive management measures will be considered.

Monitoring results will be reviewed by the IMC Subsidence Management Committee and determine whether performance indicators have been exceeded; and whether CMAs are required.

If the findings of monitoring are deemed to warrant an immediate response, the Manager Approvals will initiate the requirements of the TARP. Refer to Appendix 3, Appendix 4, Appendix 5 and Appendix 6 for the specific TARPs applying to each mining area.

### 8.3 **Amphibians (Giant Burrowing Frog, Littlejohns Tree Frog)**

#### 8.3.1 **Targeted Monitoring**

For the Giant Burrowing Frog, Littlejohns Tree Frog, Green and Golden Bell Frog there are no species records in the Project Area. Refer to Figure 2 for species record locations.

Some potential habitat exists but the species are unlikely to be present due to lack of preferred habitat over much of the Project Area. Accordingly, no targeted monitoring is proposed for these species unless more there is evidence of more than a negligible potential impact to these species.

Targeted monitoring will be considered if relevant subsidence management TARPs reach level 3, triggering CMAs for terrestrial biodiversity. Refer to Appendix 3, Appendix 4, Appendix 5 and Appendix 6 for the specific TARPs applying to each mining area.

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Any individuals of this species discovered in the Project Area will be addressed by targeted monitoring in subsequent revisions of this Plan.

Refer to Appendix 3, Appendix 4, Appendix 5 and Appendix 6 for current and proposed Appin Area 7, West Cliff Area 5 and Appin Area 9 Extraction Plans (Biodiversity Management Plans).

### 8.3.2 Terrestrial Biodiversity Monitoring Methods

Terrestrial monitoring occurs over longwall mining areas (i.e. Appin Area 7, Appin Area 9 and West Cliff Area 5) and focuses on detecting significant changes to vegetation communities and fauna habitat present within the mining area and aims to ensure complete coverage across the study area. Specific targeted monitoring sites will be determined if justified (e.g. if threatened species populations, endangered ecological communities or habitats are known and have more than a negligible potential to be impacted).

Inspections of vegetation communities within the mining areas is undertaken as a part of routine landscape and water monitoring programs. Targeted inspection by a qualified ecologist will follow should vegetation health changes be observed.

Monitoring will focus on detecting significant changes to vegetation communities and fauna habitat present within the study area and will aim to ensure complete coverage across the study area.

Inspections of vegetation condition will assess the following:

- Does the vegetation appear healthy?
- Are there any detectable visual impacts (e.g. canopy thinning, thinning of shrub layer, loss of ground cover, dead branches present)?
- Are there any significant detectable visual impacts (e.g. canopy loss with areas of dieback present, loss of whole shrubs, loss of ground cover)?

Areas of impact or any subsidence effects will be mapped and documented using digital photography.

Where a significant visual impact is detected a qualified ecologist will be engaged to document the following:

- the total area of impact. This will be mapped using a GPS and aerial photo interpretation;
- the foliage percentage cover; and
- Modified Braun-Blanquet cover abundance scores for each species.

This information will be used to objectively assess extent and degree of impact. Assessment of similar vegetation communities or fauna habitat within the broader locality will be undertaken to determine if the detected changes are within normal variation or represent a possible impact of mining. Additional studies (e.g. gas release measurements) will be commissioned in response to an observed mining impact to understand the mechanism involved and consider any CMAs that may be required.

Impacts are to be monitored as a part of ongoing observations to determine any change in extent or degree.

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The typical frequency of terrestrial biodiversity monitoring is:

- two baseline monitoring campaigns one year prior to mining;
- monthly visual inspections (as part of Landscape Features Monitoring), increased to weekly inspections during critical periods during mining;
- six monthly monitoring for two years (as part of Landscape Features Monitoring) post mining; and
- general observation of active mining areas during all other monitoring.

IMC will implement remediation measures where impacts to vegetation communities or fauna habitat are deemed to have been caused by subsidence effects.

## 8.4 Woronora Beard-heath (*Leucopogon exolasius*)

### 8.4.1 Monitoring Locations and Frequency

No specific monitoring is proposed for this species as there are no records in the Project Area. Refer to Figure 2.

Any individuals of this species discovered in the Project Area will be addressed in subsequent revisions of the AMP.

### 8.4.2 Monitoring Methods

Standard monitoring will be conducted as per Section 8.3.2. Any future targeted monitoring for this species may include (but not be limited to):

- Fixed photo points.
- Fixed vegetation quadrats. Data collected from each quadrat may include species richness, community structure and composition, vegetation condition, mortality and recruitment, the presence of soil profile development (leaf litter, presence/absence of invertebrates).
- Random meander transects in targeted monitoring areas in order to identify recruitment.

## 8.5 Water Monitoring

### 8.5.1 Overview and Context for EPBC Listed Species

For the BSO Project, IMC undertake a comprehensive suite of water quality monitoring programs to assess potential impacts from Appin Mine.

Water releases from surface operations are monitored and managed via the relevant management plans as shown in Diagram 1.

Impacts associated with longwall mining areas are addressed through specific Extraction Plans (and the associated Water Management Plans).

Objectives of the water monitoring programs are to:

- provide pre-mining baseline creek bed, bank and water quality observations for comparison with during and post-mining;

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- identify any creek bed, bank and water quality impacts related to physical or chemical changes to the creeks and/or drainage lines during mining;
- provide pre-mining baseline shallow groundwater quality and levels for comparison with during and post-mining; and
- establish appropriate triggers for actions and responses related to identifying, assessing and responding to abnormal conditions related to subsidence impacts.

In terms of identifying any potential impacts on EPBC listed species considered in the AMP (and how they would be managed as necessary), water quality monitoring is of direct relevance to only one species at the present time, that being Macquarie Perch (*Macquaria australasica*). As explained earlier in this plan, the other species are either not recorded in the Project Area or are unlikely to be subject to water or groundwater related project impacts.

Figure 2 shows the location of reported Macquarie Perch records in relation to the Project Area based on aquatic ecology reports prepared for IMC. In summary:

- Macquarie Perch has been recorded in the Georges River, near its confluence with Punchbowl Creek (S. Carter pers. Com in BioAnalysis 2010) approximately 15 km downstream of the Project extent of longwall mining area.
- A population occurs throughout the reach of the Cataract River between the Cataract Dam and Broughtons Pass Weir.
- Individuals of this species have also been found in the Nepean River, downstream of Pheasants Nest Weir (Gerhke and Harris, 1996) but it is thought to be unlikely to inhabit the section of river adjacent to Appin Area 7 (Ecology Lab 2008).

No populations are known near the Appin Area 7, 9 or West Cliff Area 5 mining areas. However, a precautionary consideration of possible Macquarie Perch individuals near the Project Area is taken because of the potential for the species to migrate upstream during flood events or be transported downstream (Ecology Lab 2008).

### 8.5.2 Water Monitoring for Potential Impacts from Mining Induced Subsidence

Potential impacts from mining induced subsidence are monitored and managed via an Extraction Plan for each mining area. The Extraction Plans are approved by the Secretary of DPIE prior to longwall mining in the area. For specific TARPs for each mining area, refer to the relevant Extraction Plan.

As outlined in Section 8.2.4, if relevant Level 3 triggers are reached, CMAs will be considered and implemented in consultation with relevant agencies commensurate with the identified impact.

Extractions Plans with detailed monitoring programs are submitted on a progressive basis as mining commences in each mining domain. Detailed Extraction Plans (or Subsidence Management Plans) are approved for:

- Appin Area 7 Longwalls 701 – 710 (Refer Appendix 3);
- West Cliff Area 5 Longwall 34 – 36 (Refer Appendix 4);
- West Cliff Area 5 Longwall 37 – 38 (Refer Appendix 5); and
- Appin Area 9 Longwalls 901 – 904 (Refer Appendix 6).

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Approved Extraction Plans are available at:

<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>.

The plans and protocols outlined above provide adequate monitoring and management to identify potential water related impacts on EPBC Act listed species.

### 8.5.3 **Water Monitoring for Potential Impacts from Surface Operations**

Potential impacts from Appin Mine surface operations are monitored and managed via the Water Management Plan and EPL 2504 (Appendix 7).

In relation to monitoring potential water impacts on the Macquarie Perch, the following surface operations have the potential to modify potential Macquarie Perch habitat via operational water discharges:

- Appin North/WCCPP/CWEA (discharges to Georges River via Brennans Creek);
- Appin East Pit Top (discharges to Georges River); and
- Appin West Pit Top (discharges to Nepean River via Allens Creek).

EPL 2504 applies to the Appin Mine operations and includes conditions relevant to surface water management and monitoring. EPL 2504 includes the monitoring points set out in Table 6.

A copy of EPL 2504 (Appendix 7) can also be accessed at the EPA website: <http://www.epa.nsw.gov.au/prpoeoapp>.

Figure 12, Figure 13 and Figure 14 show the location of the EPL monitoring points.

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**Table 6: EPL 2504 Monitoring Points**

Monitoring Point No.	Point Description	Monitoring required	Location
1	Spillway overflow from BCD	N/A	Appin North
3	Effluent spray irrigation	Refer to Point 4	Appin North
4	Effluent irrigation pump discharge	Water Quality and volume	Appin North
10	Discharge from BCD	Water Quality and volume	Appin North
11	Georges River 50m upstream of the confluence with Brennans Creek	Water Quality	Appin North
12	Georges River 50 m downstream of the confluence with Brennans Creek	Water Quality	Appin North
13	Discharge from BCD	Volume	Appin North
18	Clean stormwater discharge from filter lagoon	Water Quality and volume	Appin East
19	Treated surface water - DynaSand Filter outlet	Water Quality and volume	Appin East
21	Overflow spillway from main dam	N/A	Appin East
22	Effluent irrigation area	Water Quality and volume	Appin West
23	Treated surface water discharge outlet	Water Quality and volume	Appin West
24	Treated minewater discharge outlet	Water Quality and volume	Appin West
25	Spillway overflow from surface water dams	N/A	Appin West

#### 8.5.4 Monitoring Parameters and Performance Indicators

EPL 2504 regulates, among other things, the discharge/release of water from the surface operations into receiving waters. Quantified limits are currently stated in EPL 2504 for a range of parameters. These limits are effectively the surface water quality performance indicators for the AMP as they are aimed at maintaining suitable water quality to support downstream aquatic habitat for species such as Macquarie Perch.

Monitoring is conducted monthly. Refer to Appendix 7 for details. A substantial historical record of chemical parameters is available covering a period of more than ten years for some sites.

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## 9. ADAPTIVE MANAGEMENT ACTIONS

Condition 8g of the EPBC Approval requires the proponent to:

*g. identify requirements for adaptive management actions to achieve performance objectives and ecological outcomes, including a description of the measures that would be implemented to achieve these.*

### 9.1 Summary of Performance Measures

The TARPs relate to identifying, assessing and responding to the range of conditions related to potential subsidence impacts on the rivers which form the potential habitat for Macquarie Perch which is the primary species of management concern in the AMP. The adopted performance measures for Macquarie Perch (based on the Condition 1 of Schedule 3 of the Project Approval) are provided in Table 7.

**Table 7: Adopted Performance Measures for Macquarie Perch**

<b><i>Biodiversity (Condition 1 Schedule 3)</i></b>	
Threatened species, threatened populations, or endangered ecological communities.	Negligible environmental consequences.
<b><i>Watercourses (Condition 1 Schedule 3)</i></b>	
Nepean River	Negligible environmental consequences including: <ul style="list-style-type: none"> <li>• <i>negligible</i> diversion of flows or changes in the natural drainage behavior of pools;</li> <li>• <i>negligible</i> gas releases and iron staining; and</li> <li>• <i>negligible</i> increase in water cloudiness</li> </ul>
Georges River	Negligible environmental consequences including: <ul style="list-style-type: none"> <li>• <i>negligible</i> diversion of flows or changes in the natural drainage behavior of pools;</li> <li>• <i>negligible</i> gas releases and iron staining; and</li> <li>• <i>negligible</i> increase in water cloudiness</li> </ul> <p>over at least 80% of the stream length subject to vertical subsidence &gt;20 mm.</p> <p>No subsidence impact or environmental consequence greater than minor.</p>
Other watercourses	No greater subsidence impact or environmental consequences than predicted in the EA and PPR.

In relation to the subsidence impact performance measure for biodiversity the term “negligible” is defined within the Project Approval as “*small and unimportant, such as not to be worth considering*”.

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The implementation of remedial or adaptive management measures would be assessed through the results of the Extraction Plan monitoring programs, EPL (surface water discharge) monitoring and additional detailed assessments as required.

In the event the Performance Measures detailed in Table 7 of the AMP are considered to have been exceeded, or are likely to be exceeded, IMC will implement a Contingency Plan (refer Section 10) to manage any unpredicted impacts and their consequences. Such an exceedance would normally represent a Level 3 TARP for surface water quality, flow or aquatic habitat being triggered.

## 9.2 Adaptive Management Options

### 9.2.1 Mine Planning

The most applicable pre-emptive or adaptive measure for reduction of impact is through the reduction of subsidence. At this stage, the most appropriate method of reducing subsidence is by leaving barriers of coal to support the surface. This is achieved through mine design. It is noted that the mine plan already incorporates coal barriers to reduce impacts to achieve the performance measures.

If impacts exceed performance measures, adaptive management techniques will be considered, such as seeking variations to adjustment the length of planned longwalls. This has been implemented in the past for Longwall 34 in West Cliff Area 5 where Level 2 impacts were identified from Longwall 33.

### 9.2.2 Active Flow Management

During no or low rainfall periods the flow in the Georges River is largely determined by the volume of water discharged via licence discharge point 10 from BCD and from Appin East. If the Level 2 trigger for minor cracking leading to a reduction in pool water level is observed, then additional flow can be released from BCD and/or Appin East to ensure pool water levels are maintained.

A WTP is planned for Appin North to provide an improvement in water quality released from site. It is planned for the WTP to release 1.5 ML/day averaged over the month.

### 9.2.3 Water Quality and Discharge Management

Where low water quality is identified to be resulting from mining induced subsidence or surface discharges this exceeds relevant TARPs, consideration of appropriate CMAs will be undertaken with relevant stakeholders. Any CMA will be highly dependent on the parameter being exceeded and technical feasibility of interventions.

### 9.2.4 Natural Remediation

Cracking due to subsidence will tend to seal as a result of the natural processes of erosion and deposition. The characteristics of the surface materials and the dynamics of a specific area will determine the rate of self-healing.

Cracks that occur in drainage paths are more likely to have the erosion and deposition processes acting to facilitate natural sealing. It is also possible that the erosion deposition

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equilibrium is disrupted and one process could dominate leading to additional surface impacts.

While sealing of surface fractures will occur naturally in some instances and over time, it is recognised that this may not provide sufficient mitigation in some situations and that active sealing of the streams may be required in some locations.

## **9.2.5 Active Sealing Options**

### **9.2.5.1 Hand Mortaring**

Where water transfer is observed through well-defined joints or fractures, the joints and fractures may be sealed using a variety of products, some of which can be applied in wet conditions and under water. These materials are normally applied using small held-held equipment and in localised situations.

Should large fractures occur in the base of the pools they may be sealed over with hand placed cement grout and natural oxides.

### **9.2.5.2 Injection Grouting**

Where creeks are fractured as a result of subsidence and there is limited ability for them to naturally seal it will be necessary to carry out remedial measures. Such remedial measures have been implemented at other locations in the Illawarra region. These measures usually include grouting to return ground water to the surface or reduce pool water loss. Grout can be delivered by small handheld equipment or truck-mounted equipment for deeper holes. Angled and horizontal drilling techniques can be utilised to position grout remotely from the site. The engineering techniques on which this type of rehabilitation is based are well established and used in the mining and construction industries and can be applied in these circumstances.

A number of grouts are available for use in such situations including cement, pulverised ash and chemical grouts, with or without fillers. The fillers can include sand and gravel or vegetable fibres. The choice of grout will be determined based on the nature and extent of the fracturing, the surface/ground water interaction and the objectives of the rehabilitation program.

These rehabilitation operations have the potential to cause adverse environmental impacts through the materials used and the disturbance associated with access and will be carefully planned to avoid contamination of watercourses. Bunds will be used to contain any spillage at mixing points. The materials used in these processes are non-toxic, environmentally inert and do not significantly impact upon the natural habitats of aquatic species.

### **9.2.5.3 Permeation Grouting**

This involves the introduction of grouting and filling materials into an individual pool or a stream flow, in such a manner that the material will be drawn into cracks and thereby seals the voids in the bed of the creek.

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#### 9.2.5.4 *Impermeable Blanket of Linings*

This involves the installation of a waterproof lining to a pool to prevent loss of water into the voids below. A variety of materials are available with the choice dependent on site-specific circumstances.

#### 9.2.5.5 *Joint Sealing*

Where water is leaking from a creek or riverbed through well-defined joints or fractures, the joints and fractures can be sealed using a variety of products, some of which can be applied in wet conditions and under water.

#### 9.2.5.6 *Surface Treatment*

Surface impacts may display as cracks of varying depths and widths, erosion scars or deposition areas. The treatment of these areas will consider specific site conditions and impacts.

Where cracking develops in significant areas and natural sealing is not progressing, the cracks may require forking over and compacting to prevent subsequent erosion. Larger cracks may require more work to repair them, for example, mulch or other protection to prevent the development of erosion channels. Surface protection will remain in place until vegetation covers the disturbed area. In some cases, e.g. if the cracks are wider, they may require gravel or sand filling up to surface level and revegetation using local native plants. Such rehabilitation measures have the potential to cause impact through the materials used and the disturbance associated with access. Considerable care and relevant approvals will be obtained to ensure the protection of the environment as such works are implemented.

### 9.2.6 **Gas Releases**

A typical cause of gas release at the surface is fracturing of the rock mass and associated release with groundwater flows to the surface. Grouting techniques discussed above can reduce these associated gas flows. In all identified circumstances in the Southern Coalfields the gas releases have diminished over a number of months, but it has been noted in some circumstances to take a number of years. Where vegetation is impacted by gas releases, the areas affected will be revegetated once monitoring determines the gas releases have ceased or reduced to an extent that vegetation is no longer affected.

Where low dissolved oxygen is identified to be resulting from mining induced gas release and this exceeds relevant TARPs, consideration of appropriate CMAs will be undertaken with relevant stakeholders.

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## 10. CONTINGENCY AND RESPONSE PLANS AND INCIDENT REPORTING

### 10.1 Contingency and Response Plans

Condition 8h of the EPBC Approval requires the proponent to:

*(h) Include contingency plan(s) to manage any unpredicted impacts and their consequences*

In the event the Performance Measures pertaining to Macquarie Perch or other EPBC listed species detailed in Section 9 of the AMP are considered to have been exceeded, or are likely to be exceeded, IMC will implement a Contingency Plan to manage any unpredicted impacts and their consequences.

The actions that would be taken would include:

- capture photographic record if appropriate;
- notify relevant stakeholders, agencies and specialists as soon as practicable;
- conduct site visits with stakeholders as required;
- contract specialists to investigate and report on changes identified;
- provide incident report to relevant agencies;
- review monitoring and implement additional monitoring if required;
- inform relevant agencies and stakeholders of results of investigation;
- develop site CMA in consultation with key stakeholders if required and seek approvals;
- implement CMA as agreed with stakeholders following approvals;
- conduct initial follow up monitoring and reporting following CMA completion;
- review relevant management plan(s); and
- report in regular reporting and Annual Review.

IMC will consult with appropriate specialists and relevant agencies in order to devise an appropriate response in respect to any identified exceedance. The development and implementation of contingency measures will be designed to address the specific circumstances of the exceedance and assessment of environmental consequences.

If the contingency measures implemented by IMC fail to remediate or mitigate the impact or the Secretary of DPIE determines that it is not reasonable or feasible to remediate the impact, IMC will provide a suitable offset to compensate for the impact to the satisfaction of the Secretary of DPIE (or DAWE as appropriate), in accordance with Condition 2 of Schedule 3 of the Project Approval.

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## 10.2 Non-Compliance, Corrective Action and Preventative Action

Events, non-compliances, corrective actions and preventative actions are managed in accordance with the Reporting and Investigation Standard and Environmental Compliance/Conformance Assessment and Reporting Procedure. These procedures, which relate to all IMC operations, detail the processes to be utilised with respect to event and non-conformance/non-compliance classification and reporting, and identification of corrective and preventative actions. The key elements of the process include:

- identification of events, non-conformances and/or non-compliances;
- recording of events, non-conformance and/or non-compliance in G360;
- evaluation of the event, non-conformance and/or non-compliance to determine specific corrective and preventative actions;
- assigning corrective and preventative actions to responsible persons and entered in G360; and
- management review of corrective actions to check the status and effectiveness of the actions.

## 11. PERFORMANCE IMPROVEMENT

Condition 8i of the EPBC Approval requires the proponent to:

*(i) Include a program to investigate and implement ways to improve the environmental performance of the project over time.*

As part of the Statement of Commitments prepared for the BSO Project EA, IMC committed to implement “research, offset and compensatory measures for Project impacts on water quality and ecological aspects” with the aim of continual performance review and improvement.

The annual review process will also formalise opportunities for improvement based on the monitoring data.

## 12. REPORTING AND REVIEW

Condition 8j of the EPBC Approval requires the proponent to:

*(j) Include protocols for periodic review of the plan and annual reporting to the Minister.*

### 12.1 Reporting

Operational and environmental performance of Appin Mine is reported through the:

- Compliance Report;
- Annual Review;
- Annual Return; and
- End of Panel Reports.

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Reports are available on the South32 website. The Annual Review and Compliance Report will be provided to DAWE.

### 12.1.1 Compliance Report

Annual reporting is undertaken as per Condition 14 of the EPBC Approval which requires the proponent to:

*Within three months of every 12 month anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of any management plans as specified in the conditions. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the department at the same time as the compliance report is published.*

The Compliance Report is required to be submitted to DAWE by 15 August of each year via [EPBCMonitoring@environment.gov.au](mailto:EPBCMonitoring@environment.gov.au) and is attached as an appendix in the Annual Review.

### 12.1.2 Annual Review

IMC will report on the performance of the AMP in the Annual Review.

The Annual Review is prepared in accordance with Condition 4 of Schedule 6 of the Project Approval and is submitted to relevant agencies in September each year. Annual Reviews are made available to the general public via the South32 website.

### 12.1.3 EPL Reporting

The specific requirements for the publication of EPL monitoring results are set out in section 66(6) of the *POEO Act*. In summary, this provision requires that licensees who undertake monitoring as a result of a licence condition must publish or make available monitoring data that relates to pollution within 14 days of obtaining the data and/or receiving a specific request for a copy of the data

IMC publishes its EPL related results in accordance with this condition on its company website. A link is included below:

<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>.

In addition to the above, an Annual Return is submitted to the NSW EPA as required by the EPL. The EPL also details requirements for the Aquatic Health Monitoring Program.

### 12.1.4 End of Panel Reports

End of Panel (EoP) reports are prepared in accordance with the relevant Extraction Plan or Subsidence Management Plan. They are prepared following the completion of longwall extraction of each panel. The report outlines the measured and observed impacts relevant to the extraction of the longwall panel and summarises a comparison of observed impacts to predictions and performance criteria.

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### 12.1.5 Incident reporting

In accordance with Condition 7 of Schedule 6 of the Project Approval, IMC is to notify the Secretary of DPIE and relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. Within seven days of the date of the incident, IMC is to provide the Secretary and relevant agencies with a detailed report on the incident.

## 12.2 Review of AMP

In accordance with Condition 5 of Schedule 6 of the Project Approval, the AMP will be reviewed, and if necessary revised, within three months, of:

- the submission of an annual review;
- the submission of an incident report;
- the submission of an Independent Environmental Audit report; or
- any modification to the conditions of the Project Approval (unless the conditions require otherwise).

Outcomes from each review will be documented in the Management Plan Review Log. The AMP will only be revised where a material change to site operations or environmental management has occurred, or in accordance with the review period on the AMP. Administrative or descriptive changes do not constitute a material change.

Where a review triggers a revision of the AMP, the AMP will be revised and submitted to the Secretary and/or Minister for approval.

## 12.3 Publication

Condition 13 of the EPBC Approval requires the proponent to:

*...publish all management plans, reports, strategies or agreements required by these conditions of approval on their website. Each management plan, report strategy or agreement must be published on the website within 30 days of being approved.*

Approved versions of the AMP will be displayed on the South32 regulatory page at:

<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>

## 12.4 Audits

### 12.4.1 Independent Environmental Audit

In accordance with Condition 9 of Schedule 6 of the Project Approval and Condition 18 of the EPBC Approval, an Independent Environmental Audit (IEA) shall be commissioned every three years, that will include a review of the AMP. The report is required to be submitted to the Secretary within six weeks of completion of the audit, in accordance with Condition 10 of Schedule 6 of the Project Approval and Condition 18 of the EPBC Approval.

IEAs have been conducted in 2013, 2016/17 and 2019, with the next IEA to be conducted in 2022. Recommendations from the IEA will be incorporated into the AMP where appropriate.

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#### 12.4.2 ISO 14001

As part of the ISO 14001 certification, IMC maintains an environmental auditing and governance program across all of its operational sites. The program, which includes the use of competent internal and accredited external auditors, is an integral part of maintaining certification under the ISO 14001 standard.

External surveillance audits are undertaken on an annual basis, with recertification audits undertaken every three years.

Internal Governance Reviews of the AMP are nominally undertaken on a three yearly basis.

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### 13. ACRONYMS

Term	Definition
AMP	Adaptive Management Plan – Water Sensitive EPBC Act Listed Species
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BC Act	<i>Biodiversity Conservation Act</i>
BCD	Brennans Creek Dam
BSO	Bulli Seam Operations
CCL	Consolidated Coal Lease
CMA	Corrective Management Action
CWEA	Coal Wash Emplacement Area
DAWE	Commonwealth Department of Water and Environment
DEC	NSW Department of Environment and Conservation (since re-named)
DECC	DECC – NSW Department of Environment and Climate Change (since re-named)
DSEWPC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now DAWE)
DoEE	Commonwealth Department of the Environment and Energy (now DAWE)
DLWC	NSW Department of Land and Water Conservation (since re-named)
DoPI	NSW Department of Planning and Infrastructure (now DPIE)
DPIE	NSW Department of Planning, Industry and Environment
EA	Environmental Assessment
EIP	Environment Improvement Plan
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence (NSW EPA)

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<i>EP&amp;A Act</i>	NSW <i>Environmental Planning and Assessment Act 1979</i>
<i>EPBC Act</i>	<i>Environment Protection and Biodiversity Conservation Act</i>
G360	Incident management system
ICHPL	Illawarra Coal Holdings Pty Ltd
IEA	Independent Environmental Audit
IMC	Illawarra Metallurgical Coal
ML	Mining Lease
MPL	Mining Purposes Lease
Mtpa	million tonnes per annum
NPWS	NSW National Parks & Wildlife Service
NWQMS	The Australian National Water Quality Management Strategy
OEH	NSW Office of Environment and Heritage (since renamed)
PKCT	Port Kembla Coal Terminal
<i>POEO Act</i>	<i>Protection of the Environment Operations Act</i>
PPR	Preferred Project Report
ROM	Run of mine
SMP	Subsidence Management Plan
TARP	Trigger, Action, Response Plan
WCCPP	West Cliff Coal Preparation Plant
WTP	Water Treatment Plant

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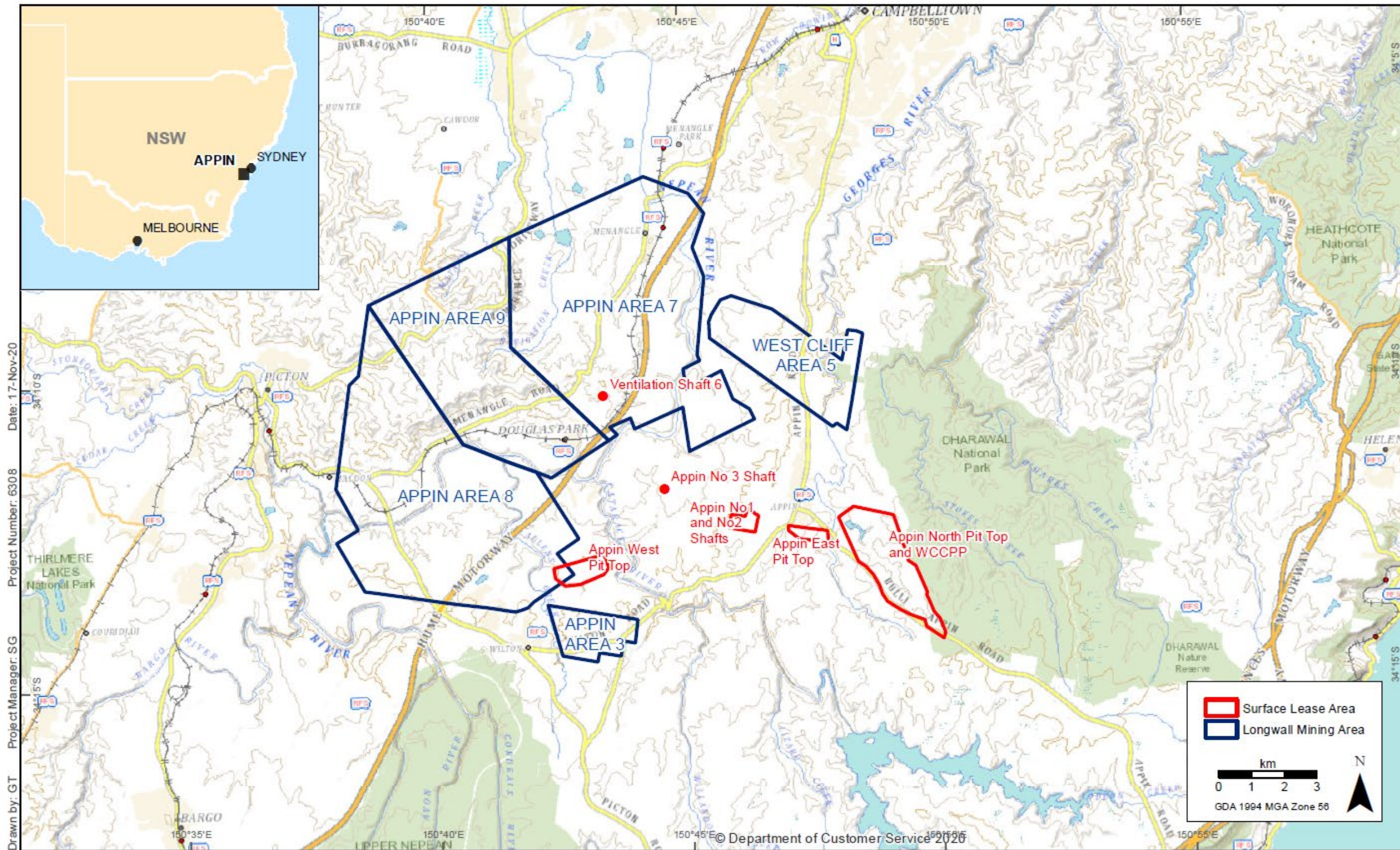


## 15. FIGURES

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Figure 1: Regional Project Location



Regional Project Location

Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species

FIGURE 1

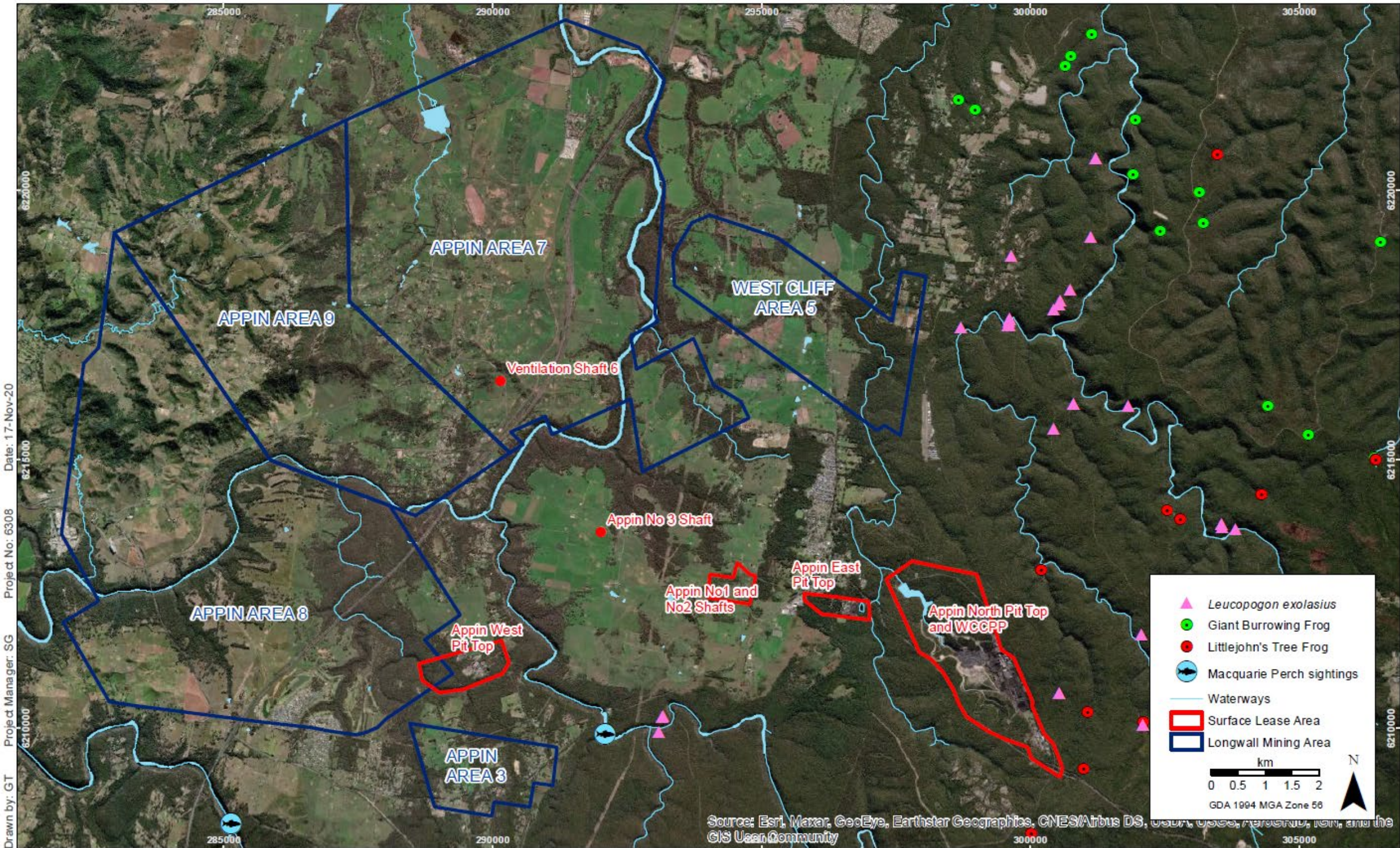


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Figure 2: Target Species



Drawn by: GT  
 Project Manager: SG  
 Project No.: 6308  
 Date: 17-Nov-20

Target Species



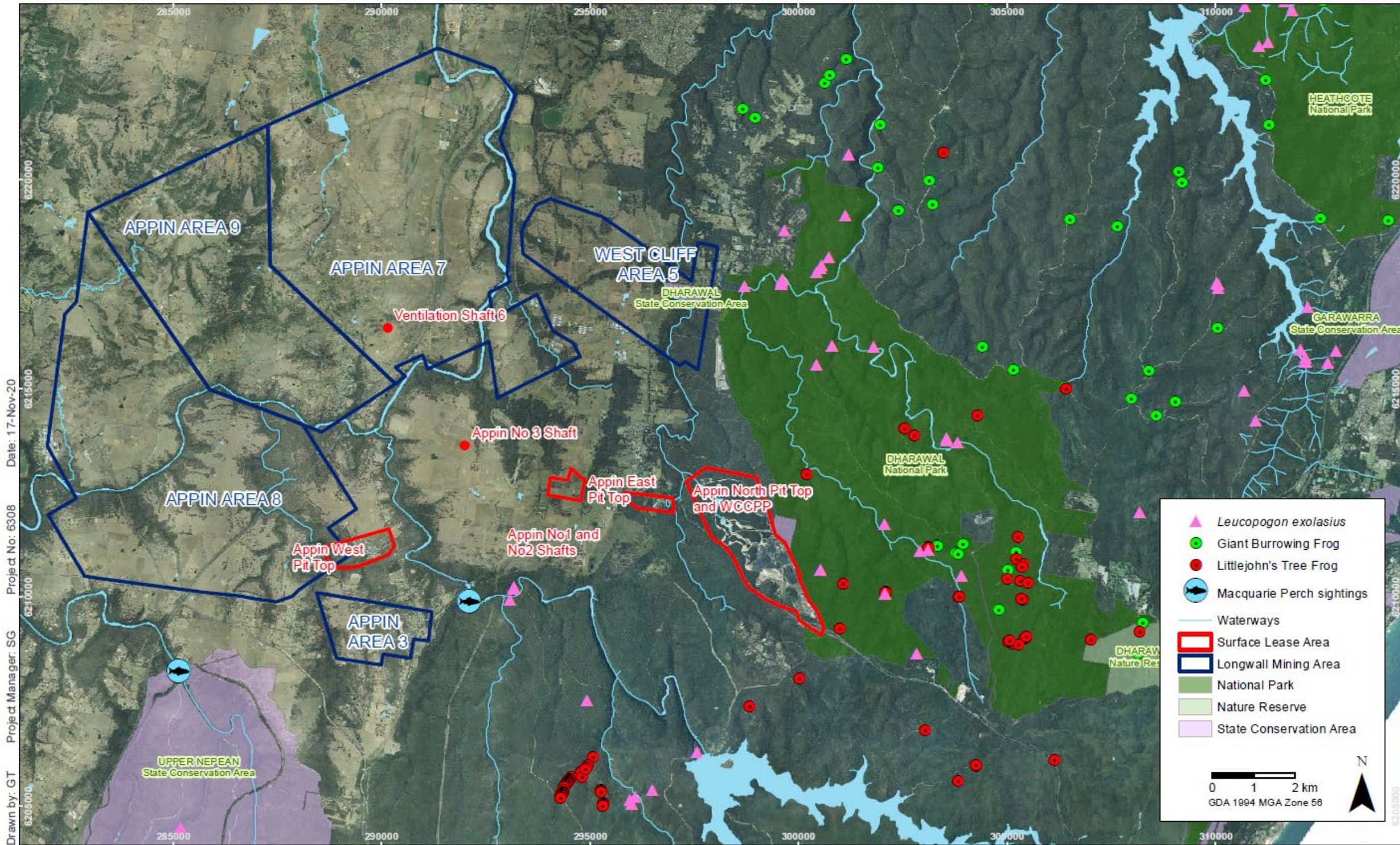
Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species

FIGURE 2

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Figure 3: National Parks/Estates



National Parks/ Estates

Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species

FIGURE 3



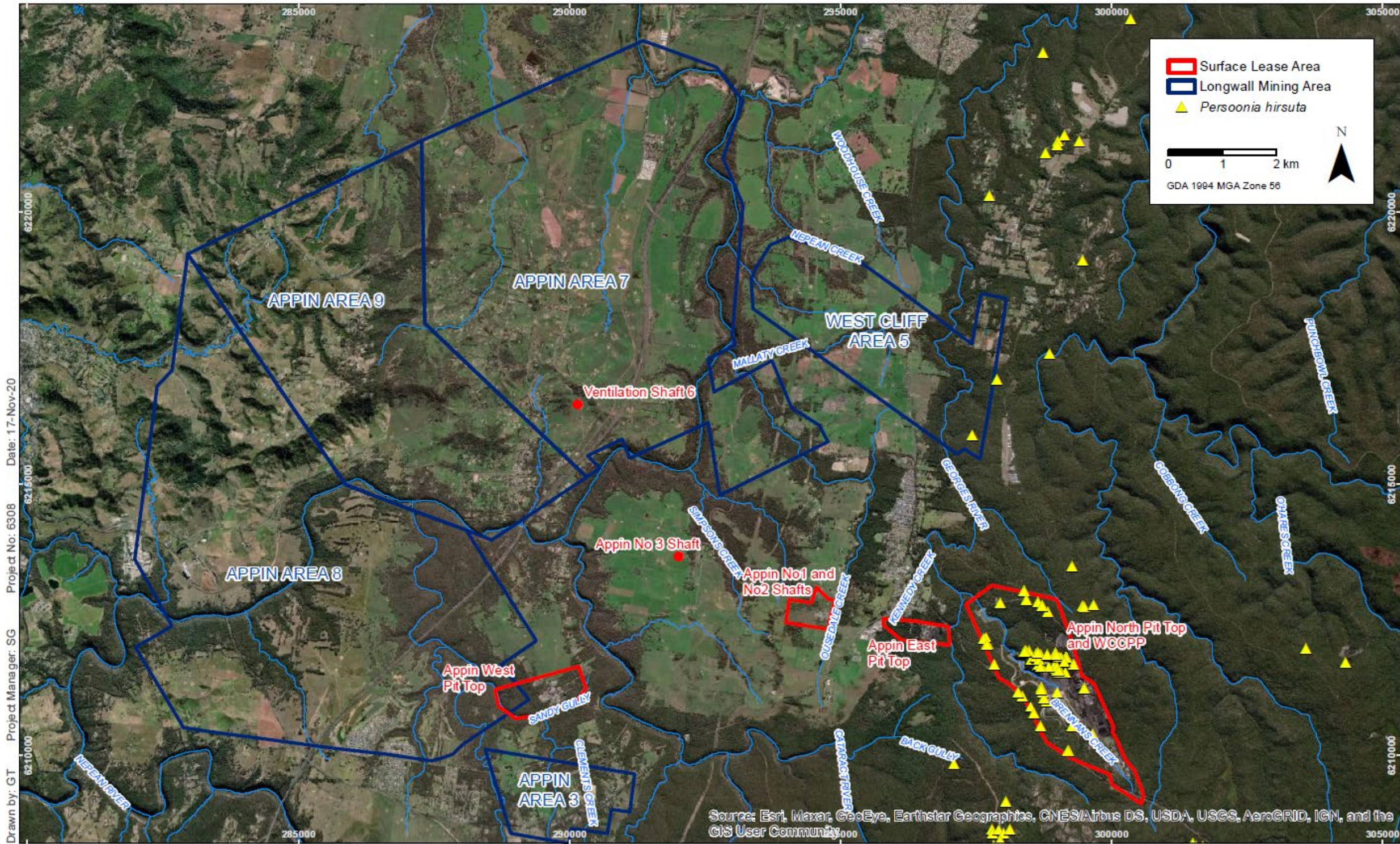
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Imagery (c) 2019 ESRI; Threatened Species locations based on NSW Wildlife Atlas 2020-11-10 and Niche field surveys

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Figure 4: *Persoonia hirsuta*



*Persoonia hirsuta*

Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species

**FIGURE 4**

Path: T:\spatial\projects\la6300\la6308\_BSO\_maps\_update\Maps\Updated\_figures\6308\_Figure\_4\_Persoonia\_hirsuta.mxd

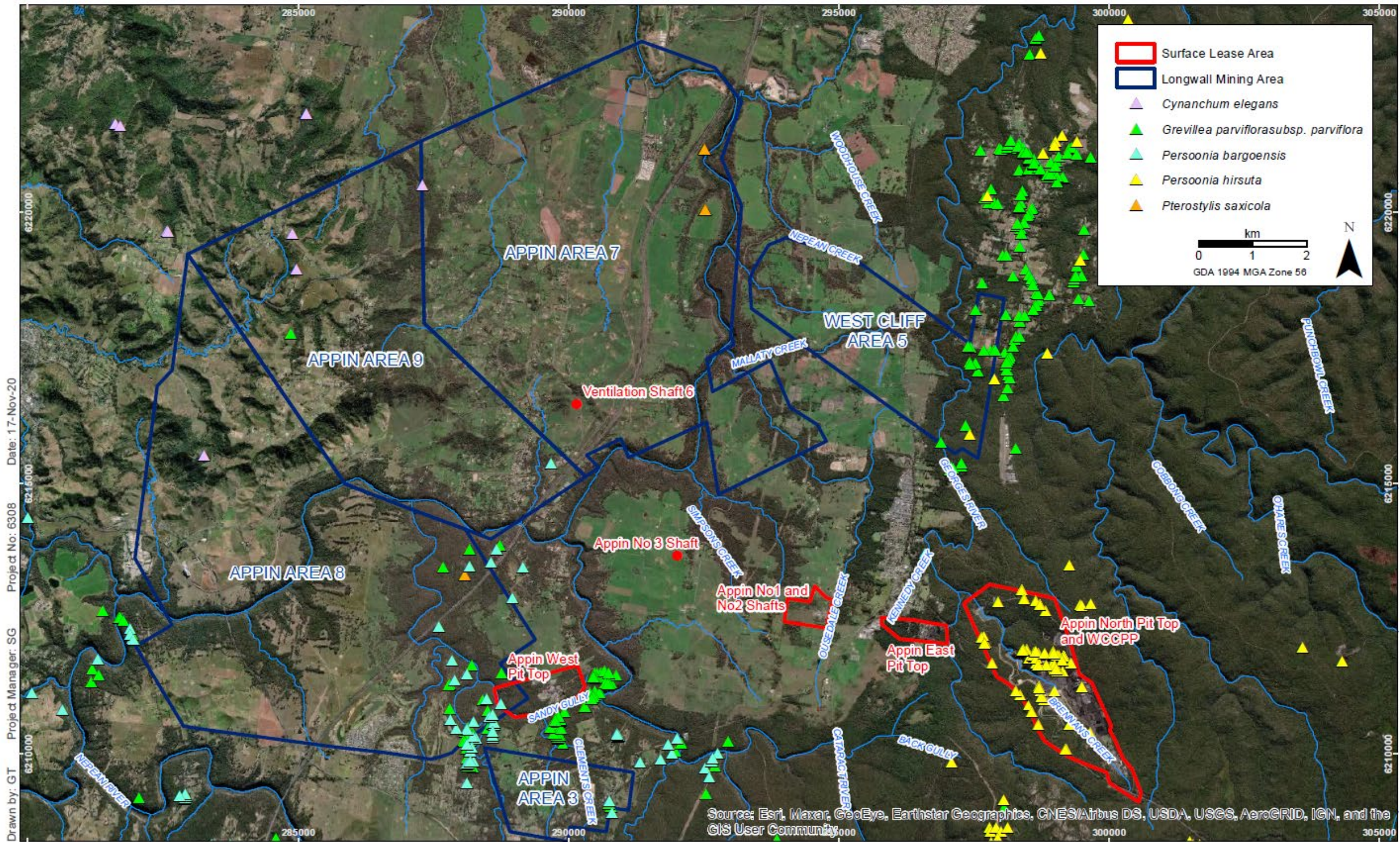
Imagery (c) 2019 ESRI; Threatened Species locations based on NSW Wildlife Atlas 2020-11-10 and Niche field surveys



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Figure 5: Queried Species



Drawn by: GT Project Manager: SG Date: 17-Nov-20  
 Project No: 6308

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Queried Species

Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species

FIGURE 5

Path: T:\spatial\projects\6300\6308\_BSO\_maps\_update\Maps\Updated\_figures\6308\_Figure\_5\_Queried\_Species.mxd

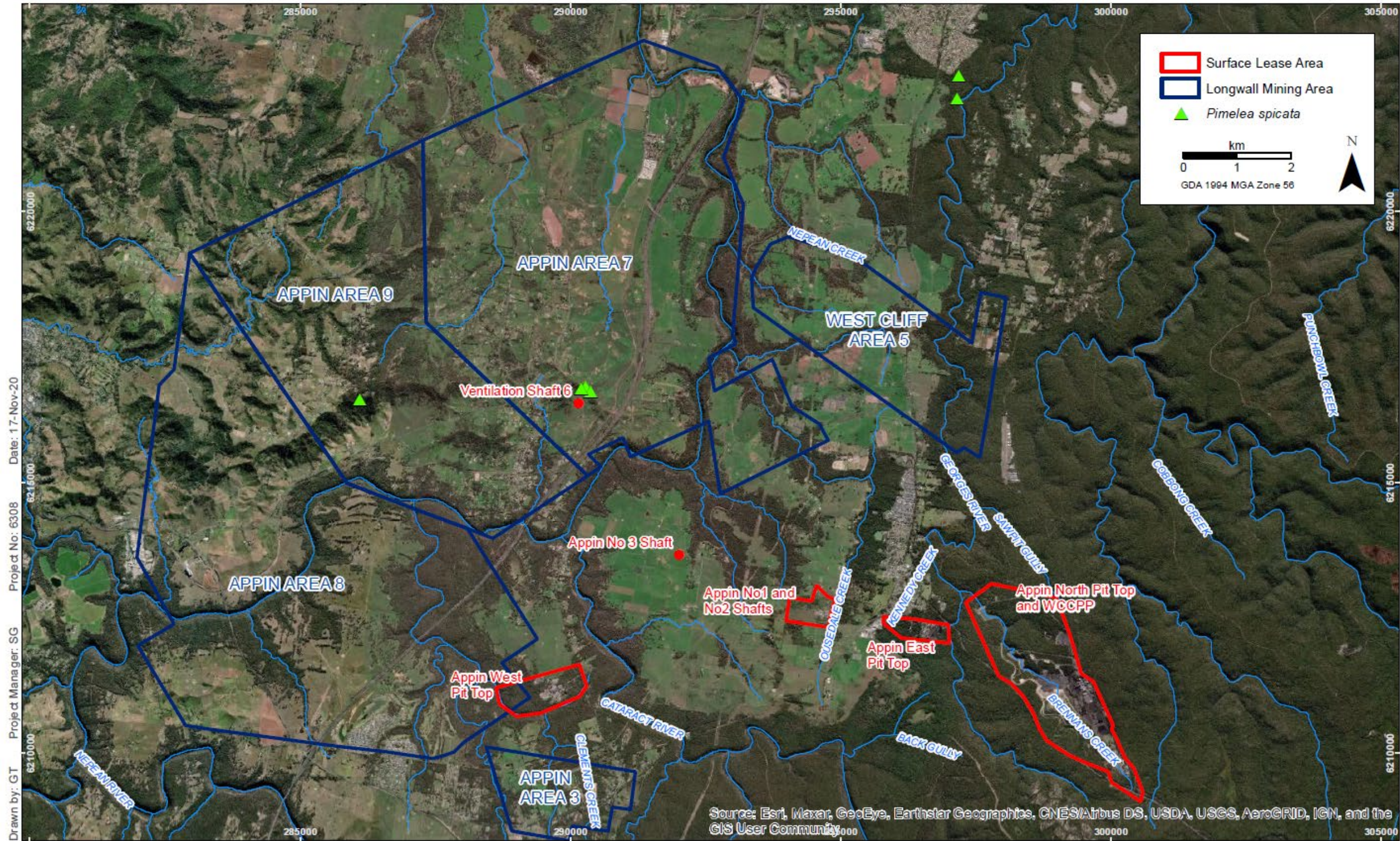
Imagery (c) 2019 ESRI; Threatened Species locations based on NSW Wildlife Atlas 2020-11-10 and Niche field surveys



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Figure 6: *Pimelea spicata* Records



Drawn by: GT  
Project Manager: SG  
Project No: 6308  
Date: 17-Nov-20

*Pimelea spicata* Records

Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species

FIGURE 6



Path: T:\spatial\projects\6300\6308\_BSO\_maps\_update\Maps\Updated\_figures\6308\_Figure\_6\_Pimelea\_spicata.mxd

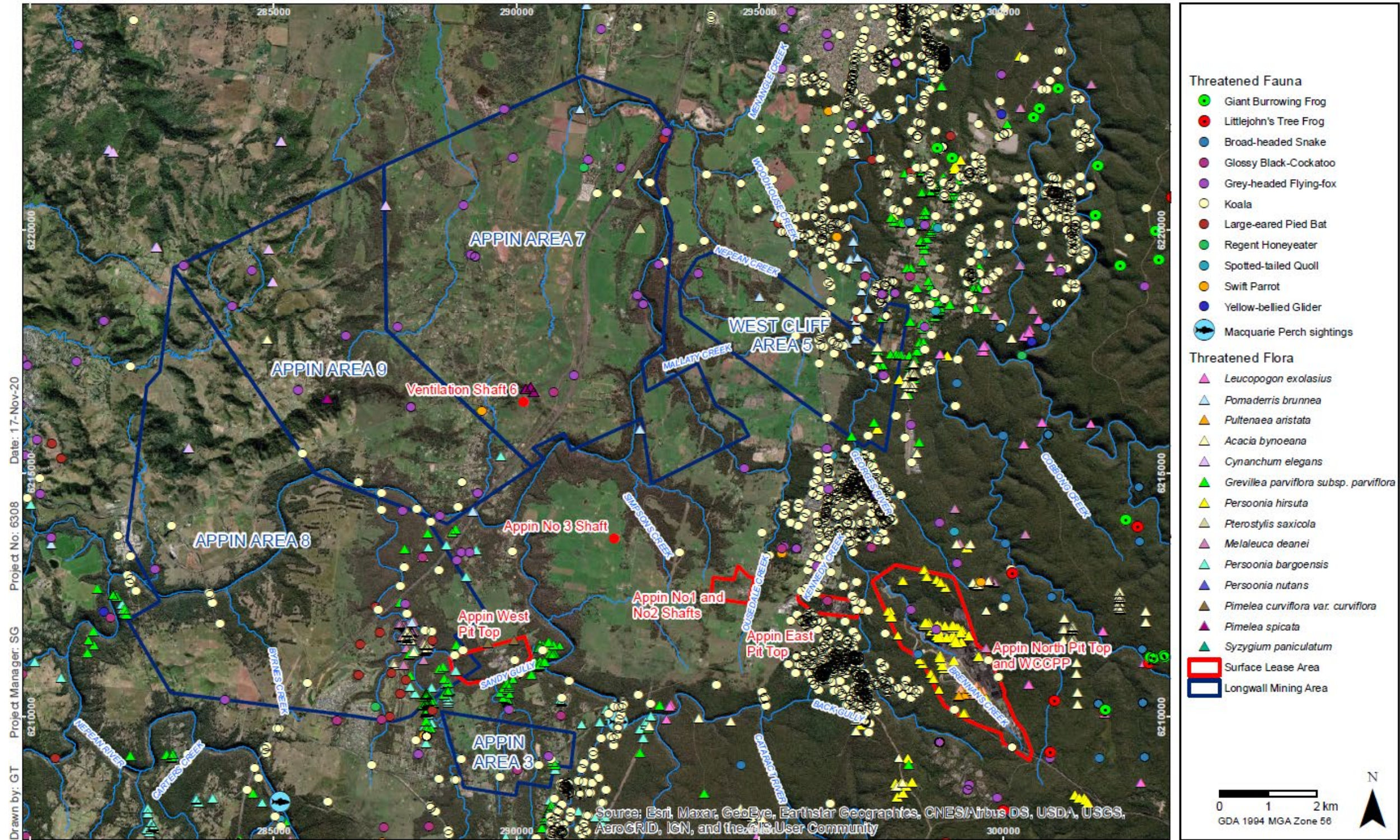
Imagery (c) 2019 ESRI; Threatened Species locations based on NSW Wildlife Atlas 2020-11-10 and Niche field surveys

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Figure 7: EPBC Act Listed Species Records



EPBC Act Listed Species Records

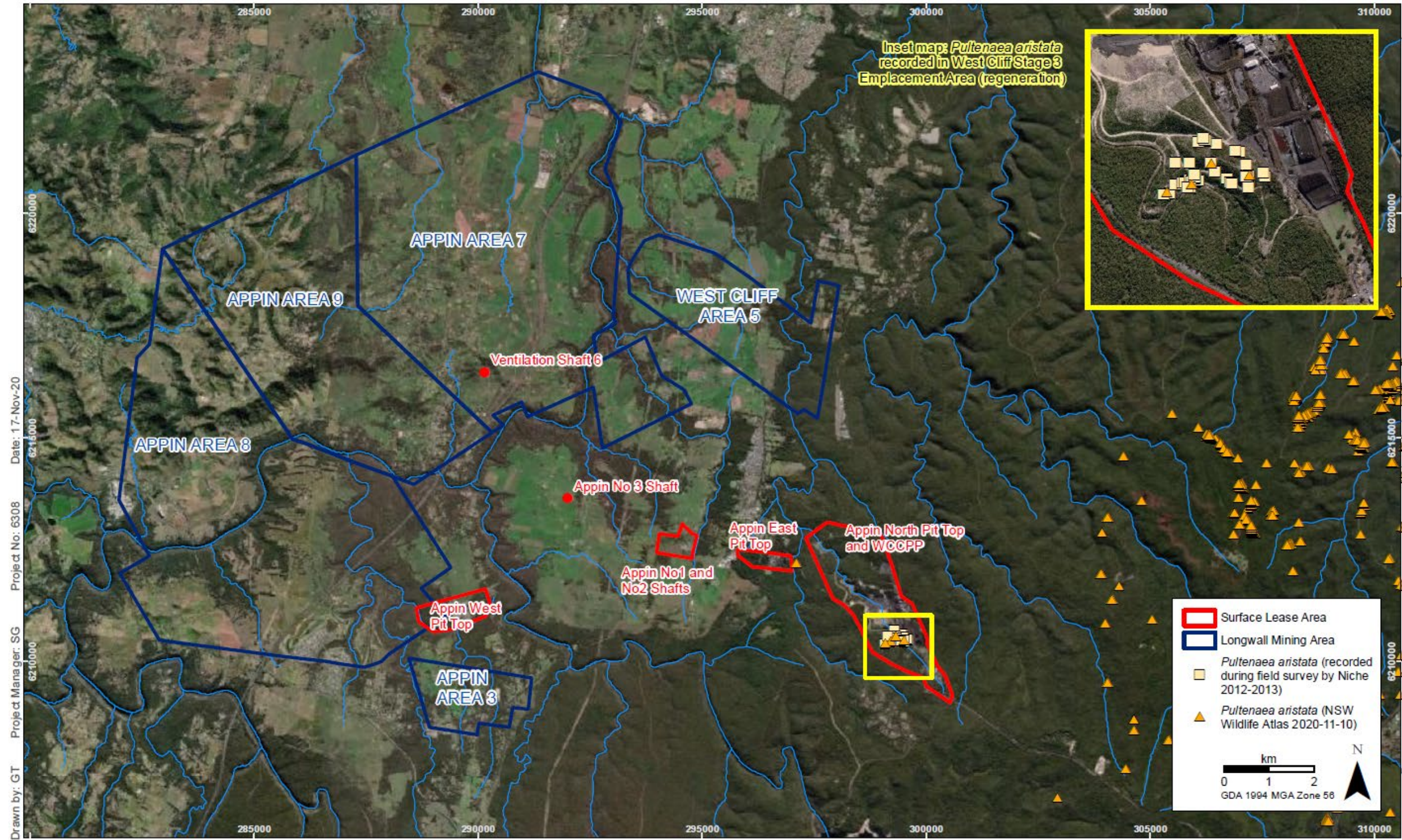
Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species

FIGURE 7

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Figure 8: *Pultenaea aristata* Records



*Pultenaea aristata* Records

Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species

FIGURE 8



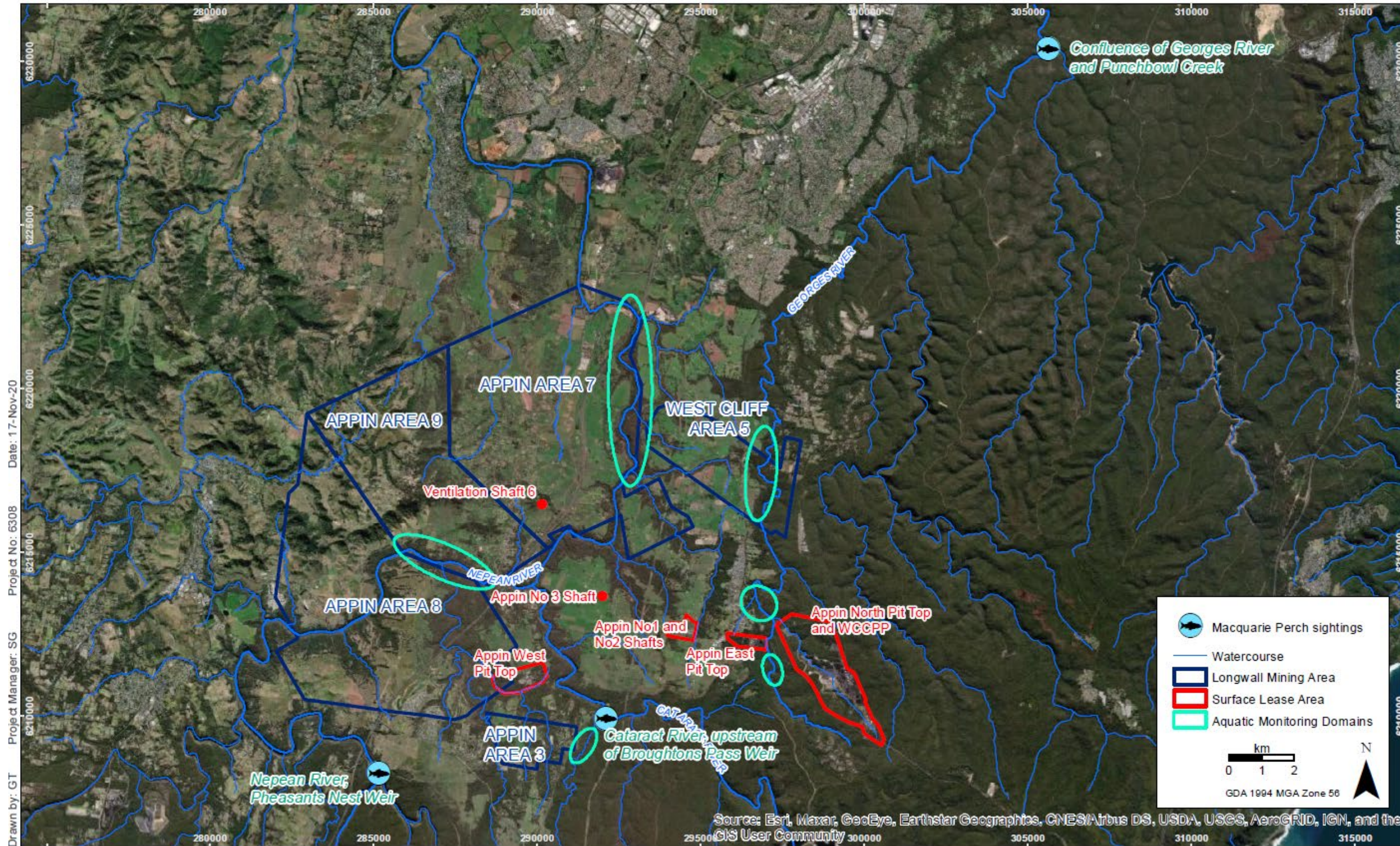
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Imagery (c) 2019 ESRI; Threatened Species locations based on NSW Wildlife Atlas 2020-11-10 and Niche field surveys

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Figure 9: Aquatic Biodiversity Monitoring Overview



Bulli Seam Operations Aquatic Biodiversity Monitoring Overview

Surface and Groundwater Quality Monitoring and Adaptive Management Plan for Water Sensitive EPBC Act Listed Species



Path: T:\spatial\projects\la6300\la6308\_BSO\_maps\_update\Maps\Updated\_figures\6308\_Figure\_9\_Aquatic.mxd

FIGURE 9

Imagery (c) ESRI 2019

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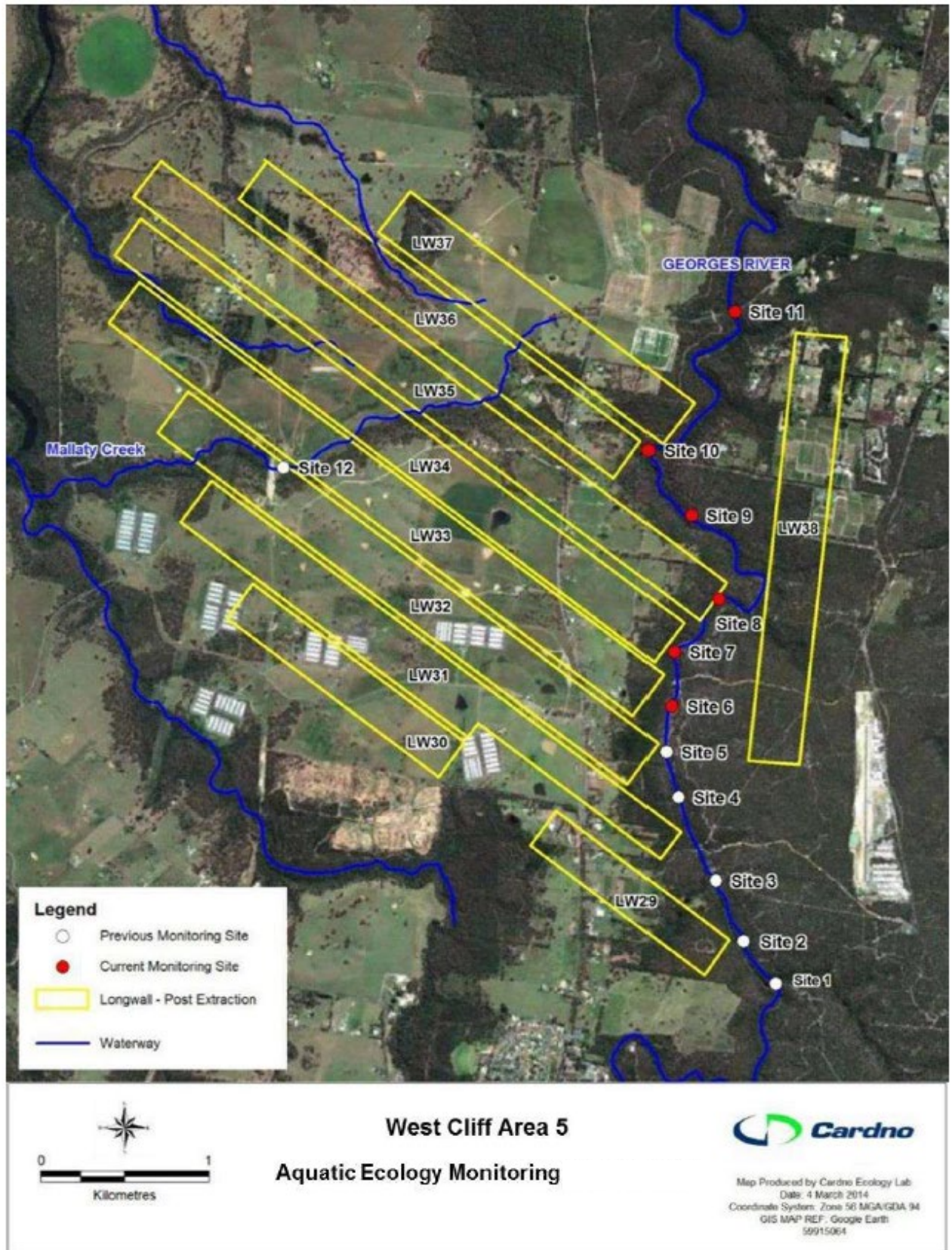
**Figure 10: Aquatic Ecology Monitoring Sites for Appin Area 7 and 9**



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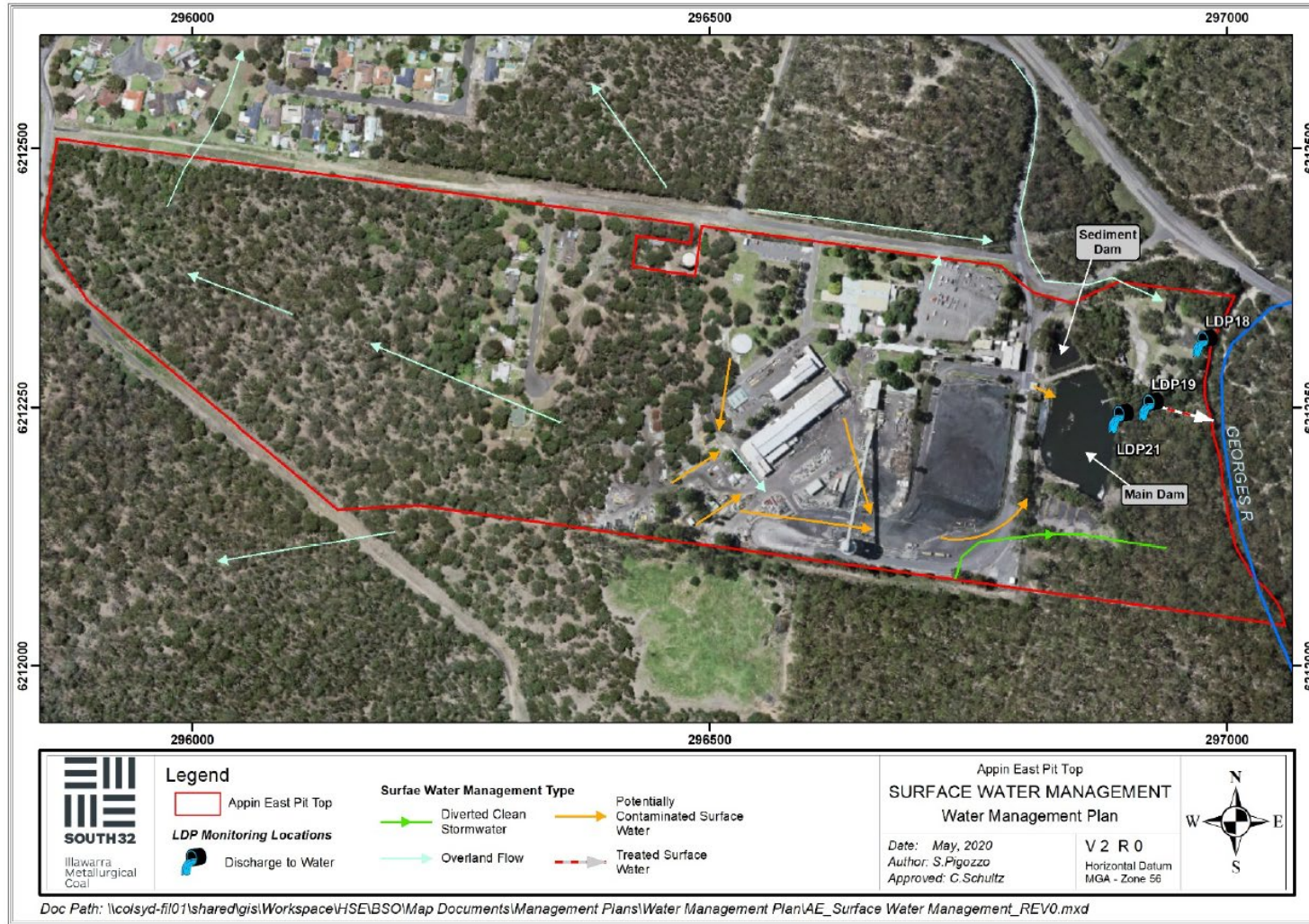
**Figure 11: Aquatic Ecology Monitoring Locations – Area 5**



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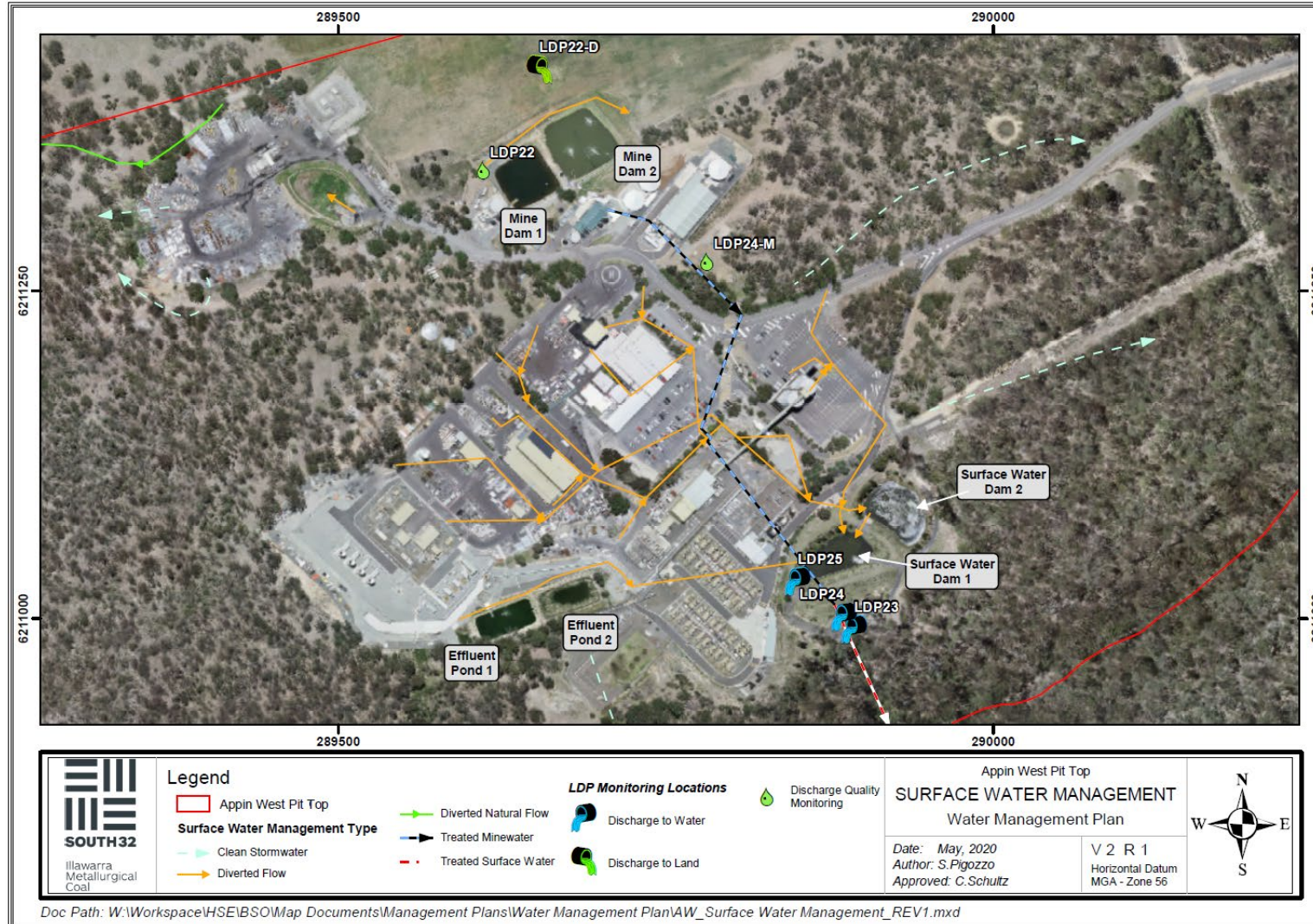
**Figure 12: Surface Water Drainage and EPL 2504 Points – Appin East**



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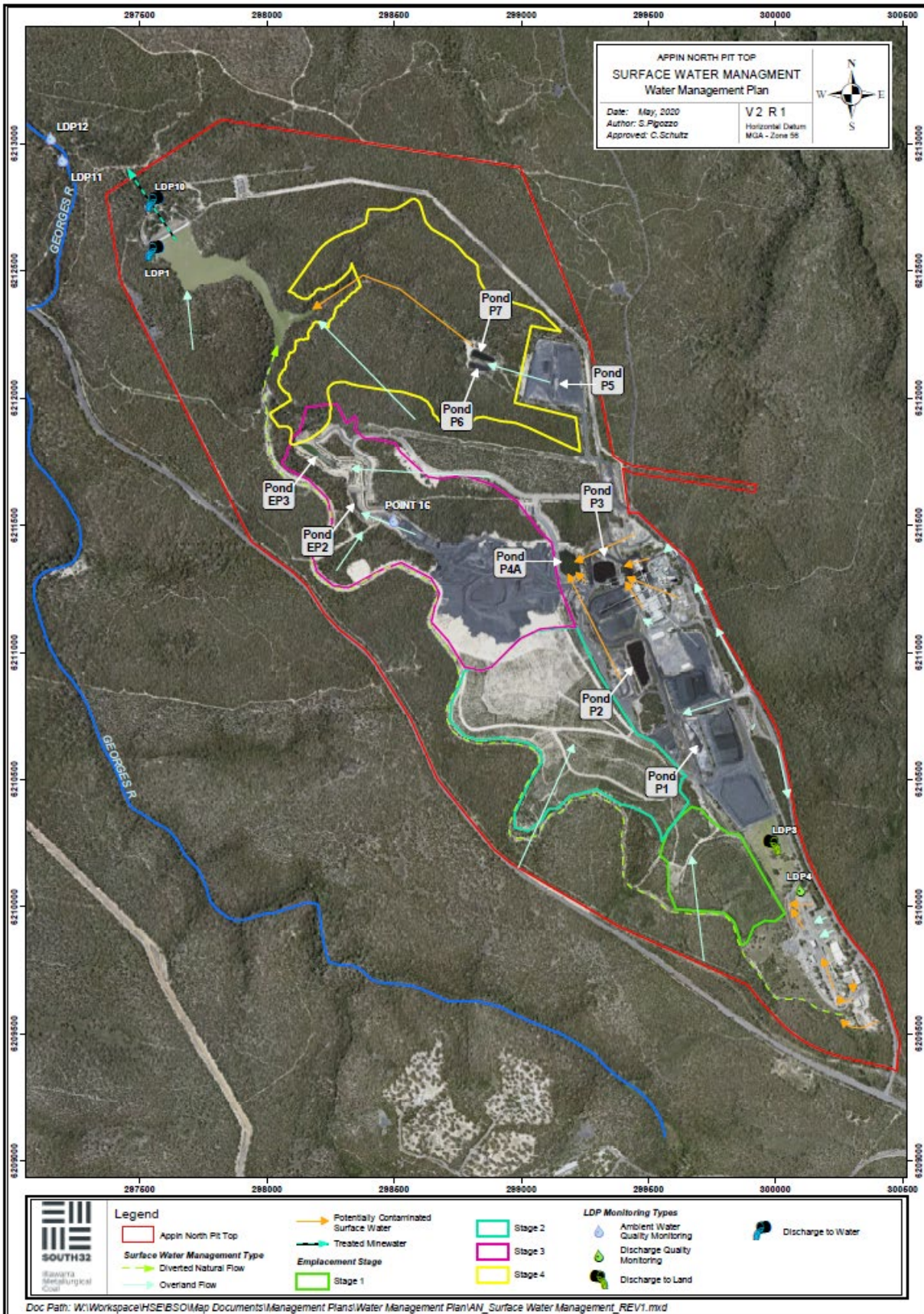
**Figure 13: Surface Water Drainage and EPL 2504 Points – Appin West**



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Figure 14: Surface Water Drainage and EPL 2504 Points – Appin North



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## 16. APPENDICES

### Appendix 1: Approval 2010/5350 Conditions: AMP

Condition	Requirement	Section
Condition 8	The person taking the action must provide a Surface and Ground Water Quality Monitoring and Adaptive Management Plan (the Water Plan) to the Minister for approval by 30 September 2012. Clearing of native vegetation for the stage 4 coal wash emplacement area and new mining activities beneath water courses containing habitat for EPBC Act listed species cannot occur until or unless the Water Plan has been approved and implemented. The Water Plan must:	
	a. provide a monitoring and adaptive management framework that will identify potential water related impacts of the action on EPBC Act listed species and their habitat.	Section 9
	b. contain a review of the ecological system that defines the ecological assets, functions and habitats to be protected and establish pre-mining baseline conditions.	Section 4
	c. detail strategies and actions for maintaining, enhancing and if required, restoring ecological assets, functions and habitats, for dependent EPBC Act listed species and their habitat including but not limited to the Macquarie Perch in Brennans Creek and the Georges and Nepean Rivers.	Section 7 Section 8 Table 4
	d. define ecological outcomes and performance objectives.	Section 5
	e. identify water requirements (volume, timing, duration, frequency, quality) for meeting ecological outcomes and performance objectives.	Section 6
	f. identify monitoring, evaluating and reporting mechanisms including comprehensive water quality monitoring, incorporating the emplacement area, that includes: <ul style="list-style-type: none"> <li>i. detailed baseline data;</li> <li>ii. monitoring methods, location and effort;</li> <li>iii. specific performance indicators that will be used to judge performance or guide the implementation of any required management measures, and</li> <li>iv. a program to monitor and report on the impacts and environmental performance of the action and effectiveness of management measures.</li> </ul>	Section 8
	g. identify requirements for adaptive management actions to achieve performance objectives and ecological outcomes, including a description of the measures that would be implemented to achieve these.	Section 9

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	h. include contingency plan(s) to manage any unpredicted impacts and their consequences.	Section 10
	i. include a program to investigate and implement ways to improve the environmental performance of the project over time.	Section 11
	j. include protocols for periodic review of the plan and annual reporting to the Minister.	Section 12
Condition 18	<p>By the end of 31 December 2013 and every three years thereafter, unless the Minister directs otherwise, the person taking the action must commission and pay the full cost of an independent environmental audit of project. This audit must:</p> <ul style="list-style-type: none"> <li>a. be conducted by a suitably qualified and independent team of experts whose appointment has been endorsed by the Minister;</li> <li>b. include consultation with relevant state agencies;</li> <li>c. assess the environmental performance of the project and assess whether it is complying with the requirements in this approval (including any assessment, plan or program (however described) required under this approval);</li> <li>d. review the adequacy of strategies, plans or programs required under the abovementioned approvals; and</li> <li>e. recommend appropriate measures or actions to improve the environmental performance of the action, and/or any assessment, plan or program required under the above mentioned approvals; and</li> <li>f. audit criteria must be agreed to be the Minister;</li> <li>g. within 6 weeks of the completion of this audit, or as otherwise agreed by the Minister, the person taking the action must submit a copy of the audit report to the Minister. The audit report must address the criteria to the satisfaction of the Minister.</li> </ul> <p>Note: The audit team must be led by a suitably qualified auditor and include experts in any field specified by the Minister.</p>	Section 12.4.1



## Appendix 2: Review and assessment of EPBC Act Species Included in the AMP

Common name	Scientific Name	EPBC Status	Included in Management Plan	Justification for Inclusion/ Exclusion
<b>FISH</b>				
Macquarie Perch	<i>Macquaria australasica</i>	V	YES	<p>According to the Environmental Assessment prepared for the BSO Project, a viable population is present throughout the reach of the Cataract River between the Cataract Dam and the Broughtons Pass Weir, and individuals of this species have also been found in the Nepean River, downstream of Pheasants Nest Weir and in the Georges River, near its confluence with Punchbowl Creek (approximately 17 km downstream of West Cliff Area 5). However, a search of the NSW Wildlife Atlas has detected only one record of Macquarie Perch, which occurs outside the BSO Project Area (see Figure 2).</p> <p>The lifecycle of the Macquarie Perch has the potential to be adversely affected if activities associated with the Project cause loss of habitat (associated with rock bar fracturing and subsequent draining of pools), physical barriers (drainage of sections of stream resulting in extensive barriers to fish movement), chemical barriers, reduction in water quality (e.g. increased acidity or sediments loads, low DO levels and increased concentrations of metals such as iron, zinc, manganese and nickel) and smothering of eggs in breeding areas (e.g. iron precipitates forming over eggs and rock surfaces).</p>
<b>AMPHIBIANS</b>				
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	V	YES	<p>Tadpoles were identified at one site during field assessment for the EA (Biosphere Environmental Consultants 2010) and there are previous records of the species in the original BSO Project Area. There are no records of this species within the current study area (see Figure 2) however habitat for this species may exist within this area.</p> <p>Changes in surface hydrology have the potential to impact on the habitats of the Giant Burrowing Frog including potential impacts on habitats likely to be important in the species' breeding.</p>
Littlejohns Tree Frog	<i>Litoria littlejohni</i>	V	YES	<p>Three individuals were found at one survey site outside the current Project Area by Biosphere Environmental Consultants (2010). There are previous records of the species within the original BSO Project Area, but there are no records within the current study area (see Figure 2). It is unlikely, but possible that some remnants of suitable habitat for this species may exist within the current study area (marginal potential habitat may exist with West Cliff Area 5). Therefore, it is considered in this Management Plan.</p> <p>Changes in surface hydrology have the potential to impact on habitat of the Littlejohn's Tree Frog.</p>
Green and Golden Bell Frog	<i>Litoria aurea</i>	V	NO	<p>The Green and Golden Bell Frog was not recorded during the BSO Project surveys by Biosphere Environmental Consultants (2009). This species has previously been recorded several times, to the south-east of the BSO Project Area (DECC, 2009a). The nearest contemporary site known to contain Green and Golden Bell Frogs is at Darkes Forest, to the north-east of the Dharawal National Park.</p>

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Common name	Scientific Name	EPBC Status	Included in Management Plan	Justification for Inclusion/ Exclusion
				Changes in surface hydrology have the potential to impact on the habitats of the Green and Golden Bell Frog including potential impacts on habitats likely to be important in the species' breeding. This species is relatively conspicuous and the lack of records near the Project Area suggests it is highly likely that the species is locally extinct in the Project Area and surrounds, probably due to the chytrid fungus ( <i>Lemckert Pers. Comm.</i> ). Given the nature of the hydrological changes and other potential Project impacts, the Project is unlikely to significantly reduce the quality or availability of habitat for the Green and Golden Bell Frog (Biosphere 2010). For this reason, it is not considered further in this plan.
<b>REPTILES</b>				
Broad headed snake	<i>Hoplocephalus bungaroides</i>	V	NO	<p>One individual (Biosis Research 2007) and one sloughed skin (Biosphere Environmental Consultants 2010) have been recorded in the Project Area. The Broad-headed Snake habitat is rocky outcrops and adjacent sclerophyll forest and woodland and as such, it is unlikely to be affected by water related impacts of the Project.</p> <p>Under the BSO and Dendrobium Mine Projects EPBC Act approval, ICHPL prepared a Broad-headed Snake Management Plan specifically relating to potential impacts from the Stage 3 and future Stage 4 Coal Wash Emplacement.</p> <p>The original Broad-headed Snake Management Plan was prepared by Biosis Research (2007c) and was approved by DEWHA on 10 December 2007. The plan now incorporates the requirements of the BSO approval conditions and this plan was approved on 28 May 2014.</p> <p>The water related impacts of the project are not likely to impact on Broad-headed Snake or its habitat therefore this species has been excluded from this Management Plan.</p>
<b>MAMMALS</b>				
Spotted Tail Quoll	<i>Dasyurus maculatus</i>	E	NO	<p>Habitat for Spotted Tail Quoll includes eucalypt forests and woodlands, coastal heathlands and rainforests. They require large areas of relatively intact vegetation but may also traverse more open country such as farmlands, rocky outcrops and other treeless areas when moving between feeding areas.</p> <p>The water related impacts of the project are not likely to impact on Spotted Tail Quoll or its habitat therefore this species has been excluded from this Management Plan.</p>
Southern Brown Bandicoot	<i>Isodon obesulus obesulus</i>	E	NO	<p>The Southern Brown Bandicoot (eastern) is known to inhabit a variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland.</p> <p>The water related impacts of the project are not likely to impact on Southern Brown Bandicoot or its habitat therefore this species has been excluded from this Management Plan.</p>
Grey headed Flying fox	<i>Pteropus poliocephalus</i>	E	NO	<p>The Grey-headed Flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, <i>Melaleuca</i> swamps and <i>Banksia</i> woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas.</p>

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Common name	Scientific Name	EPBC Status	Included in Management Plan	Justification for Inclusion/ Exclusion
				The water related impacts of the project are not likely to impact on Grey headed Flying fox or its habitat therefore this species has been excluded from this Management Plan.
<b>PLANTS</b>				
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	NO	This species was not found by FloraSearch (2010) during assessment for the Project EA, but it is known to occur on the Woronora Plateau. This species grows in heath and dry sclerophyll forest. The substrate is typically sand and sandy clay, often with ironstone gravels and is usually very infertile and well-drained. The water related impacts of the project are not likely to impact on <i>Acacia bynoeana</i> or its habitat.
<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	V	NO	This species was not found by FloraSearch (2010) during assessment for the Project EA, but it is known to occur on the Woronora Plateau. It occurs in dry sclerophyll woodland on sandstone. The water related impacts of the project are not likely to impact on <i>Astrotricha crassifolia</i> or its habitat.
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	NO	This species was recorded in the Razorback Range in the Project Area by FloraSearch (2010). White-flowered Wax Plant occurs on a variety of lithologies and soil types, usually on steep slopes with varying degrees of soil fertility. The water related impacts of the project are not likely to impact on <i>Cynanchum elegans</i> or its habitat. Locations of <i>Cynanchum elegans</i> plants are shown in Figure 5.
<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	V	NO	<i>Grevillea parviflora subsp. parviflora</i> occurs in Appin Area 3 Extended and Appin Area 8 on shale/sandstone transition soils. It is similarly abundant in the power line easement and surrounding bushland in Appin Area 3 Extended, and is also common to the east of Wallandoola Creek. It is widespread but uncommon on St Mary's Towers in Appin Area 8. It is also abundant in the eastern parts of the West Cliff Area 5 domain of the proposal, where it is widespread in Dharawal SCA and the Tharawal LALC areas. The water related impacts of the project are not likely to impact on <i>Grevillea parviflora subsp. parviflora</i> or its habitat. Locations of <i>Grevillea parviflora subsp. parviflora</i> plants are shown in Figure 5.
<i>Leucopogon exolasius</i>	Woronora Beard-heath	V	YES	<i>Leucopogon exolasius</i> is known to be widespread but rare in sandstone gully and riparian habitats on the Woronora Plateau FloraSearch (2010). FloraSearch (2010) recorded this species in areas that were removed from the current approved Project Area. There are no records of this species in the current study area (Figure 2) but potential habitat for this species does occur within the Georges River. As the Georges River occurs within the West Cliff area 5 study area, it is considered in this Management Plan.
<i>Melaleuca deanei</i>	Deane's Paperbark	V	NO	<i>Melaleuca deanei</i> was not recorded in the Project Area by FloraSearch (2009) but it is known to occur on the Woronora Plateau and shale/sandstone transition soils on Cumberland Plain.

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Common name	Scientific Name	EPBC Status	Included in Management Plan	Justification for Inclusion/ Exclusion
				The water related impacts of the project are not likely to impact on <i>Melaleuca deanei</i> or its habitat.
<i>Persoonia bargoensis</i>	Bargo Geebung	V	NO	<i>Persoonia bargoensis</i> was identified only in Appin Area 3 Extended where it occurred commonly with <i>Epacris purpurascens</i> var. <i>purpurascens</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> between Cascade and Wallandoola Creeks, particularly in the 330 kV power line easement. The population was estimated at over a thousand plants, which occur as isolated individuals and small scattered groups among other shrub species. The water related impacts of the project are not likely to impact on <i>Persoonia bargoensis</i> or its habitat. Locations of <i>Persoonia bargoensis</i> plants are shown in Figure 5.
<i>Persoonia hirsuta</i>	Hairy Geebung	E	NO	<i>Persoonia hirsuta</i> occurs on the Woronora Plateau. The species is subject to the impacts of vegetation clearing for construction of the Stage 3 & 4 Coal Wash Emplacement Area and a specific Management Plan for this species has been prepared. As there are no water related impacts anticipated for this species, it has been excluded from this Management Plan. Locations of <i>P. hirsuta</i> plants are shown in Figure 4.
<i>Pomaderris brunnea</i>	Brown Pomaderris	V	NO	<i>Pomaderris brunnea</i> was not recorded by FloraSearch (2010) but records are mapped within the study area along Nepean River (see Figure 1). It occurs in riparian areas and floodplains. The species is not considered to be dependent on standing water for its survival. Further, the NSW Subsidence Key Threatening Process does not list the species as likely to be at risk of impact from subsidence. On the basis that it will not likely be impacted by subsidence or project water related impacts, this species is not considered further.
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	NO	<i>Pterostylis saxicola</i> was recorded by FloraSearch (2010) in the original BSO Project Area near Douglas Park. Its habitat includes rock shelves above cliff lines on shale or shale/sandstone transition soils. The water related impacts of the project are not likely to impact on <i>Pterostylis saxicola</i> or its habitat. Locations of <i>Pterostylis saxicola</i> plants are shown in Figure 5.
<i>Pultanaea aristata</i>	Prickly Bush-pea	V	NO	<i>Pultanaea aristata</i> was recorded by FloraSearch (2010) in the original BSO Project area and found to be widely dispersed and locally common in the east of the area. It occurs primarily on the margins of upland swamps. It was also occasionally found in riparian habitats in upper catchments. There were no records of this species within the current study area however several individuals of this species have since been located in the 2012 and 2013 surveys of the rehabilitated Stage 3 West Cliff Emplacement Area. Refer Figure 8. As these individuals are located on the West Cliff Emplacement Area and are not affected by either surface water flows or groundwater it is not considered further in this management plan. Further, this species is appropriately addressed within the Emplacement Area Management Plan. Locations of <i>Pterostylis saxicola</i> plants are shown in Figure 8.

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### Appendix 3: Appin Area 7 Extraction Plan

Volume 1 – Written Report and Reduced Plans and Volume 2 – Subsidence Management Plan is available on the South32 Regulatory website:

<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>

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## Appendix 4: West Cliff Longwalls 34-36 Extraction Plans

The West Cliff Area 5 Longwall 34-36 SMP is available on the South32 Regulatory Website.

<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>

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## Appendix 5: West Cliff Longwalls 37-38 Extraction Plans

The West Cliff Longwalls 37-38 Extraction Plan is available on the South32 Regulatory website:  
<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>

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## Appendix 6: Appin Area 9 Extraction Plans

The Appin Area 9 LW 901-904 Extraction Plan is available on the South32 Regulatory website:

<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>

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## Appendix 7: Environment Protection Licence 2504

EPL 2504 is available on the EPA Website:

<https://apps.epa.nsw.gov.au/prpoeoapp/>

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## Appendix 8: Georges River Aquatic Health Monitoring Program

The Georges River Aquatic Health Monitoring Program is available on the South32 Website:

[https://www.south32.net/docs/default-source/illawarra-coal-bulli-seam-operations/licenses/georges-river-aquatic-health-monitoring-program-\(2020\).pdf?sfvrsn=fab0c7b1\\_4](https://www.south32.net/docs/default-source/illawarra-coal-bulli-seam-operations/licenses/georges-river-aquatic-health-monitoring-program-(2020).pdf?sfvrsn=fab0c7b1_4)

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## Appendix 9: Appin Mine Water Management Plan

The Appin Mine Water Management Plan is available on the South32 Regulatory website:

<https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>

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## Appendix 10: Agency Consultation

Agency Comments	IMC Response
<b>Department of Agriculture, Water and Environment</b>	
<p><u>Response received 6 January 2021</u></p> <p>The Adaptive Management Plan does not meet the requirements of the conditions of approval as it does not detail actions and strategies for enhancing ecological assets, functions and habitats for dependent EPBC Act listed species.</p> <p>These enhancing actions and strategies are a requirement of Condition 8c and must be included and detailed sufficiently if the revised plan is to be approved.</p>	<p>Section 7 has been included in the AMP.</p>

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## Appendix 11: Management Plan Approval



Australian Government

Department of Agriculture, Water and the Environment

Mr Chris Shultz  
Superintendent Environment  
Illawarra Metallurgical Coal  
Enterprise 1 Building, level 3 Squires Way  
North Wollongong, NSW 2500

### **Bulli Seam Operations Expansion, Bulli, NSW (EPBC 2010/5350) – Revised Management Plans**

Dear Mr Shultz,

Thank you for submitting revised management plans for approval in accordance with Condition 16 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval for EPBC 2010/5350.

Officers of the Department have advised me on the revised plans, including amendments to the approved plans, and on the requirements of the EPBC Act conditions of approval for the above project. On this basis, and as a delegate of the Minister for the Environment, I have decided to approve:

- The *Coal Wash Emplacement Area Management Plan*, version 5.0, dated 16 December 2020;
- The *Broad-headed Snake and Southern Brown Bandicoot Management Plan*, version 1.1, dated 23 December 2020; and
- The *Adaptive Management Plan – Water Sensitive EPBC Act Listed Species*, version 6.0, dated January 2021.

The approved plans must now be implemented.

The Department has an active compliance monitoring program which includes monitoring inspections, desk top document reviews and audits. Please ensure that you maintain accurate records of all activities associated with, or relevant to, the conditions of approval including the implementation and revision of management plans, so that they may be made available to the Department on request.

Should you require any further information please contact Thomas Smith directly or [postapproval@awe.gov.au](mailto:postapproval@awe.gov.au).

Yours sincerely

Dwaine McMaugh, Director, Post Approvals,  
Assessments (Vic, Tas) and Post Approvals Branch,  
Environment Approvals Division

28 January 2021

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